BHP Mitsubishi Alliance

Progressive Rehabilitation and Closure Plan

Caval Ridge Mine

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Tenure Number(s)

ML1775 (part), ML70403 (part) and ML70462

EA holder name

QCT MINING PTY. LTD.
Mitsubishi Development Pty Ltd
BHP COAL PTY LTD
QCT Resources Pty Limited
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TABLE OF CONTENTS

List of Figures

List of Tables

Glossary of terms and abbreviations

Key terms and abbreviations, and associated definitions used in this report are listed below.

Term / Abbreviation	Description
3P grasses	Perennial, productive and palatable (3P) grasses
Administrating authority	Department of Environment and Science (Queensland)
AD	acid/acidic drainage
AEP	Annual exceedance probability
AHD	Australian height datum
AMD	Acid and metalliferous drainage
AQP	Appropriately qualified person
ARR	Australian rainfall and runoff
ASC	Australian soil classification
BBAC	Barada Barna Aboriginal Corporation
BMA	BHP Mitsubishi Alliance
BOM	Bureau of Meteorology
Berm	The level bench or offset between sloped high-wall, end-wall, low-wall or dump benches. Also known as a catch bench
Bund	A mounded embankment typically made of spoil material used to prevent access or water ingress (of variable height depending on application)
CCP	Community consultation plan
CEC	Cation exchange capacity
CHPP	Coal handling and preparation plant
Co-disposal	The practice of disposing different waste types together. For example, co-disposal of rejects (coarse and/or fine) with spoil in spoil dumps
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
CVM	Caval Ridge Mine
DEM	Digital elevation model
DES	Department of Environment and Science (Queensland) (The administrating authority)

Term / Abbreviation	Description
DLGP	Department of Local Government and Planning (Queensland)
DM	Dry matter (with reference to vegetation)
DoR	Department of Resources (Queensland) (previously referred to as the Department of Natural Resources, Mines and Energy)
DSITI	Department of Science, Information Technology and Innovation (Queensland)
DY	Dysart coal seam
DYL	Dysart Lower (D Seam group)
DYU	Dysart Upper (D Seam group)
EA	Environmental Authority (*Environmental Protection Act 1994*, Queensland)
EC	Electrical conductivity
EIS	Environmental Impact Statement
EMR	Queensland environmental management register
EP Act	*Environmental Protection Act 1994* (Queensland)
EP Regulation	Environmental Protection Regulation 2019 (Queensland)
EPP (Water)	Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (Queensland)
ERA	Environmentally relevant activity (*Environmental Protection Act 1994*, Queensland)
ERD	Effective rooting depth
ESA	Environmentally sensitive area
ESP	Exchangeable sodium percentage
FoS	Factor of safety
FRREMP	Fitzroy Basin regional receiving environment monitoring program
GDE	Groundwater dependent ecosystem
HC	Harrow Creek coal seam
HCL	Harrow Creek Lower (H Seam group)
HCU	Harrow Creek Upper (H Seam group)
HVR	High value regrowth

Term / Abbreviation	Description
IA	Improvement area "…for a NUMA, means an area of land in the NUMA to which a management milestone for the NUMA relates". (PRCP Guideline, 2023)
IDC	Index of diversion condition
Interburden	Mineral (mining) waste located between mined coal seams
IRC	Isaac Regional Council
LGA	Local government area
LOD	Land outcome document
LSA	Land suitability assessment
MAW	Mine affected water
MCM	Moranbah Coal Measures
MERFP Act	*Mineral and Energy Resources (Financial Provisioning) Act 2018* (Queensland)
MIA	Mine industrial area
Milestone criteria	"…for a management milestone or a rehabilitation milestone, means a requirement that must be met to achieve the milestone". (PRCP Guideline, 2023)
Mineral waste	Material comprising spoil, ± rejects, ± waste coal. Sometimes called 'mine waste' or 'mining waste'
ML	Mining lease
MM	Management milestone "…for a NUMA, means each significant event or step necessary to achieve best practice management of the area and to minimise risks to the environment" (section 112 of the EP Act) (PRCP Guideline, 2023)
MPR	Mixed plant reject
NAF	Non-acid forming
NC Act	*Nature Conservation Act 1992* (Queensland)
NMD	Neutral and metalliferous drainage
NUMA	Non-use management area
OQMRC	Office of the Queensland Mine Rehabilitation Commissioner
Overburden	Mineral (mining) waste located above the top coal seams

Term / Abbreviation	Description
PAF	Potentially acid forming
PDM	Peak Downs Mine
PFAS	Perfluoroalkyl and polyfluoroalkyl substances
PMLU	Post-mining land use “…for land, means the purpose for which the land will be used after all environmentally relevant activities carried out on the land have ended” (section 112 of the EP 1994) (PRCP Guideline, 2023)
PRCP	Progressive rehabilitation and closure plan
PRCP Guideline	Progressive rehabilitation and closure plan Guideline (April 2023) (DES, Queensland)
QA/QC	Quality assurance and quality control
QR	Queensland Rail
RA	Rehabilitation area “… for a post-mine land use, means an area of land in the post-mine land use to which rehabilitation milestone for the post-mining use relates” (PRCP Guideline, 2023)
RCP	Representative concentration pathway
RE	Regional ecosystem
Rejects	Waste material produced during coal processing
REMP	Receiving environment monitoring program
Residual void	An open pit resulting from the removal of ore and/or waste rock that will remain following the cessation of all mining activities and completion of rehabilitation processes
RM	Rehabilitation milestone “…for the rehabilitated land, means each significant event or step necessary to rehabilitate the land to a stable condition (section 112 of the EP Act)" (PRCP Guideline, 2023)
ROM	Run-of-mine
RRR	Residual risk rating (with reference to the risk assessment)
SD	Saline drainage
SMP	Site management plan
Spoil	Rock material overlying and between ‘target’ coal seams, which is mined and placed in the spoil dumps (i.e., overburden and interburden)

Term / Abbreviation	Description
Spoil dump	Landform containing mineral waste
SPR	Source-pathway-receptor
SQP	Suitably qualified person (for performing a regulatory function)
STAC	Smart Transformation Advisory Council
TDS	Total dissolved solids
TLO	Train load-out
TMR	Department of Transport and Main Roads (Queensland)
Transitional PRCP	"…the holder of an existing EA for an ineligible mining activity relating to a mining lease that is transitioning into the new PRCP framework" (PRCP Guideline, 2023)
TSF	Tailings storage facility
VM Act	*Vegetation Management Act 1999* Queensland
Waste coal	Sub-economical coal that reports to the spoil dumps as waste
WBNM	Watershed Bounded Network Model
WEPP	Water erosion prediction program
WQO	Water quality objectives

INTRODUCTION

Caval Ridge Mine (CVM), operated by BHP Mitsubishi Alliance (BMA), is a metallurgical coal mine located in the Bowen Basin, Queensland.

This transitional Progressive Rehabilitation and Closure Plan (PRCP) has been prepared for CVM in accordance with the requirements of the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (MERFP Act). This PRCP has been developed to meet the requirements of the *Environmental Protection Act 1994* (EP Act) and the Progressive Rehabilitation and Closure Plan Guideline (PRCP Guideline) (DES, 2023a).

Environmentally relevant activities (ERAs) at CVM include mining black coal, resource recovery and transfer facility operation, chemical storage, mineral processing and sewage treatment. These are undertaken under the conditions of the site's Environment Authority (EA) EPML00562013, provided in Appendix A.

Environmental Authority Holder:	**BHP COAL PTY LTD; QCT INVESTMENT PTY. LTD.; Umal Consolidated Pty Ltd; Mitsubishi Development Pty Ltd; QCT MINING PTY. LTD.; QCT Resources Pty Limited; BHP Queensland Coal Investments Pty Ltd**
Environmental Authority Number:	**EPML00562013 (29 June 2023)**
Tenements:	**ML1775 (part), ML70403 (part), ML70462**

This PRCP comprises two parts:

- Section A: Rehabilitation planning part - provides information about the site, details the rehabilitation methodologies and techniques, and includes evidence and justification to support the development of the proposed PRCP schedule; and
- Section B: PRCP schedule - includes maps of rehabilitation and closure outcomes for the site, and tables of time-based rehabilitation milestones.

This PRCP also includes Section C: Appendices, providing specialist studies and technical assessments used to support the development of the PRCP.

TRANSITIONAL PROVISIONS

Part 27, Chapter 13 of the EP Act sets out the transitional provisions following the commencement of the MERFP Act. In particular, BMA is a 'mining EA holder' for the purposes of the transitional provisions on the basis that, on commencement of the MERFP Act, BMA was "*the holder of an environmental authority (EPML00562013) for a mining activity relating to a mining lease authorising operations*" at CVM (section 750, EP Act).

Furthermore, Section 6 of the PRCP Guideline makes provision for *"existing EA holders who must transition into the new PRC Plan framework"*. As CVM has an approved EA, the site falls under the ambit of the requirements of a transitional PRCP.

Based on the requirements of Section 6 of the PRCP Guideline, the following are applicable to this PRCP:

- In accordance with transitional provisions (section 750, EP Act), the CVM EA (EPML00562013) is an approved land outcome document (LOD).
- A Transition Notice for CVM was issued to BMA by the administrating authority (Department of Environment and Science (DES)), dated 30 October 2020 (Appendix B). This Transitional Notice required submission of the CVM PRCP by 1 December 2022.
- The Transitional Notice was issued following a pre-notification meeting held between the administrating authority and BMA, on 14 October 2020. This PRCP is based on the key aspects agreed on by the administrating authority during this meeting, as documented in the PRCP BMA - Caval Ridge Mine Memo, provided in Appendix C.
- A request for an amendment to the transition notice timeframe was made to the administrating authority on 16 September 2022 through the *Operational Policy* (DES, 2021) due to a *"major Environmental*

Authority amendment being under assessment where the outcome has a bearing on the PRC Plan development" (Horse Pit Extension EA Amendment application submitted to the administrating authority on 15 December 2021). In response to this application, an extended submission to 1 December 2023 was approved (Appendix D).

- Prior to the PRCP submission, it was agreed with the administrating authority that it was not necessary for a pre-submission meeting in relation to the CVM PRCP prior to the final submission.
- As required, this PRCP covers the approved mining footprint at CVM. Therefore, this PRCP does not include the unapproved mining area and conditions of the draft EA Amendment application for Horse Pit (reference number A-EA-AMD-100178679). If the EA Amendment is approved prior to the approval of the CVM PRCP application, then a change of application can be submitted under the Act.

Aligned to the above, and the PRCP Guideline requirements, the following process for transitioning rehabilitation and closure outcomes from the CVM EA into the site's PRCP schedule has been followed:

1. Identifying rehabilitation and closure outcomes in the LOD (EA EPML00562013)
2. Identifying post-mining land uses (PMLUs)
3. Identifying non-use management areas (NUMAs)
4. Defining rehabilitation areas within the PMLU, or improvement areas (IA) within the NUMA
5. Identifying milestones
6. Identifying milestone criteria
7. Identifying when the first rehabilitation milestone must commence and completion dates for the milestones

KNOWLEDGE BASE REFINEMENT

Compilation of this PRCP has been supported by the rehabilitation and closure-related knowledge base for CVM at the time of submission of this PRCP (1 December 2023). Relevant studies contributing to this knowledge base have been referenced throughout this PRCP, with key resources provided in Part C: Appendices.

As highlighted by the International Council of Mining and Metals in the Integrated Mine Closure Good Practice Guide, 2nd Edition (2019), *"the collection, updating, use and review of the knowledge base is considered an ongoing and iterative process over the mine life, and will be used to inform iterative refinement and improvement of the rehabilitation and closure planning process over time"*. As the rehabilitation and closure knowledge base for CVM develops over the life of the operation, it will be used to inform ongoing refinement of the plans for rehabilitation and closure, as well as this PRCP as required.

A: REHABILITATION PLANNING

1 PROJECT PLANNING

Legislative Requirement

In accordance with Section 126C(1)(b) and (c)(ii) of the EP Act, the rehabilitation planning part of the PRC Plan must include a description of:

- *each resource tenure, including the area of each tenure*
- *the relevant activities to which the application relates*
- *the likely duration of the relevant activities*
- *how and where the relevant activities are to be carried out, including maps.*

PRCP Guideline

The following spatial information must be submitted as part of the PRC Plan:

- *the location and maximum extent of disturbance footprint for the mine life*
- *the PMLUs and NUMAs for the area within the resource tenures*
- *any sensitive receptors.*

In addition to the list above, the PRC Plan must include spatial information outlining the rehabilitation and improvement areas that correspond to the proposed PRCP schedule. The spatial information must show the locations of the rehabilitation and improvement areas for a 10-year period (minimum).

All spatial information must be prepared and submitted in accordance with the guideline 'Spatial Information Submission' (ESR/2018/4337).

1.1 Project description

1.1.1 Geographic location

CVM is a metallurgical coal resource, located 10km south of the town of Moranbah in the Bowen Basin and approximately 160km south-west of Mackay (Queensland) (Figure 1).

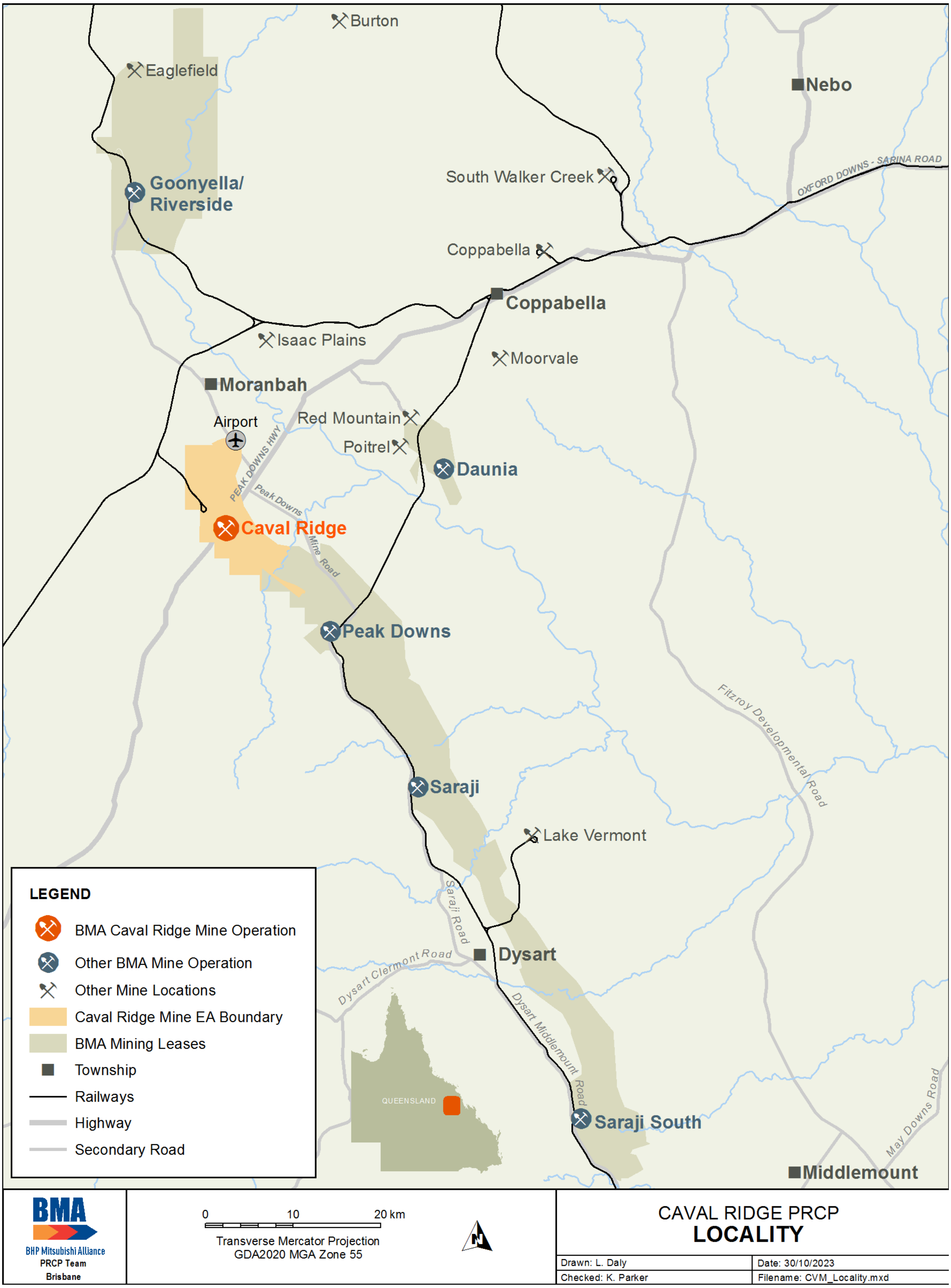

Figure 1: CVM location map

1.1.2 Mining tenements

CVM operates on the mining leases (MLs) listed in Table 1 and illustrated in Figure 2. The mining tenements as per the associated CVM EA boundary, cover 10,160 hectares (ha).

Table 1: CVM mining tenements

Lease number	Name	Date granted
ML1775 (part)	Caval Ridge	22 December 1983
ML70403 (part)	Caval Ridge West	09 December 2010
ML70462	Tomaren	24 February 2014

Mining activities at CVM occur on the northern section of ML1775. Spoil dumps and mine infrastructure are located on ML70403, with additional infrastructure located on ML70462. Harrow Creek defines part of the southern-most boundary between BMA's CVM and Peak Downs Mine (PDM).

This PRCP covers the approved mining footprint, which does not include unapproved mining area within ML1775, to the east of Horse Pit, to the east of Heyford Pit and between Horse Pit and Heyford Pit. An EA amendment application has been submitted for Horse Pit extension project, which extends the approved mining footprint to the east of Horse Pit. If the EA Amendment is approved prior to the approval of the CVM PRCP application then a change of application can be submitted under the Act.

Other EA amendment applications may be submitted in the future which may require submission of an associated PRCP amendment.

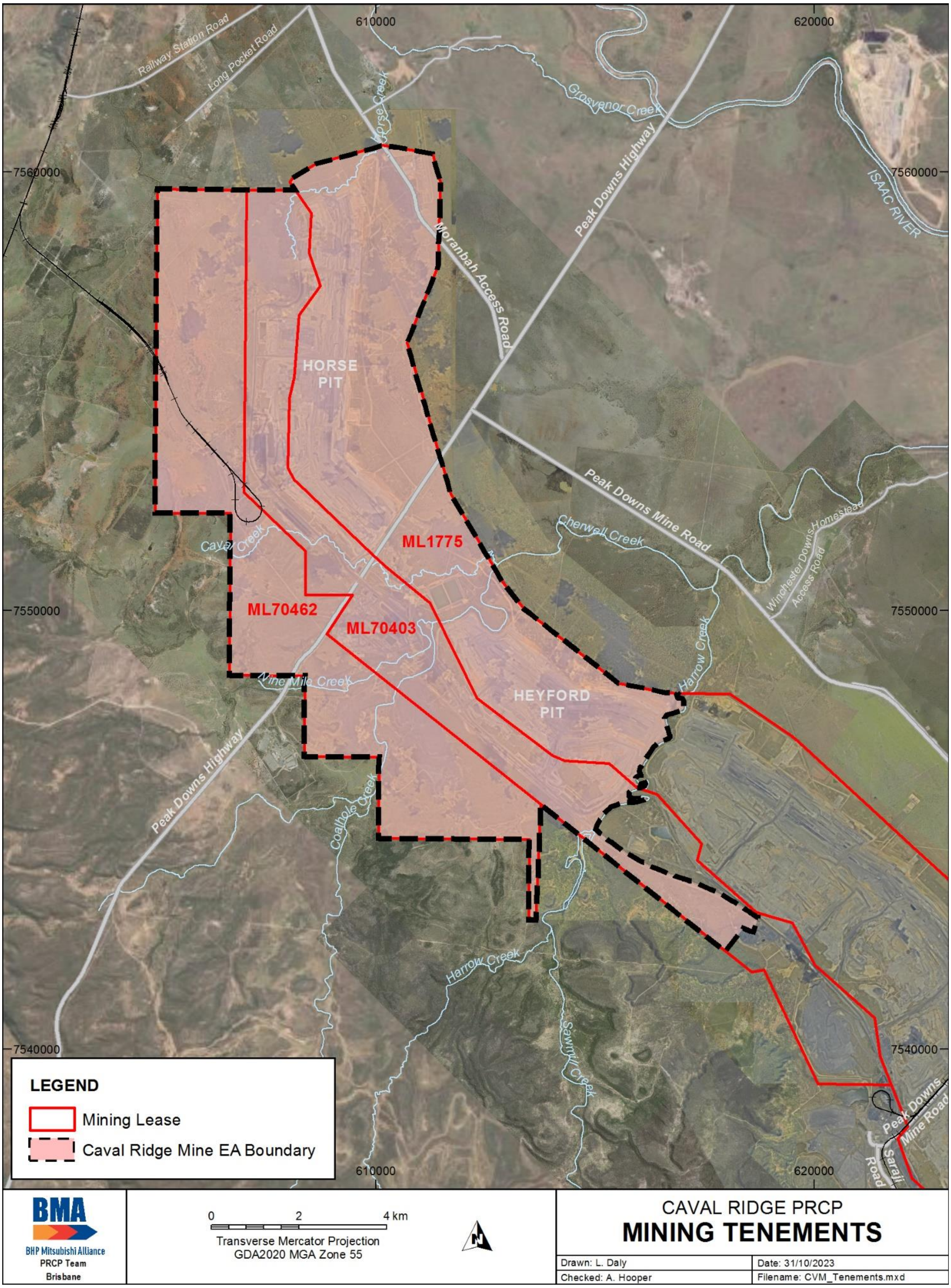

Figure 2: CVM mining tenements

1.1.3 Primary mine features and infrastructure on-site

The current primary mine features and infrastructure at CVM are summarised in Table 2. The current site layout is shown in Figure 3.

Table 2: Primary mine features and infrastructure at CVM

Mine domain	Description
Voids	• Horse Pit • Heyford Pit
Spoil dumps	• Horse dump • Heyford dump
Stockpiles	• Run-of-mine (ROM) coal stockpiles • Product coal stockpiles • Topsoil stockpiles • Rock stockpiles
Dams	• Mine affected water (MAW) dams • Raw water dams • Sediment dams
Surface water diversions	• Horse Creek diversion (within an unmapped portion of Horse Creek) • Caval Creek diversion • Cherwell Creek diversion
Processing infrastructure	• Coal handling and preparation plant (CHPP) • Conveyors and transfer stations • Stackers and reclaimers • Surge bins and hoppers • Tunnels
Rail infrastructure	• Rail loop and spur • Train load-out (TLO) bin and facilities • Conveyors
General infrastructure	• Administration, crib, warehouse and various buildings • Workshops • Fuel, oil, chemical and water storage • Fuel and wash bays • Pipes and pumps • Sewage treatment plant • Power lines • Switchyard and substations

Mine domain	Description
	• Communications and lighting towers • Fences
General disturbance	• Laydown areas • Access roads • Haul roads • Borrow pits • Drains • Exploration
Excised land with public infrastructure (to remain at closure)	• Moranbah Airport • Moranbah Access Road • Peak Downs Highway

1.1.4 Type of mining operation

CVM is a conventional open cut, strip mine using both draglines and truck and shovel fleets. Mining activities occur within Horse Pit and Heyford Pit, with pit development progressively working eastwards, down the coal dip. Current operational pits extend over a strike length of approximately 12km.

Mining activities at CVM involve the removal and stockpiling of topsoil, drilling and blasting of overburden and interburden, mining of overburden and interburden by draglines and truck and shovel fleets, and mining of the coal by truck and shovel fleets. The majority of the overburden and interburden is placed in spoil dumps within the void of the previous strips.

Coal is hauled from the pits to the CHPP ROM area, or to designated coal stockpiles. The coal is processed at the CHPP and the product coal is conveyed to the TLO area located on ML70403. Fine rejects from the CHPP are dewatered via belt press filters. The fine and coarse rejects are hauled and co-disposed within the spoil dumps. Coal from PDM is also conveyed to CVM CHPP for processing.

Product coal is transported on Aurizon owned rail infrastructure to BMA's Hay Point Coal Terminal for export.

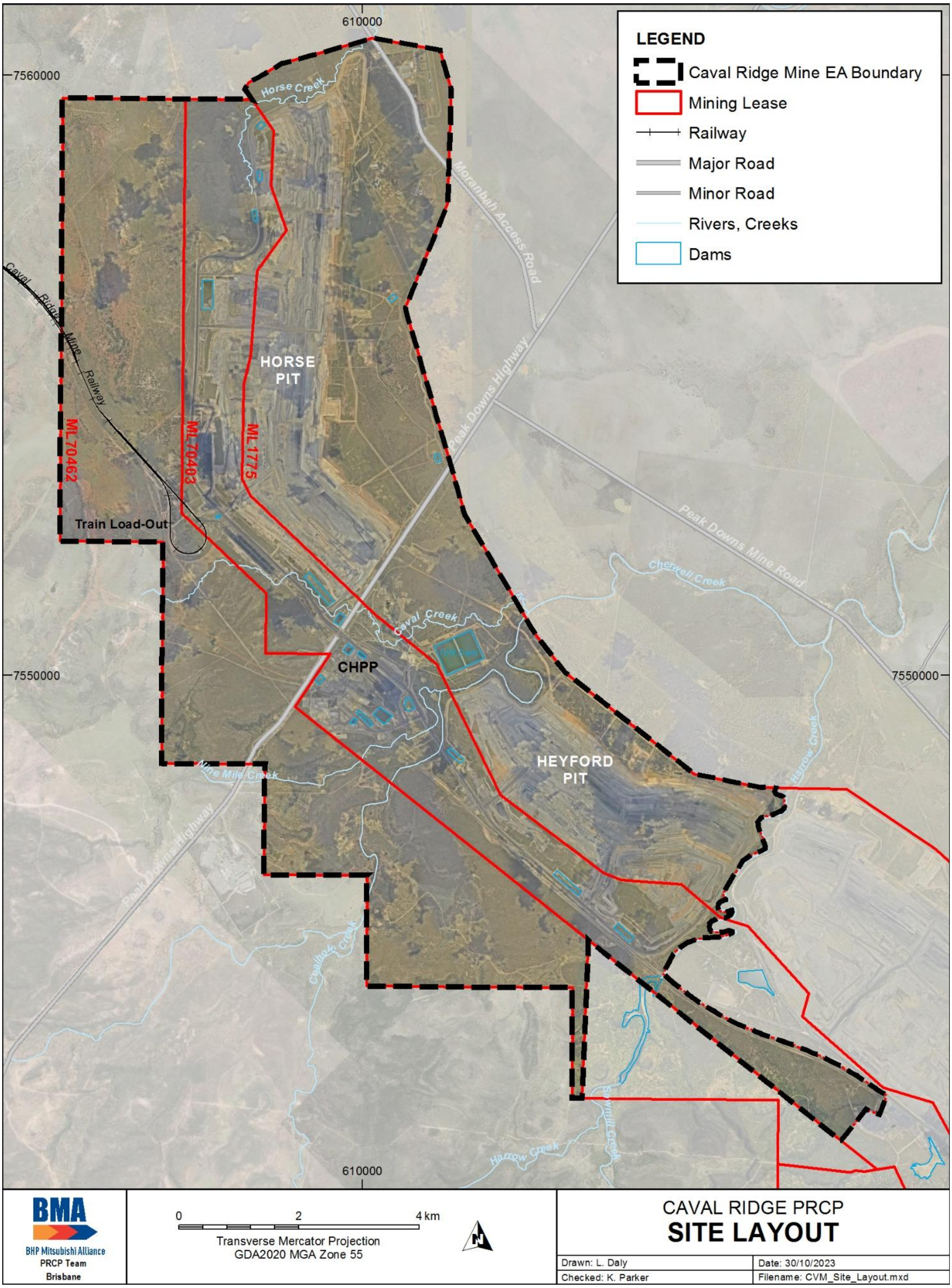

Figure 3: CVM site map

1.1.5 Proposed duration of the operation

Operations at CVM commenced in 2014 and included the previously developed Heyford Pit, which was previously mined as part of PDM. Current approved areas are planned to be mined until 2046. The mine life will increase with the EA Amendment application for Horse Pit extension project, as well as any other future approvals to expand mining areas. Variations to the planned mining rates due to business or market conditions, changes to technology, or refined resource information may also change the proposed duration of the operation, and as a result, when necessary, a PRCP amendment would be submitted to the administrating authority.

1.2 Baseline information

PRCP Guideline (Section 3.1)

In addition to the legislative requirements, the following information about the site, where relevant, is considered necessary by the administering authority (as per section 126C(1)(j) of the EP Act) to decide whether to approve the PRCP schedule:

- *site topography (locally and regionally)*
- *climate (general and specific (rain, evaporation, temperatures)) including long-term projections*
- *geological setting*
- *site hydrology and fluvial networks*
- *groundwater levels and properties*
- *soil types, properties, and productivity*
- *land stability (pre-existing land degradation/erosion and predisposition to ongoing stability issues)*
- *vegetation communities and ecological data (including existing regional ecosystem mapping)*
- *fauna presence and populations*
- *pre-mining land use*
- *identification of underlying landholders*

Transitional PRC Plans must include any baseline information collected as part of an EIS process or original EA application. If this information is unavailable, the reasons should be explained in this section of the rehabilitation planning part. Transitional PRC Plans are not required to demonstrate how aspects of the mine site have been designed for closure for existing or approved disturbance. However, any expansion to an existing site must demonstrate how it has been designed for closure. The rehabilitation/improvement planning must include data from when mining first commenced up until planned surrender. The transitional provisions of the EP Act include an exceptional circumstance for when land is available for rehabilitation.

1.2.1 Site topography

The site topography of CVM is generally flat to undulating. CVM is located on the western edge of the floor of the Isaac River Valley, which is a broad valley approximately 30km wide that generally runs north to south. Topography across the Isaac River Valley in the vicinity of CVM varies from approximately 220m Australian Height Datum (AHD) along the Isaac River east of CVM to approximately 450m AHD along portions of the Denham Range that define the western edge of the Isaac River Valley. The relatively steep slopes associated with the Denham Range contrast with the extensive flat areas along the floor of the valley.

1.2.2 Climate

CVM is located in a semi-arid climatic zone, which is characterised by high summer temperatures, warm dry winters and a distinct wet and dry season. Weather data was collected at the Moranbah Water Treatment Plant (Station No. 034038) between 1972 and 2012; and since 2012 it has been collected at the Moranbah Airport (Station No. 034035) (BoM, 2021).

1.2.2.1 Temperature

Maximum average temperatures range from 24°C in June/July to 34°C in December/January, with minimum average temperatures ranging from 10°C in July to 22°C in January.

1.2.2.2 Rainfall

Although rainfall occurs throughout the year, it is more prevalent in the summer months (Table 3).

Table 3: Moranbah monthly average rainfall for station no. 034038 and station no. 034035

Month	Station no. 034038 (mm)	Station no. 034035 (mm)
January	103.8	88.0
February	100.7	100.5
March	55.4	92.6
April	36.4	23.8
May	34.5	30.1
June	22.1	16.7
July	18.0	28.0
August	25.0	9.0
September	9.1	8.3
October	35.7	24.0
November	69.3	38.3
December	103.9	55.3
Annual	**614.2**	**514.6**

1.2.2.3 Evaporation

The evaporation rate is highest in the summer months - mean daily rate of 8.5mm in December; and lowest in the cooler months - mean daily rate of 3.5mm in June. The annual average rate of evaporation is approximately 2,300mm, which greatly exceeds the annual rainfall, a characteristic of semi-arid environments.

1.2.2.4 Wind

Wind records for Moranbah for January-April show an easterly predominance of moderate strength (1 - 20km/h), with easterlies dominating in May-July with some south-easterly influence. Easterly winds predominate for August-December which tends north to north-easterly from October to December.

1.2.2.5 Long-term climate projections

To account for potential future climate uncertainties within hydrologic designs and mine water planning, this PRCP and supporting technical studies have utilised the BMA Climate Change Adaptation in Mine Water Planning and Hydrologic Assessments Guideline (BMA, 2023b). This guideline was developed specifically for the locations of the BMA assets to provide a consistent approach to the adoption of future climate variables. The approach and baseline data, on which the guideline was based, has been derived from Commonwealth Scientific and Industrial Research Organisation (CSIRO), Bureau of Meteorology (BOM), DES and other published sources and is aligned with the published projection database and methods including Consistent Climate Scenarios Projection Data and High-Resolution Projection Data.

1.2.3 Geological setting

CVM is located on the western limb of the northern Bowen Basin. In this area, the Bowen Basin is characterised by a relatively thin accumulation of sediments, gentle easterly dips and minor to moderate deformation. The lithology at CVM is characterised by typical basin-fill sediments comprising mudstone, claystone, siltstone, sandstone (typically fine-grained), carbonaceous sediments and coal seams. Minor basalt is encountered within Tertiary-age material. The depth to base of weathering averages about 20m below natural surface but ranges from about 10m to 30m below natural surface, depending on the local topography.

The coal bearing sequences within the Horse and Heyford pits are the Permian-age Moranbah Coal Measures (MCM), comprising the following seam groups in stratigraphic order, from youngest to oldest:

- Q Seam / R Seam / S Seam - minor upper seams not currently encountered
- P Seam - only recently encountered in Heyford Pit
- Harrow Creek Upper (HCU) and Harrow Creek Lower (HCL) - encountered in both pits
- Dysart Upper (DYU) and Dysart Lower (DYL) - encountered in both pits

The Q/R/S/P seams are associated with a marine transgression (a brackish environment), whilst the Harrow Creek (HC) and Dysart (DY) seams are interpreted to have formed in fresh(er) water basins.

Non-mined seams below the DYL include the DLL, DLLL and C groups. Seam splitting is prevalent along the length (north-south) of both Horse Pit and Heyford Pit, and continuing southwards into neighbouring PDM. Overlying the MCM is a thin veneer of Quaternary- and Tertiary-age sediments. Throughout the region the Quaternary and Tertiary sediments are highly weathered, semi-consolidated and typically comprise of sand, clay and gravel.

To date, most of the coal mined at CVM has been from the HC and DY seam groups – predominantly the DY Seam Group – with P Seam being mined from Heyford Pit. As mining progresses eastwards (down-dip) the upper seams such as the HC Seam Group, followed by the P Seam Group (and Q-R-S Seam Group), will become more prevalent in both pits.

Due to the eastward dip of the seams, the location of the weathered zone ranges from above the DYU seam at the start of mining operations to the current location (at the highwall) above the P seam in Heyford Pit and above the DYU and HCU/HCL seams in Horse Pit.

Geological long-sections (indicatively north-south) along the current Horse Pit and Heyford Pit high-wall are provided in Figure 4 and geological cross-sections (indicatively west-east) through Horse Pit and Heyford Pit are provided in Figure 5. The seam groups are shown in the geological sections.

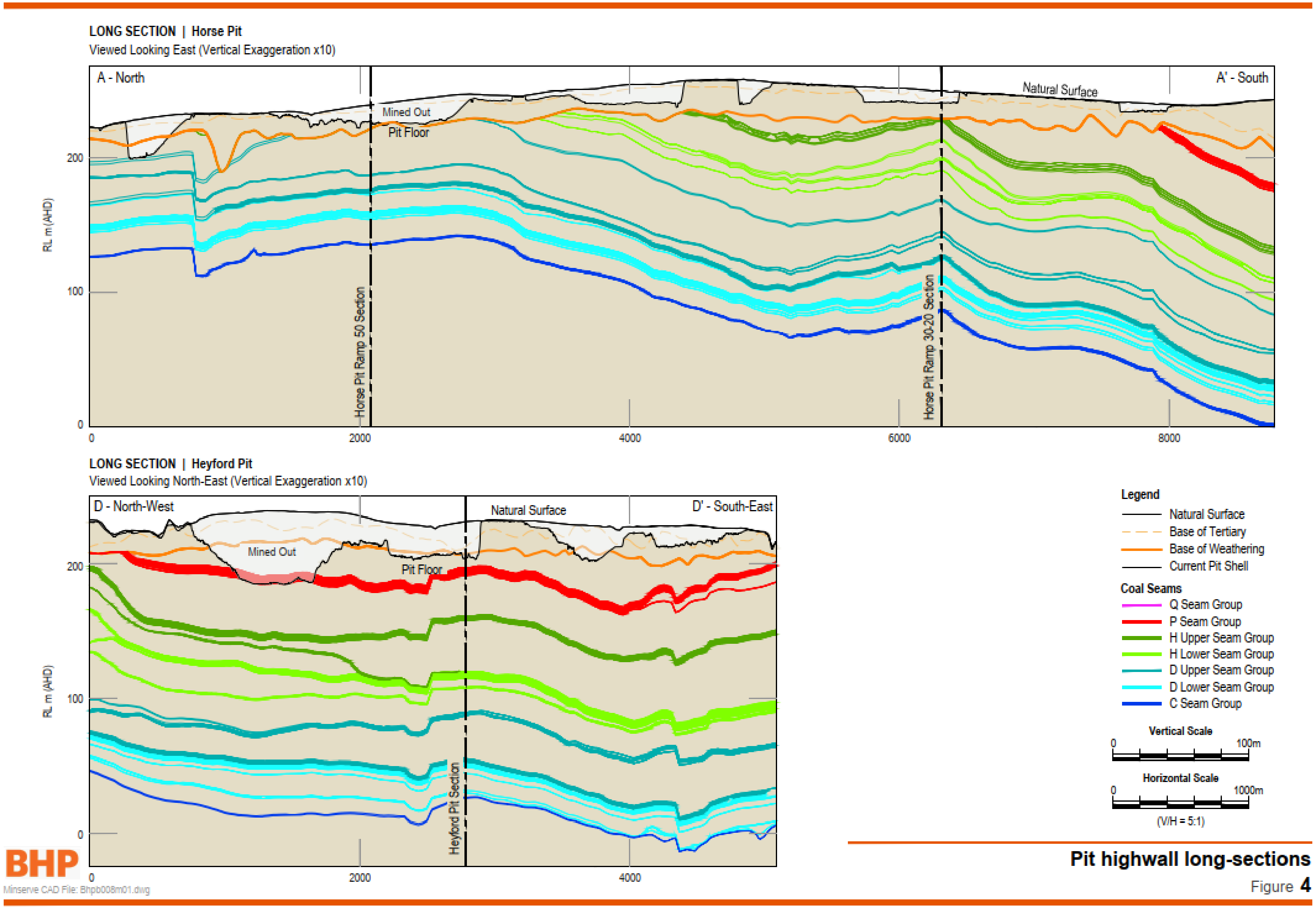

Figure 4: Representative geological long-section of CVM - Horse Pit and Heyford Pit (indicatively north-south)

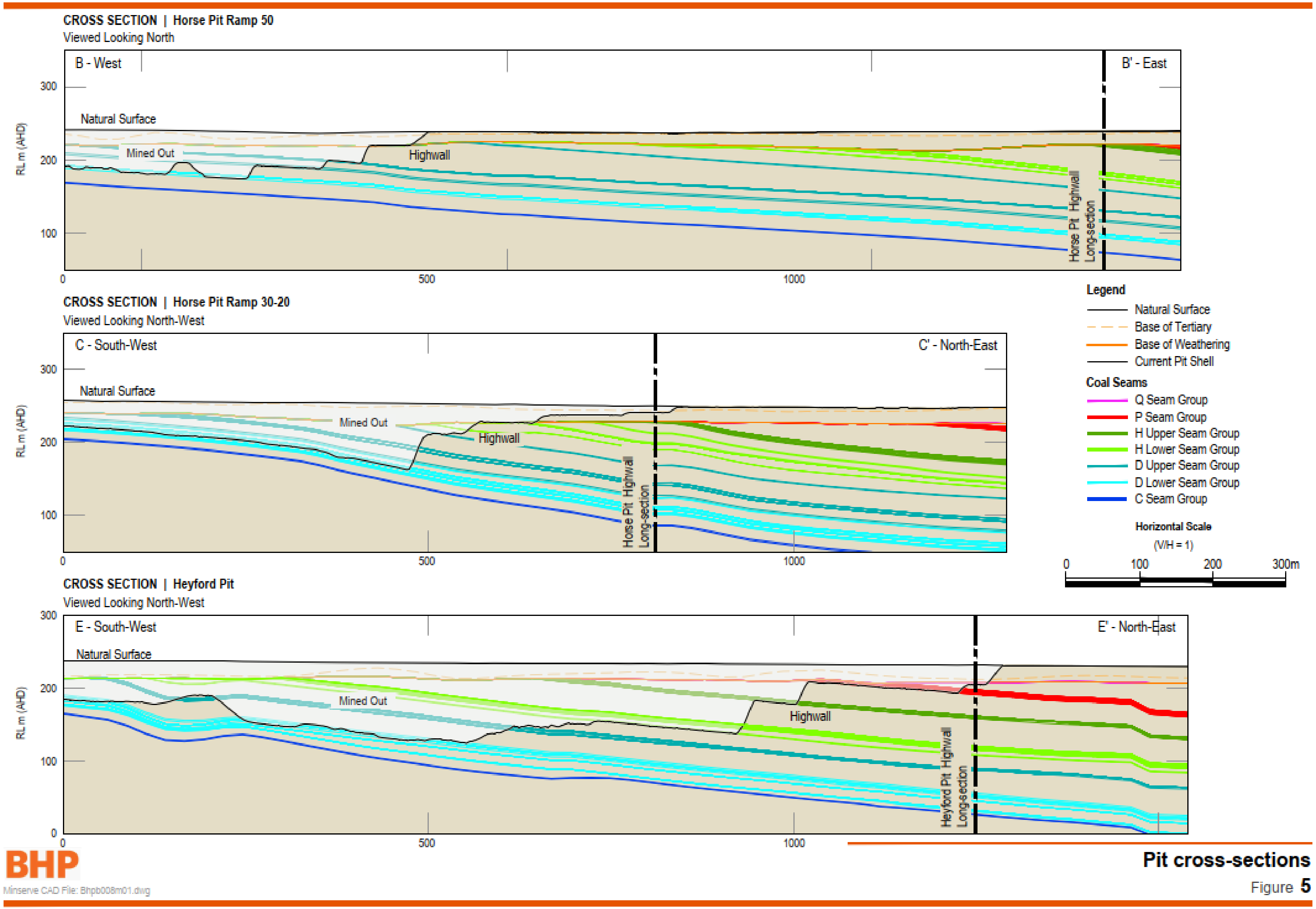

Figure 5: Representative geological cross-section of CVM Horse Pit and Heyford Pit (indicatively west-east)

1.2.4 Site hydrology and fluvial networks

CVM is located within the Fitzroy Basin, Isaac River Sub-basin and the Upper Isaac River Catchment (Queensland Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (DEHP, 2019). The majority of CVM is located within the Isaac Western Upland Tributaries Sub-catchment, with only the eastern lease boundary of ML1775 to the south of the Moranbah Airport, crossing into the Isaac and Lower Connors River Main Channel Sub-catchment (Figure 6).

The CVM leases cover approximately 101.6km^2, which is approximately 0.07% of the Fitzroy Basin (142,500km^2) and 0.4% of the Isaac River Sub-basin (22,327km^2). Land use within the Isaac River Sub-basin is dominated by grazing, woodland habitat, mining, infrastructure corridors, and townships including Moranbah, Nebo and Dysart. The sub-catchment of the Isaac Western Upland Tributaries, in which CVM is predominantly located, is extensively mined along the coal strike running north-south between the Goonyella Riverside Mine in the north to Saraji South Mine (formally known as Norwich Park Mine) at the southern sub-catchment boundary.

The surface water environmental values for the Isaac Western Upland Tributaries and the Isaac and Lower Connors River Main Channel are detailed in the Environmental Protection (Water) Policy 2009 Isaac River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all water of the Isaac river Sub-basin (including Connors River) (DEHP, 2011) and summarised in Table 4.

Table 4: Surface water environmental values

Sub-catchment	Aquatic ecosystems	Irrigation	Farm supply/ use	Stock water	Aquaculture	Human consumer	Primary recreation	Visual recreation	Drinking water	Industrial use	Cultural and spiritual value
Isaac Western Upland Tributaries	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Isaac and Lower Connors River Main Channel	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓

All watercourses and drainage lines in the proximity of CVM are ephemeral and do not hold naturally occurring permanent water. These watercourses generally have headwaters in the Denham and Cherwell Ranges to the west of the site and drain towards the Isaac River to the east. The watercourses within CVM are summarised in Table 5 and are shown in Figure 6.

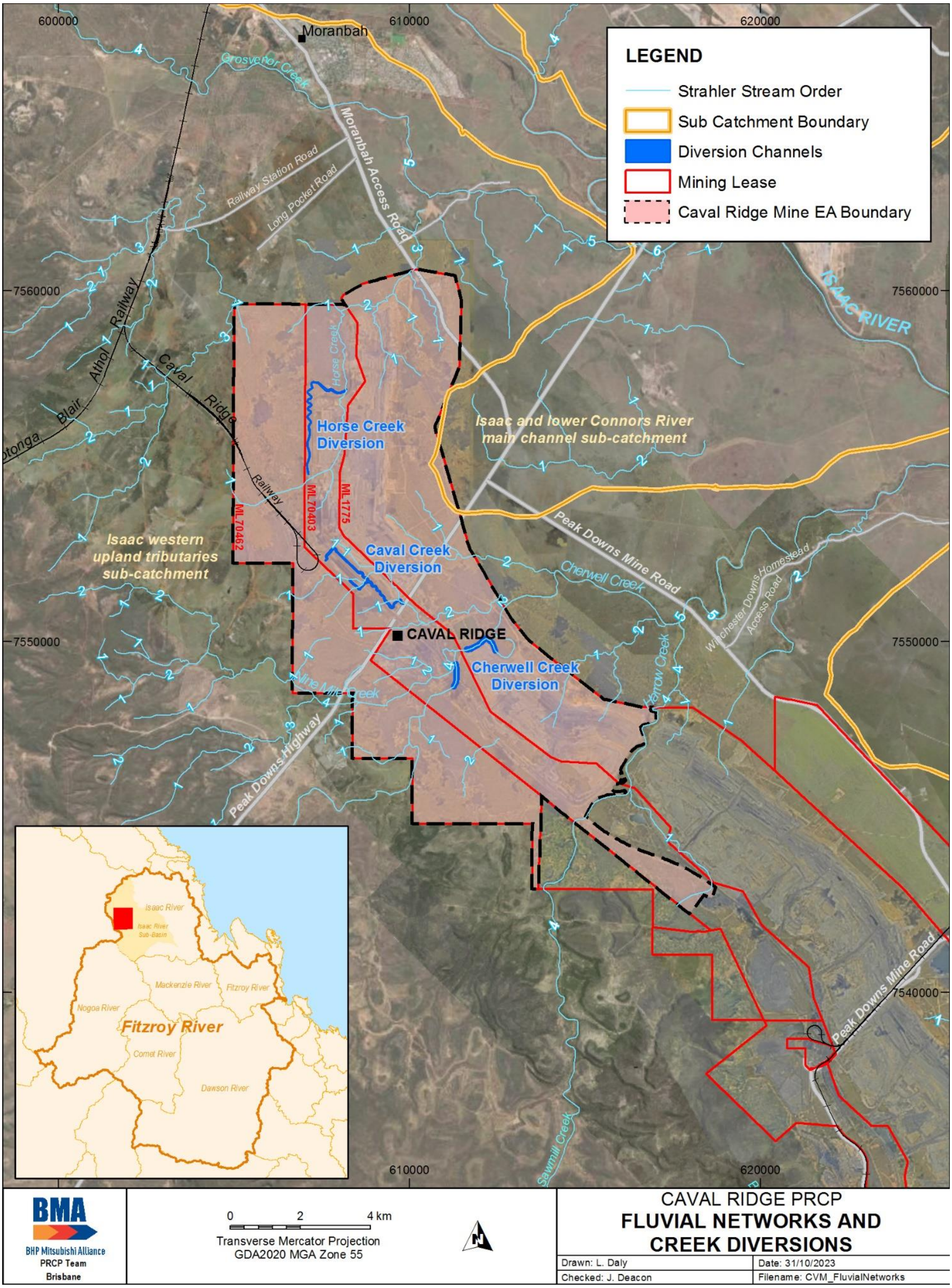

Figure 6: CVM's fluvial network and diversions

Table 5: Watercourses and key drainage lines within and immediately surrounding CVM

Watercourse	Perennially	Hierarchy	Strahler Stream Order	Comment
Horse Creek	Non-perennial	Minor	1 - 3	A tributary of Grosvenor Creek, which flows in a north/north-east direction through the northern watershed of CVM. Horse Creek is approximately 15km long to the junction with Grosvenor Creek with a catchment area of approximately 57km^2. Includes a clean water diversion within the upper reaches of Horse Creek, on the western side of the mining operations. The clean water diversion directs flows around mine operations within an unmapped portion of Horse Creek (as defined by the Water Act 2000).
Caval Creek (unnamed tributary of Cherwell Creek)	Non-perennial	Minor	1 - 2	A minor tributary of Cherwell Creek, which flows in an easterly direction. Caval Creek catchment area is approximately 15km^2 at the junction of Cherwell Creek. Includes a diversion around the product stockpile and CHPP area.
Nine Mile Creek	Non-perennial	Minor	4	A tributary of Cherwell Creek, which flows in a south easterly direction through CVM before joining Cherwell Creek. Nine Mile Creek catchment area is approximately 72km^2 at the junction with Cherwell Creek. Includes constructed open drains in the proximity of the mine industrial area (MIA) that direct clean runoff water to Nine Mile Creek.
Cherwell Creek	Non-perennial	Minor	4 - 5	A tributary of the Isaac River. The Cherwell Creek catchment begins in the Denham Range and runs through the Cherwell Range (west of CVM) and flows downstream to join the Isaac River (east of CVM). Cherwell Creek is approximately 65km long to the Isaac River junction. The upstream catchment area of Cherwell Creek is approximately 150km^2 (total catchment ~689km^2). Includes two diversion reaches around Heyford Pit.
Harrow Creek	Non-perennial	Minor	4	A tributary of Cherwell Creek, which flows predominantly within the PDM area along the southern boundary of CVM. Harrow Creek catchment area is approximately 223km^2 at the junction with Cherwell Creek. Approximately 400m of Harrow Creek Dam (including the dam wall) and the haul road culvert is located within the CVM EA area. To the east of the haul road, the top of the northern bank of Harrow Creek forms the southern boundary of the CVM EA area.

As part of the CVM mining operations BMA currently holds water licences permitting:

- Diversion of watercourses
- Taking of underground water from the MCM
- Interfering with the flow of water by impounding Harrow Creek
- Taking of water from Harrow Creek (water utilised by both CVM and PDM operations)

Water licences applicable to CVM surface waters are summarised in Table 6.

Table 6: Water licences applicable to CVM surface waters

Authorisation number	Authorisation activity	Authorised purpose	Approval date (most recent update)	Expiry date
104779	Licence to interfere by diversion – channel - Cherwell Creek Diversion 2	Diverting the flow of water	13 October 2014	30 June 2111
49428L	Licence to interfere by diversion – channel - Cherwell Creek Diversion Stage 1	Diverting the flow of water	23 December 2014	30 June 2111
606715	Licence to interfere by diversion – channel - Unnamed Tributary of Cherwell Creek - Caval Creek Diversion	Diverting the flow of water	16 December 2014	30 June 2111
608364	Licence to take water - underground water from Moranbah Coal Measures	Dewatering	29 August 2013	30 June 2111
577678	Licence to interfere by diversion – channel - Harrow Creek	Diverting the flow of water	31 October 2014	30 June 2111
43123L	Licence to interfere by impounding - embankment or wall – Harrow Creek Dam	Impounding water	05 February 2010	30 June 2111
43158L	Licence to take water – Harrow Creek Pump	Industrial	05 February 2010	30 June 2111

No water licences are held within any of the immediately adjacent properties (DoR, 2022), other than those held for the BMA mines to the south. The only non-BMA water licence within 10km of CVM is associated with ML70389 (on the eastern side of the Peak Downs Highway) for dewatering the MCM. A dam located to the north of CVM on Horse Creek, upstream of the confluence with Grosvenor Creek, is associated with a non-BMA operation and is not listed as having a water licence.

Within and surrounding the CVM tenement, there are number of small dams that have been constructed to support grazing land uses. The on-tenement stock watering dams are predominantly located on the western side of the mining operations and have not been constructed by the EA holder or used by the mining operations.

Water inventory management within the operational areas of CVM is centred around 12N dam and through transfers to and from the PDM located immediately to the south. The 12N dam is a lined turkey's nest dam consisting of two cells. The eastern cell is used to collect water from sediment dams and the western cell is used to collect MAW. Under CVM's EA, 12N dam is a conditioned approved release point into Cherwell Creek. Other water storage facilities that have been constructed for mining purposes include sediment dams and mine water dams, which are used to collect, recycle and stage water movements.

Sediment dams and mine water dams are periodically constructed and relocated to meet progressive mining requirements. During operations, runoff from unrehabilitated spoil dumps and disturbed areas is directed into sediment dams, and when required, are pumped to the eastern cell of 12N dam. Water collected in voids, from coal stockpile areas and from the CHPP and MIA, is pumped through mine water dams to the western cell of 12N dam. Monitoring of water quality within 12N dam, as well as water quality and flow rates within Cherwell Creek, are undertaken to confirm compliance with EA release requirements. At closure, surface water from rehabilitated landforms will report to the receiving environment.

During mining operations, levees are utilised where appropriate to provide suitable levels of flood protection to the voids and operational areas. At closure, post-mining landforms have been designed to provide alternative flood mitigation measures for the residual voids.

1.2.4.1 Fluvial Water Quality

Surface water quality within the fluvial network that intersects CVM has been assessed through the Receiving Environment Monitoring Program (REMP). This monitoring program has been undertaken in accordance with Conditions F20 to F22 of the site's EA. The REMP reports and associated surface water quality results are supplied to the administering authority as part of the EA's annual reporting requirements.

The REMP reports have included the assessment of background surface water quality through sample points within Cherwell and Harrow creeks located upstream and to the west of CVM. Sampling methodologies employed for the program are aligned with the Queensland Water Quality Guidelines (DEHP, 2009).

The interpretation of upstream water quality has utilised suitable monitoring data collected during periods of flow from the commencement of the REMP in 2015. Upstream results reflective of background surface water quality at CVM, reproduced from the Gauge (2021) REMP report, are summarised in Table 7.

Table 7: Summary of upstream water quality results (2015 to 2021)

Analyte	Unit	Cherwell Creek Upstream			Harrow Creek Upstream		
		80th Percentile	Mean	20th Percentile	80th Percentile	Mean	20th Percentile
EC	µS/cm	251	290.52	114	233.5	173.93	70
Turbidity	NTU	3380	2267.64	855.24	1535.2	901.34	382.6
DO	%	29.73	29.73	29.73	75.3	75.3	75.3
Temp	°C	30.7	28.42	25.67	30.3	27.68	25.6
TSS	mg/L	2310	1336.67	83.2	925.6	450.9	77.6
Hardness	mg/L	69	61.06	28	84	68.89	16
SO4	mg/L	16.8	16.53	5.2	15	8	3
Fluoride	µg/L	200	135.29	100	100	96.82	50
Ammonia	µg/L	148	91.62	44	240	151.67	50
Nitrate	µg/L	788	784.46	264	280	273.33	180
TN	µg/L	7680	4601.92	1960	3180	2130	1360
TP	µg/L	1386	1090.62	342	508	265.88	76.8

Analyte	Unit	Cherwell Creek Upstream			Harrow Creek Upstream		
		80th Percentile	Mean	20th Percentile	80th Percentile	Mean	20th Percentile
C6-C9	µg/L	10	10.88	10	10	10	10
C10-C36	µg/L	69	53.24	25	25	25	25
Al (dissolved)	µg/L	592	479.71	5	420	230	10
As (dissolved)	µg/L	0.50	0.56	0.50	1.1	0.83	0.50
B (dissolved)	µg/L	76	45.62	25	68	52.86	25
Cd (dissolved)	µg/L	0.05	0.08	0.05	0.05	0.05	0.05
Cr (dissolved)	µg/L	0.50	0.59	0.50	0.50	0.50	0.50
Co (dissolved)	µg/L	0.50	0.50	0.50	0.50	0.67	0.50
Cu (dissolved)	µg/L	2	1.35	0.60	1	0.95	0.50
Fe (dissolved)	µg/L	408	314.41	25	290	178.64	25
Pb (dissolved)	µg/L	0.50	0.53	0.50	0.50	0.56	0.50
Mn (dissolved)	µg/L	21.6	16.56	0.50	28.6	32.44	0.80
Hg (dissolved)	µg/L	0.05	0.05	0.05	0.05	0.05	0.05
Mo (dissolved)	µg/L	0.50	0.50	0.50	0.70	0.61	0.50
Ni (dissolved)	µg/L	2	1.76	1.2	2	1.59	1
Se (dissolved)	µg/L	5	5	5	5	5	5
Ag (dissolved)	µg/L	0.50	0.50	0.50	0.50	0.50	0.50
U (dissolved)	µg/L	0.50	0.50	0.50	0.50	0.50	0.50
V (dissolved)	µg/L	5	5	5	5	5	5
Zn (dissolved)	µg/L	2.5	2.85	2.5	2.5	2.5	2.5
Al (total)	µg/L	32760	18898.24	3660	12700	11277.27	6750
As (total)	µg/L	6.8	4.15	2	2.4	2.22	2
B (total)	µg/L	86	64.41	30	60	42.5	25
Cd (total)	µg/L	0.10	0.11	0.05	0.05	0.05	0.05
Cr (total)	µg/L	35.2	22.26	3.4	13	14.18	5

Analyte	Unit	Cherwell Creek Upstream			Harrow Creek Upstream		
		80th Percentile	Mean	20th Percentile	80th Percentile	Mean	20th Percentile
Co (total)	µg/L	29.4	15.76	2.4	8.4	6.11	3.6
Cu (total)	µg/L	26.8	15.68	4.2	14	10.18	5
Fe (total)	µg/L	36680	22378.82	4060	14200	12381.82	6570
Pb (total)	µg/L	50.6	27.85	4.8	23	13.67	5.4
Mn (total)	µg/L	825.8	450.24	146.6	317.6	222.78	122
Hg (total)	µg/L	0.05	0.05	0.05	0.05	0.05	0.05
Mo (total)	µg/L	0.50	0.50	0.50	0.50	0.50	0.50
Ni (total)	µg/L	53.6	28.53	5.2	17	15.82	8
Se (total)	µg/L	5	5	5	5	5	5
Ag (total)	µg/L	0.50	0.50	0.50	0.50	0.50	0.50
U (total)	µg/L	2	1.18	0.50	0.50	0.73	0.50
V (total)	µg/L	48	32.35	6	20	13.33	8
Zn (total)	µg/L	91.2	49.75	11.6	27	24.17	16

Notes:
Data collection and interpretation methodology detailed within Gauge (2021) REMP.
Only monitoring data collected during flow events has been utilised within the assessment of background conditions.
Results below the laboratory limit of reporting were assumed to equal half the limit of reporting.

Field monitoring of upstream sample locations during flow events, undertaken as part of the REMP, also identified pH in surface water ranging between 7.94 and 6.4 in Cherwell Creek and 7.65 and 6.56 in Harrow Creek.

The background surface water quality results are reflective of the land uses to the west of CVM, which primarily consist of grazing and woodland habitat. The 80th/20th percentile concentrations within the upstream sample locations are above the adopted published investigation levels for turbidity, total suspended solids, ammonia, nitrate, total nitrogen, phosphorus, aluminium, boron and copper. Any future assessments of downstream receiving environment surface water quality will need to take into consideration the background water quality in addition to the catchment's water quality objectives.

The on-going collection of surface water quality data will continue to develop the surface water quality database for CVM throughout the operational life, increase the statistical relevance of the data set and provide information on surface water quality trends over time. Future monitoring under the program is intended to be undertaken as part of the Fitzroy Basin Regional Receiving Environment Monitoring Program (FRREMP). The FRREMP aims to provide a more regional and consistent approach throughout the Bowen Basin.

1.2.5 Hydrogeology

A hydrogeological assessment, including conceptual and numerical modelling, has been undertaken to support the development of this PRCP. The detailed report - *Caval Ridge Mine Transitional PRCP Hydrogeology Assessment* (SLR, 2023b), is provided in Appendix E.

CVM is located within the Isaac Connors Groundwater Management Area (Zone 34) within the Fitzroy Basin (State of Queensland, 2022b). Within the groundwater management area, volumetric limits apply to extraction of groundwater for uses other than stock watering and domestic purposes. The objectives for groundwaters within the management area of the Water Plan (Fitzroy Basin) 2011 (State of Queensland, 2022b) are for sustainable management to maintain ecological values and enable maintenance and ongoing use of the resource through water allocations and licensing.

Water licences applicable to CVM groundwaters are summarised in Table 8.

Table 8: Water licence applicable to CVM groundwaters

Authorisation number	Authorisation activity	Authorised purpose	Approval date (most recent update)	Expiry date
608364	Licence to take water - underground water from Moranbah Coal Measures	Dewatering	29 August 2013	30 June 2111

1.2.5.1 Groundwater environmental values

CVM is located within the Isaac Groundwaters environmental values area and the groundwater chemistry zone of 'Sodic sequence', which is saline and sodium-chloride dominated (DEHP, 2011) (Queensland Government, 2013). Table 9 summarises the environmental values of the Isaac Groundwater environmental values area.

Table 9: Groundwater environmental values

Groundwater zone	Aquatic ecosystems	Irrigation	Farm supply/use	Stock water	Aquaculture	Human consumer	Primary recreation	Secondary Recreation	Visual recreation	Drinking water	Industrial use	Cultural and spiritual value
Isaac Groundwaters	✓	✓	✓	✓	-	-	✓	-	-	✓	-	✓

1.2.5.2 Hydrogeological units

Groundwater at CVM comprises the following key hydrogeological units:

- Cainozoic sediments, comprising:
  - Quaternary alluvium – Unconfined aquifer (sporadically water-bearing strata of permeable unconsolidated sand or gravel) localised along Cherwell Creek, Harrow Creek and Horse Creek, and regionally along the Grosvenor Creek and Isaac River
  - Quaternary to Tertiary colluvium and weathered units (collectively regolith) – Unconfined and largely unsaturated unit
- Tertiary basalt: This unit is unconfined, heterogenous and discontinuous within and to the east of CVM. The basalt deposits are not regionally extensive with only a sub-crop along the western edge of Horse Pit and in the proximity of Cherwell Creek, which are associated with paleochannel constrained lava flows. The unit has highly variable permeability depending on the degree of weathering and nature of fracturing/ vescularity.

- Permian coal measures, comprising:
  - Overburden and interburden: These units generally have low permeability and have aquitard properties with groundwater occurrence largely restricted to weathered horizons or to secondary porosity through fractures
  - Coal seams: The primary aquifers at CVM, with water bearing properties primarily associated with secondary porosity through cracks and fissures.

Groundwaters contained within the Cainozoic sediments and Tertiary basalt at CVM are unconfined, only sporadically water-bearing and not regionally extensive. These groundwaters are not considered a significant groundwater resource on the CVM tenement. The primary aquifers at CVM are the groundwaters hosted within the Permain coal seams, which are characterised as confined fractured rock aquifers, within the Q Seam, P Seam, H Seam and D Seam. The overburden and interburden act as aquitards and are typically dry, or very low yielding with groundwater only associated with zones of weathering and fractures.

Quaternary alluvium

Qualitative assessment of the alluvial groundwaters indicates that it is topographically controlled and likely consistent with surface drainage patterns, which generally flow from the west towards the Isaac River. Available monitoring data shows groundwater elevations in the alluvium are approximately 225 to 224.25m AHD in the upstream (western) parts of the Cherwell Creek alluvium, and 213.3 to 212m AHD in the downstream (eastern) parts of the alluvium. Similar west-to-east trends are expected in the Harrow Creek alluvium materials.

Recharge of the alluvium is primarily driven by ephemeral stream flows, flooding and rainfall infiltration where no substantial clay deposits are present and monitoring data indicates that alluvial groundwater heights are influenced by climatic conditions. Recharge rates have been estimated to range from 0.1 to 1.3mm/year within the alluvium at CVM and 3mm/year within the Isaac River channel alluvium.

Discharge of groundwater from the alluvium is through:

- Downstream throughflow
- Evapotranspiration through deeper rooted riparian vegetation
- Contribution to baseflow after significant rainfall and flood events

The alluvium is underlain by stratigraphy with low hydraulic conductivity (i.e. claystone, siltstone and sandstone), limiting the rate of downward infiltration to underlying formations.

Published regional data for hydraulic conductivities within the alluvium ranges from 10^{-2}m/day to almost 10^{1}m/day. The wide range of hydraulic conductivity reflects the heterogeneous nature of the alluvial sediments. Hydraulic testing of the alluvium within CVM identified hydraulic conductivities ranging between 0.09m/day to 1.25m/day.

The dominant water type in the unconsolidated alluvium, based on site monitoring, is generally Na-Mg-Cl and Na-Mg-Cl-HCO3.

Regolith

The presence of water in the regolith in the region is restricted to lower elevation areas. Flow within the regolith, where it is saturated, is a reflection of topography. The available regolith monitoring data indicates groundwater levels are between 217.7m AHD and 215.7m AHD.

The regolith material comprises low hydraulic conductivity strata (i.e., clay and claystone), which restricts recharge. Recharge rates for the regolith has been calculated using the chloride mass balance method as 0.1mm/yr. Recharge of the regolith is via surface infiltration and overland flow.

Groundwater discharge from the regolith occurs primarily via evapotranspiration, with some baseflow to streams from the regolith under wet climatic conditions. Vertical seepage through the regolith is limited by the low hydraulic conductivity of the regolith, overburden and other aquitards.

The dominant water type in the regolith, where present, is generally Na-Mg-Cl and Na-Mg-Cl-HCO3.

Tertiary basalt

Qualitative assessment of groundwater flow within the basalt indicates that groundwater would follow the topographic relief within the basalt extents. Recorded basalt groundwater elevations range from around 225m AHD south of Horse Pit to 202.5m AHD to the east of Horse Pit.

Recharge of the basalt aquifer is via surface infiltration and overland flow in areas where the basalt is exposed and/or no substantial clay barriers occur in the shallow subsurface. Groundwater discharge from the basalt occurs primarily via evapotranspiration. Discharge via baseflow to minor tributaries of Cherwell Creek (in areas intersected by the basalt) may also occur after significant rainfall and flood events. Vertical seepage out of the basalt is limited by the underlying low hydraulic conductivity overburden and other aquitards.

Slug testing of CVM monitoring bores has identified highly variable hydraulic conductivities within the Tertiary basalts ranging from 5.18×10^{-3} to 3.19m/day. This is reflective of the heterogenous nature of the basalt associated with weathering and fractures/vesicles.

The dominant water type in the basalt, based on site monitoring, is generally Na-Mg-Cl and Na-Mg-Cl-HCO3.

Permian coal measure - interburden/overburden

Limited groundwater monitoring of the interburden in the north of CVM has identified groundwater levels ranging from 203.5m AHD in mid-2008 to 214.8m AHD in late 2019.

Recharge to the Permian coal measures predominantly occurs at the sub-crop to the west of CVM. The interburden/overburden has hydraulic conductivities at least an order of magnitude less than that of the coal seams and typically less than 10^{-4} m/day, and act as aquitards with groundwater occurrence restricted to zones of weathering and fractures.

Permian coal measure interburden bores indicate mixed water types of Na-Cl-HCO3 and Na-Mg-Cl.

Permian coal measure - coal seams

A potentiometric surface map for the coal measures pre-mining was generated for the CVM Environment Impact Statement (EIS) (URS, 2009) and showed pre-mining groundwater flow within the Permian coal measures to be west to east, consistent with the seam dip and recharge of the coal seams where they sub-crop to the west of CVM. The following summarises the groundwater elevations within the monitored coal seams:

- Q Seam - 210.2m AHD to 209.6m AHD. Note that an insufficient number of data points are available to generate potentiometric contours for the Q Seam as it exists only towards the east of CVM.
- P Seam - 209.99m AHD to 175.2m AHD. An insufficient number of data points are available to generate potentiometric contours for the P Seam. The P Seam has only recently been encountered in Heyford Pit and exists to the east of the CVM area.
- H Seam - 209.63m AHD to 191.84m AHD. The groundwater within the H Seam is mined at both Horse Pit and Heyford Pit. The direction of flow, in areas with limited mining influence, is inferred to be west to east consistent with the regional flow. Within the area of mine dewatering influence, groundwater flow is inferred to be east to west.
- D Seam - 199.34m AHD to 191.5m AHD. As the D Seam is mined at both Horse Pit and Heyford Pit, the local groundwater flow direction of the D Seam is inferred to be east to west towards the active mining areas.

Recharge to the Permian coal seams occurs where the units sub-crop to the west of CVM. Using the chloride mass balance method, a recharge rate for the weathered Permian units was calculated as 0.1mm/yr. Due to the low hydraulic conductivity of the interburden material, groundwater largely flows horizontally within the coal measures, along the bedding plane of the coal seams. Groundwater discharge occurs via evaporation and inflows into the mine voids.

The dual porosity of the coal seams, with a dominant porosity provided by fractures (joints and cleats), results in the coal seams being the dominant groundwater zones at CVM. Slug tests on CVM monitoring bores targeting the coal seams reported the following horizontal hydraulic conductivities (Kh) ranges:

- Q Seam: 0.26 – 0.33m/day
- P Seam: 0.02 – 0.16m/day
- H Seam: 0.01 – 0.33m/day

- D Seam: 0.03 – 0.59m/day

Mining of the coal seams and associated dewatering has influenced the groundwater flow directions within the coal seams through passive dewatering in the mine voids. The groundwater within the coal seams, particularly the H and D seams, which pre-mining flowed west to east, now flows toward the voids from the east. Potentiometric maps for the Permian pre-mining and each of the coal seams are provided in Appendix E (Figures 4-11 to 4-15).

Within the CVM Permian coal measure monitoring bores, the following water types have been identified:

- P Seam - Na-Cl water type
- Q Seam, H Seam, D Seam - variable depending on depth, with deeper bores to the east of CVM displaying Na-Cl water types and shallower bores having higher proportions of calcium and magnesium ions

1.2.5.3 Groundwater Quality

An assessment of groundwater quality for each of the hydrogeological units, based on the existing data held, was undertaken as part of the Hydrogeological Assessment (Appendix E). On-going monitoring of the groundwater will be undertaken throughout the operational life of the mine, which will provide for a statistically relevant data set to enable assessment of deep drainage from the rehabilitated landform. A summary of the currently known groundwater quality characteristics within each of the aquifers is provided below. Interpretation of the salinity levels provided below are based on the Food and Agriculture Organization of the United Nations (FAO), 2013. Chapter 2 – Saline waters as resources.

Quaternary alluvium

Salinity within the Quaternary alluvium ranges from fresh to saline with an average total dissolved solids (TDS) of 556mg/L (ranging between 10mg/L and 5,620mg/L).

A comparison of the available alluvial groundwater data to the water quality objectives for the Fitzroy Basin groundwaters (DEHP, 2011) indicates that water within the alluvium at CVM is generally suitable for stock water supply and short-term irrigation but exceeds:

- Drinking water levels (i.e. TDS, chloride and sodium), freshwater aquatic systems and long-term irrigation (boron and iron)
- Water quality objectives (Zone 34 –shallow) for fluoride

Regolith

Salinity within the regolith ranges between moderately saline to highly saline with an average TDS of 7,101mg/L (ranging between 1,110mg/L and 18,600mg/L).

A comparison of the limited available groundwater data to the water quality objectives for the Fitzroy Basin groundwaters (DEHP, 2011) indicates that water within the regolith, where present, at CVM generally:

- Exhibits poorer quality compared to the alluvium and is not considered a suitable groundwater resource for livestock, irrigation, drinking water or aquatic ecosystems
- Exceeds the water quality objectives (Zone 34 – shallow) for electrical conductivity (EC), chloride, calcium, sodium, hardness, magnesium, sulphate, copper and manganese

Tertiary - basalt

Salinity within the Tertiary material ranges between fresh to highly saline with an average TDS of 3,538mg/L (ranging between 656mg/L and 16,526mg/L).

A comparison of the available groundwater data to the water quality objectives for the Fitzroy Basin groundwaters (DEHP, 2011) indicates that water within the basalt at CVM is generally suitable for stock water supply and short-term irrigation, but exceeds:

- Guideline levels for drinking water (i.e., TDS, chloride, sodium, total iron, total and dissolved manganese and dissolved arsenic), freshwater aquatic systems and long-term irrigation (total boron, total iron, and total and dissolved manganese)

- Water quality objectives (Zone 34 –shallow) for bicarbonate, total and dissolved manganese and dissolved iron

Overburden/interburden

Salinity within the Permian interburden ranges between moderately saline to highly saline with an average TDS of 5,349mg/L (ranging between 1,520mg/L and 9,126 mg/L).

A comparison of the limited available interburden groundwater data to the water quality objectives for the Fitzroy Basin groundwaters (DEHP, 2011) indicates that water within the interburden at CVM is generally suitable for stock water supply, but not considered suitable for irrigation, drinking water or aquatic ecosystems.

Coal seams

Water within the coal seams is generally saline with an average TDS of 7,598mg/L (ranging between 720mg/L and 24,704mg/L). H Seam bores are alkaline, which is in contrast to all other aquifers in the CVM area, which are neutral to slightly acidic.

Analytical results from coal seam hosted groundwaters at CVM indicate they are not suitable groundwater resources for irrigation, drinking water or aquatic ecosystems. A comparison of coal seam groundwater results to the water quality objectives for the Fitzroy Basin groundwaters (DEHP, 2011) indicates the following exceedances:

- Bicarbonate (D Seam) and sodium (D Seam) are above the Water Plan (Fitzroy Basin) 2011 (Zone 34 – deep)
- EC levels (P Seams), concentrations of sulphate (D Seam), total manganese (D Seam), sodium (P Seam), chloride (P and D Seam) and magnesium (D Seam) above the Water Plan (Fitzroy Basin) 2011 (Zone 34 – shallow)
- Sodium (D Seam), sulphate (P, H and D seams), fluoride (Q and D seams), dissolved iron (Q, P, H and D seams), calcium (P and H seams), EC levels (D Seam) and pH units above the Water Plan (Fitzroy Basin) 2011 (Zone 34 –shallow and deep)

1.2.5.4 Groundwater use

A bore census undertaken in 2020 (BMA, 2021) targeting properties within 5km of CVM, identified and surveyed a total of 26 bores. Of the 26 bores: 17 were found to be existing and in use; seven were existing but not in use (abandoned); one bore was decommissioned; and one bore was destroyed. Of the existing and in use bores, one was used for quarry water supply (gravel washing and dust suppression), three were used for stock water supply, 12 were used for groundwater monitoring and one was used for stock and non-potable domestic water supply.

Geological information, which was available for 14 of the surveyed bores, indicated the bores utilised for stock water and domestic purposes were installed into the Permian coal measures and the bore utilised for industrial purposes was installed within the alluvium associated with Grosvenor Creek.

The bore identified with potential for non-potable domestic use was installed 3.3km southwest and upgradient of CVM in the Permian Back Creek Group, which is not impacted by the mining operations.

Results of the bore census found groundwater use in the area to be limited due to low yields and salinity levels, with bores abandoned in favour of water supply from the Eungella-Bingegang pipeline. Groundwater was found not to be privately extracted from the MCM or Tertiary basalt within 5km of CVM tenure boundary. Given the increasing depth to the MCM to the east, it is considered unlikely groundwater extraction is undertaken further to the east. Water extraction in the surveyed bores was determined to be primarily from the shallower Fort Cooper coal measures where it overlies the MCM to the east of CVM.

Future potential for extraction and beneficial use of groundwater at CVM is considered limited, as groundwaters with suitable salinity levels are limited in extent. Due to the coal seam dip to the east, low yield and salinity, water hosted within the MCM, which is dewatered as part of mining operations, is not anticipated to be extracted and beneficially utilised.

Groundwater Dependant Ecosystems (GDEs) have been assessed as part of site-specific assessments undertaken for the Horse Pit Extension project. These assessments have included remote sensing and field assessments/surveys across the northern portion of CVM and identified the following:

- No potential terrestrial GDEs were identified in the vicinity of CVM using remote sensing, with the closest terrestrial GDE mapped approximately 45km to the east of CVM (2rog Consulting, 2021). No obvious surface-expressions of groundwater were identified (ESP, 2020).
- Assessment of the rooting depths of the species and the groundwater depths across the CVM area found the groundwater, outside of the riparian areas of the creeks, lies beyond the reach of the observed vegetation communities. Therefore, vegetation communities outside of the riparian areas were not considered to be representative of GDEs. Riparian vegetation along Horse, Caval and Cherwell creeks were found to contain communities that, on the basis of species type and predicted water table depth, may be considered terrestrial GDEs (BMA, 2021).

Stygofauna sampling in April 2020 at CVM did not identify stygofauna communities within the 13 sampled bores. This was consistent with the findings of the desktop assessment, which concluded that the aquifers in the vicinity of CVM are unlikely to support diverse stygofauna communities (ESP, 2020).

1.2.5.5 Conceptual site model

A hydrogeological conceptual site model representing the PRCP extent of mining, at the last day of mining at CVM, is illustrated in Figure 7. This conceptual site model indicates the mining operations result in the following:

- Groundwater drawdown within the MCM, associated with passive dewatering into the CVM voids, with inward hydraulic flow gradients surrounding the residual voids
- Residual voids capture seepage from spoil dumps
- Little to no impact on surficial aquifers including the Isaac River alluvium
- Little to no impact on environmental receptors
- No impact on anthropogenic receptors

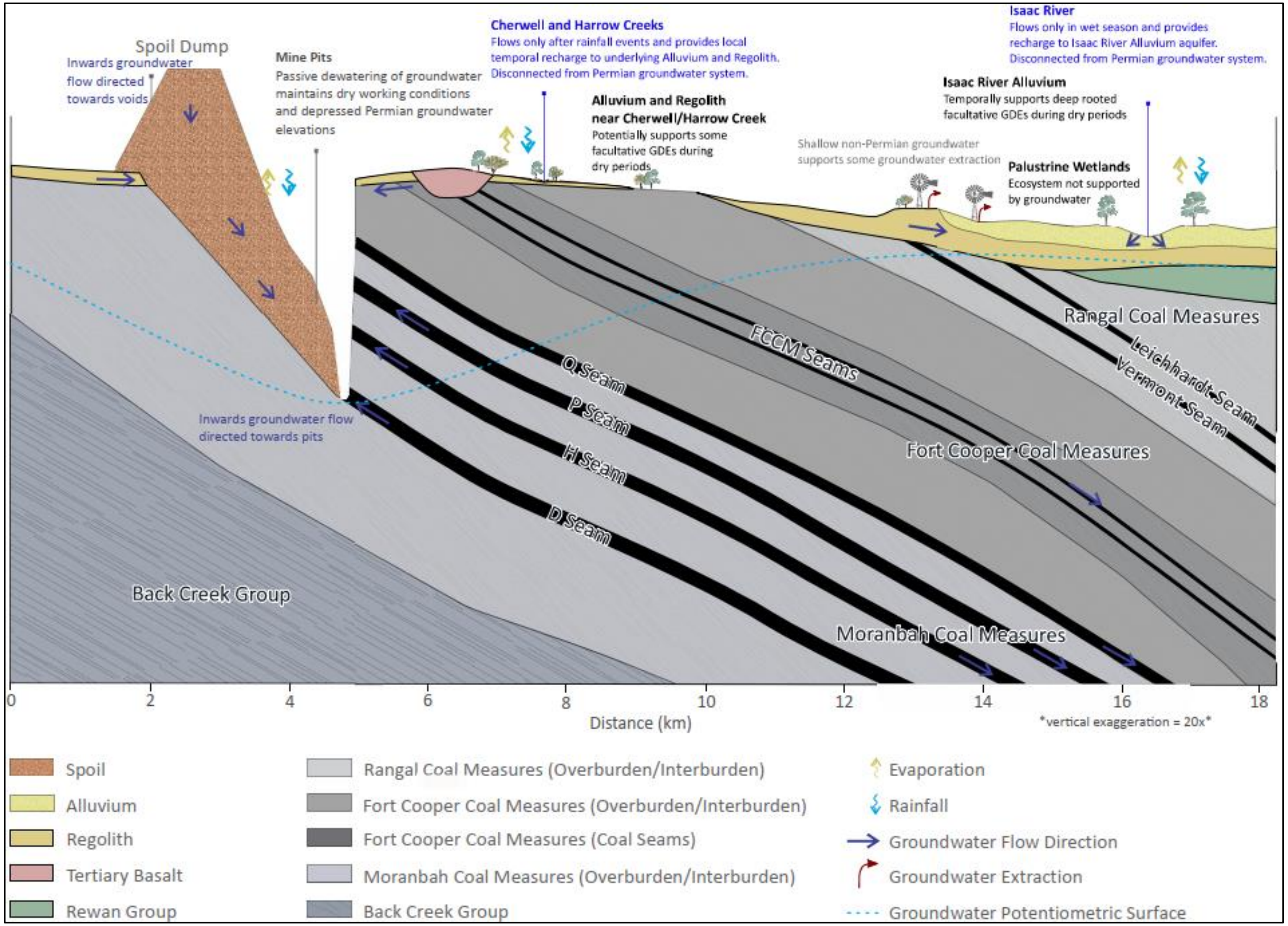

Figure 7: Conceptual site model of CVM at last day of mining (SLR, 2023b)

1.2.6 Soil types, properties and productivity

A number of baseline soil surveys have been undertaken at CVM. A summary of the Australian Soil Classification (ASC), soil type, soil management group and description for the soil types is provided in Table 10. The soil mapping according to the ASC is shown in Figure 8. Further detail is provided in *Caval Ridge Mine Material Characterisation Study* (Landloch, 2023), provided in Appendix F.

Table 10: CVM baseline soil types

Australian Soil Classification	Soil type	Soil management group	Description
Sodosol, Chromosol	Poplar Box Duplex Sandy Loams	Sand/Loam Topsoil	Texture contrast soils with a surface texture of sand to sandy clay loam. Subsoils range from light to medium clay and are typically sodic. Associated with Poplar Box woodlands.
Tenosol	Deep Riverine Sandy Alluvium	Sand/Loam Topsoil	Deep sand to loamy sands associated with drainage line, creeks and flood plains. Limited profile development.
Dermosol, Vertosol	Brigalow Clays	Clay Topsoil	Generally grey to brown cracking clays. May contain gravel. May contain gilgai. Associated with brigalow woodland.
Shallow Gravelly Dermosol	Skeletal Ridge Soils	Clay Topsoil	Shallow gravelly clays showing little to no profile development associated with ridge tops and steep stony slopes.

Based on the undisturbed topsoil characteristics, two soil management groups have been identified for rehabilitation, clay topsoil and sand/loam topsoil. Table 11 summarises the chemical and physical parameters of the undisturbed topsoils at CVM. Sand/loam topsoils are neutral in pH, low EC and have a moderate cation exchange capacity (CEC). Clay topsoils are neutral to marginally alkaline in pH, low EC and high CEC. Both management groups have low sodicity in their undisturbed form.

Table 11: Summary of chemical properties of undisturbed CVM soil types (0-10cm) (BMA, 2009)

Analysis (unit)	Soil management group and sample ID			
	Clay topsoil		Sand/loam topsoil	
	21	23	1	3
Soil pH (1:5)	7.0	8.0	6.9	7.1
Soil EC (dS/m)	0.08	0.17	0.12	0.09
CEC (meq/100g)	23.0	27.7	16.7	21.3
Exchangeable sodium percentage (ESP) (%Na/CEC)	4.35	1.08	4.19	1.88
Ca/Mg (ratio)	0.68	2.69	1.95	3.24
Clay Content	30-50%		<25%	
Water Holding Capacity	Moderate to high		Low	

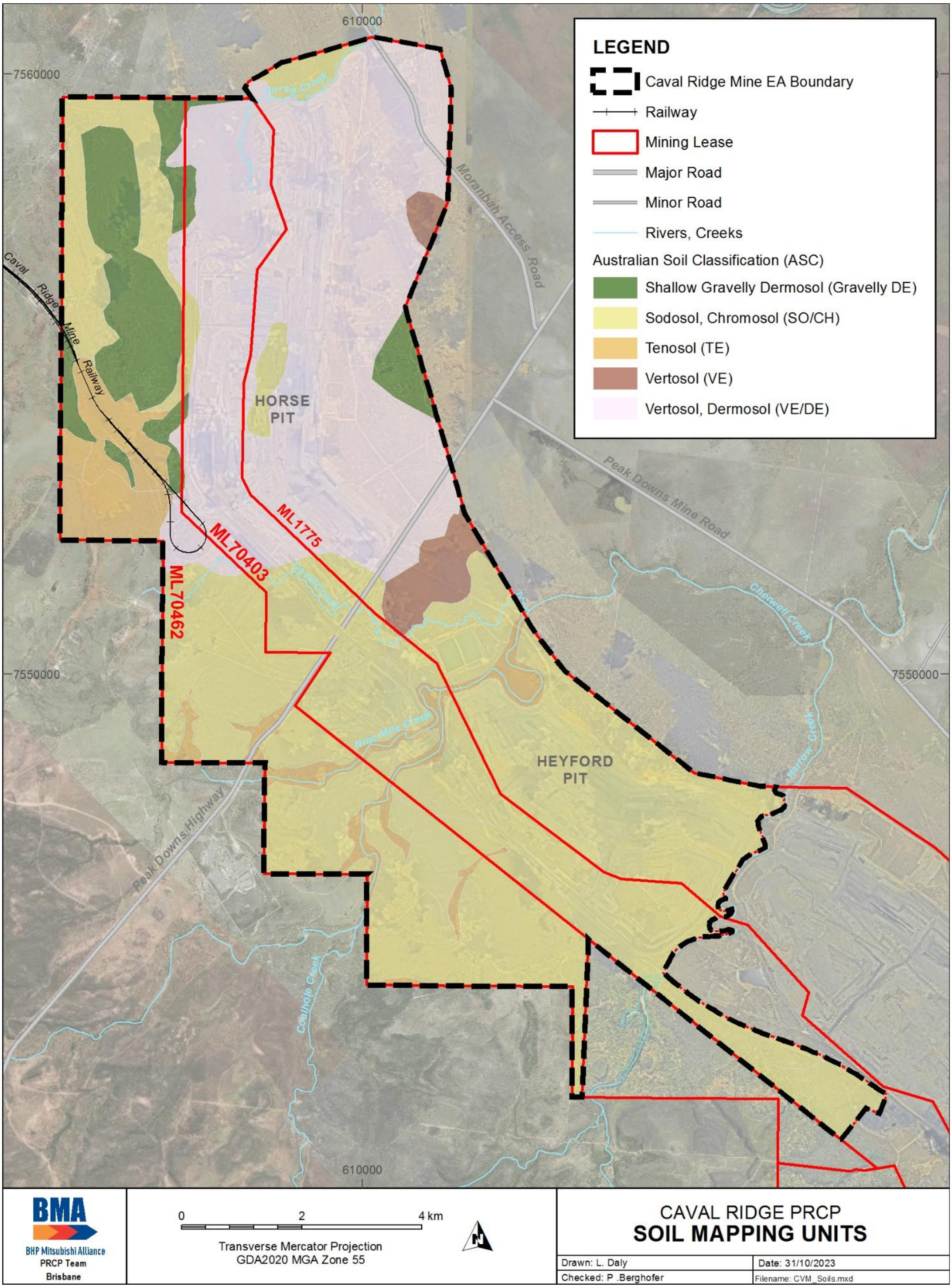

Figure 8: CVM soil mapping units (ASC)

1.2.7 Land stability

The pre-mining topography at CVM was generally flat to undulating and is consistent with the regional landscape. A pre-mining site visit observed that erosion was present mainly on creek banks (BMA, 2009). Land adjacent to CVM and within the Bowen Basin indicates surface erosion is common upon disturbance of soils and vegetation from cattle grazing.

1.2.8 Vegetation communities and ecological data

A number of ecological studies relating to vegetation communities and ecological values have been undertaken within the CVM site. Initial ecological studies included assessments undertaken to support the CVM EIS (BMA, 2009). Since approval of the mine, additional ecological studies have been undertaken, including:

- Horse Pit Extension Project – Caval Ridge Mine, Terrestrial Ecology Assessment (BMA, 2021)
- Cherwell Pit Development – Caval Ridge Mine, Terrestrial Ecological Assessment (E2M, 2020)
- Ecological Surveys: Caval Ridge Mine Stage 1: Desktop Assessment (AECOM, 2020)

The baseline vegetation communities and ecological values of the CVM site are based on the results of the previous ecological studies (BMA, 2021; E2M, 2020; AECOM, 2020; BMA, 2009) as well as updated desktop searches of the following Queensland Government databases:

- Regional ecosystem mapping - ML1775, ML70403, ML70462 (DES, 2023d)
- Matters of State Environmental Significance - ML1775, ML70403, ML70462 (DES, 2023b)
- Maps of environmentally sensitive areas - ML1775, ML70403, ML70462 (DES, 2023c)
- Wildlife Online Database ML1775, ML70403, ML70462 (DES, 2023e)

1.2.8.1 Regional ecosystems

Regional ecosystem (RE) mapping for CVM is based on the results of ground-truthed vegetation surveys and mapping undertaken for the Horse Pit Extension Project (BMA, 2021), the Cherwell Pit Development Project (E2M, 2020) and the CVM EIS (BMA, 2009). The Queensland Government RE mapping has also been used to indicate the REs occurring on CVM where ground-truthed vegetation survey data and mapping was lacking for ML70462. The REs on CVM are listed in Table 12 and mapped in Figure 9.

The results of vegetation surveys undertaken during the CVM EIS (BMA, 2009) indicated that the majority of the area proposed to be mined supported non-remnant vegetation and was subject to livestock grazing, however RE surveys and mapping did indicate a mosaic of remnant vegetation occurring along Cherwell Creek and associated plains to the south of the Peak Downs Highway. This mosaic included open forests and woodlands dominated by poplar box (*E. populnea*), silver-leaved ironbark (*E. melanophloia*), Queensland blue gum (*E. tereticornis*) and bloodwood (*Corymbia spp*.) (BMA, 2009). The Heyford Pit area south of Cherwell Creek has been mapped as containing a mosaic of vegetation including high-value regrowth (HVR) brigalow on Cainozoic clay plains (RE 11.4.9), remnant poplar box woodland on alluvium (RE 11.3.2) and areas of narrow-leaved red ironbark (*E. crebra*) woodland on Cainozoic sandplains (RE 11.5.9) (BMA, 2009). Several patches of mountain coolabah (*E. orgadophila*) open forest woodlands on basalt (RE 11.8.5) and *Dichanthium sericeum* grassland on Cainozoic igneous rocks (RE11.8.11) have also been mapped to the south of the Peak Downs Highway (E2M, 2020).

The Horse Pit Extension Project (E2M, 2021) ground-truthed tracts of non-remnant brigalow regrowth on Cainozoic clay plains to the east of Horse Pit as well as several smaller remnant ironstone jump-ups supporting remnant lancewood (*Acacia shirleyi*) and napunyah (*E. thozetiana*) woodlands (RE 11.7.1). To the north of Horse Pit, regrowth vegetation has been mapped in association with HVR brigalow woodland on alluvium (RE 11.3.1) and remnant blue gum fringing woodland (RE 11.3.25) along Horse Creek. Adjacent to Horse Creek, patches of HVR brigalow woodland with Dawson River gum (*E. cambageana*) (RE11.4.8) and remnant poplar box on Cainozoic sand plains (RE 11.5.3) were mapped. Two patches of *Dichanthium sericeum* grassland on Cainozoic igneous rocks (RE11.8.11) were mapped to the north east of Horse Pit dump (E2M, 2021).

Desktop searches of Queensland Government vegetation mapping databases indicated the northern section of ML70462 primarily contains non-remnant vegetation with only mapped watercourses potentially supporting regulated vegetation.

Ongoing operational vegetation clearing occurs in accordance with existing approvals.

Table 12: Regional ecosystems within CVM

Regional ecosystem descriptions	RE Code	Remnant/HVR	RE VM Act class	RE Biodiversity status
Acacia harpophylla and/or *Casuarina cristata* open forest on alluvial plains	11.3.1	HVR	Endangered	Endangered
Eucalyptus populnea woodland on alluvial plains	11.3.2	Remnant	Of concern	Of concern
Eucalyptus tereticornis or *E. camaldulensis* woodland fringing drainage lines	11.3.25	Remnant HVR	Least concern	Of concern
Eucalyptus cambageana woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	11.4.8	Remnant HVR	Endangered	Endangered
Acacia harpophylla shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	11.4.9	Remnant HVR	Endangered	Endangered
Eucalyptus populnea and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces	11.5.3	Remnant HVR	Least concern	No concern at present
Eucalyptus crebra and other *Eucalyptus spp*. and *Corymbia spp*. woodland on Cainozoic sand plains and/or remnant surfaces	11.5.9	Remnant	Least concern	No concern at present
Eucalyptus crebra, E. tenuipes, Lysicarpus angustifolius +/- Corymbia spp. woodland on Cainozoic sand plains and/or remnant surfaces	11.5.9b	Remnant HVR	Least concern	No concern at present
Eucalyptus thozetiana woodland on slopes of rocky residual ranges with Cainozoic lateritic duricruct.	11.7.1	Remnant	Least concern	Of concern
Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	11.7.2	Remnant	Least concern	No concern at present
Eucalyptus orgadophila open woodland on Cainozoic igneous rocks	11.8.5	Remnant HVR	Least concern	No concern at present
Dichanthium sericeum grassland on Cainozoic igneous rocks	11.8.11	Remnant	Of concern	Of concern
Acacia harpophylla and/or Casuarina cristata open forest to woodland on fine grained sedimentary rock	11.9.5	Remnant	Endangered	Endangered

Regional ecosystem descriptions	RE Code	Remnant/HVR	RE VM Act class	RE Biodiversity status
Acacia shirleyi or *A. catenulata* open forest on coarse-grained sedimentary rocks. Crests and scarps	11.10.3	Remnant	Least concern	No concern at present

*Queensland government mapped regional ecosystems only ML70462

1.2.8.2 Environmentally sensitive areas

Category B environmentally sensitive areas (ESAs) are defined under the Queensland's *Environmental Protection Regulation 2019* to include Endangered REs based on the biodiversity status in the 'Regional ecosystem description database' (Queensland Herbarium, 2018).

The results of the ground-truth vegetation surveys completed as part of the Horse Pit Extension Project (BMA, 2021), Cherwell Pit Development Project study (E2M, 2020) and CVM EIS (BMA, 2009) verified the presence of Category B ESAs associated with the following ground-truthed Endangered REs (Figure 9):

- RE 11.3.1 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
- RE 11.4.8 - *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains
- RE 11.4.9 - *Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains
- RE 11.9.5 - *Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on fine grained sedimentary rock.

No Category B ESAs have been mapped on ML70462 (DES, 2023c).

1.2.8.3 State significant Threatened flora species

One threatened flora species, *Dichanthium queenslandicum* (king blue grass) listed as Vulnerable under the *Nature Conservation Act 1992* (NC Act), was recorded during ecological surveys undertaken for the CVM EIS (BMA, 2009). No other threatened flora species were recorded during ecological surveys undertaken for the Horse Pit Extension Project (BMA, 2021) or Cherwell Pit Development study (E2M, 2020).

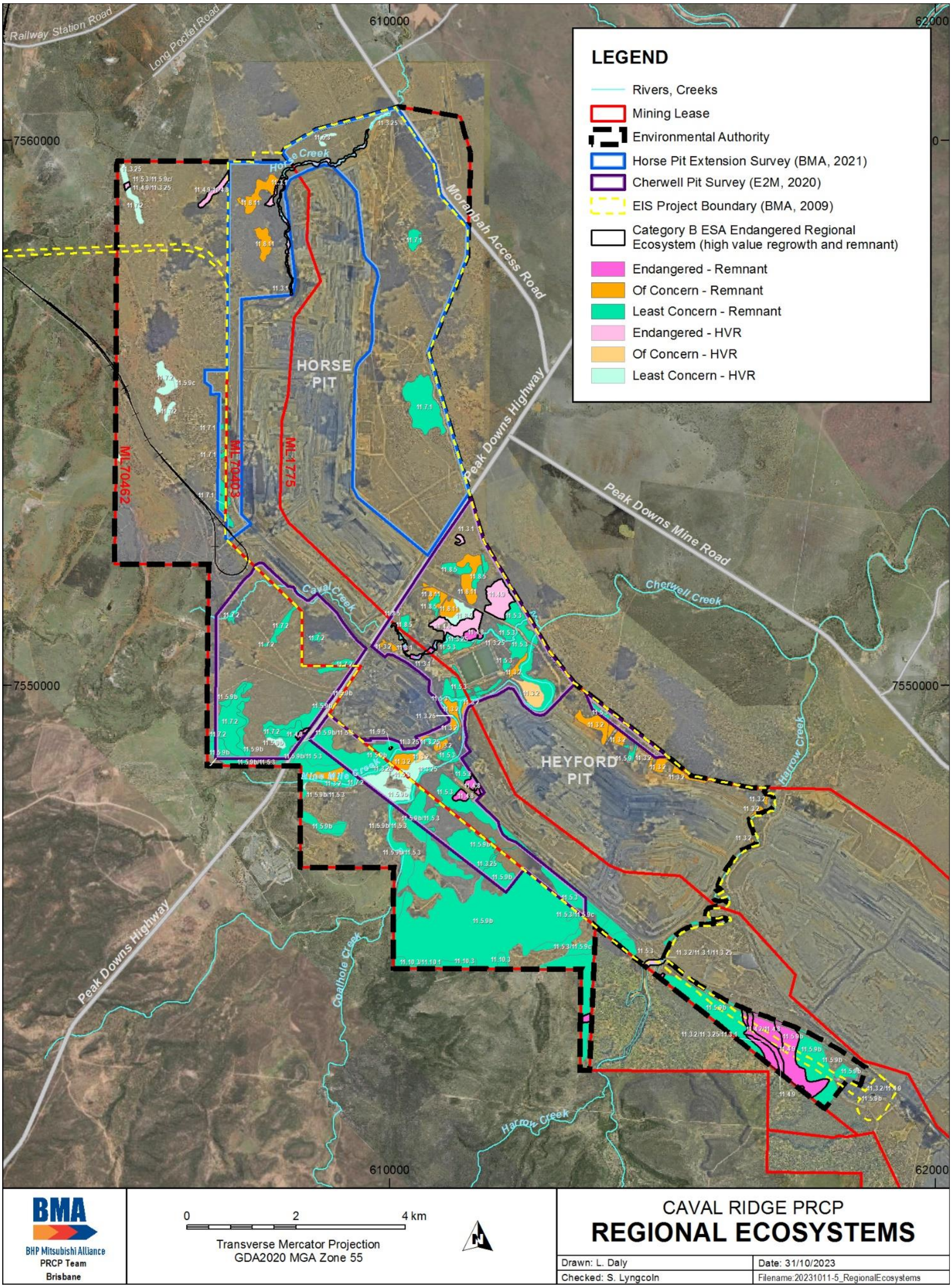

Figure 9: CVM Regional Ecosystems

1.2.9 Fauna presence and populations

1.2.9.1 State significant fauna species

The following threatened fauna species listed under the NC Act have been recorded during previous ecological surveys on CVM:

- Koala (*Phascolarctos cinereus*) (Endangered NC Act) (E2M, 2020) (BMA, 2009)
- Greater glider (*Petauroides armillatus*) (Endangered NC Act) (E2M, 2020) (BMA, 2009)
- Squatter pigeon (*Geophaps scripta scripta*) (Vulnerable NC Act) (BMA, 2009)
- Ornamental snake (*Denisonia maculata*) (Vulnerable NC Act) (BMA, 2021)
- White-throated needletail (*Hirundapus caudacutus*) (Vulnerable NC Act) (BMA, 2009)
- Short beaked echidna (*Tachyglossus aculeatus*) (Special Least Concern NC Act) (BMA, 2009)

Ten koalas were observed in Cherwell Creek, Nine Mile Creek and Caval Creek during the Cherwell Pit Development ecological survey (E2M, 2020). Potential koala habitat has been mapped in association with the woodlands along Cherwell Creek, Nine Mile Creek and Caval Creek, as shown in Figure 10.

Eleven individual greater gliders were detected within the eucalypt-dominant woodlands fringing Cherwell Creek (seven) and Nine Mile Creek (four) during the Cherwell Pit Development ecological survey (E2M, 2020). Potential habitat for the greater glider has been mapped along the forests and woodlands occurring along Cherwell Creek and Nine Mile Creek (Figure 10). Cherwell Creek, in particular, supports an abundance of large hollows and a dense eucalypt-dominant canopy (E2M, 2020).

Squatter pigeons were not observed during the Horse Pit Expansion Project (BMA, 2021) or the Cherwell Pit Development ecological surveys (E2M, 2020), however several were previously recorded during ecological surveys for the CVM EIS (BMA, 2009). All individuals were observed in areas of active grazing and substantial habitat degradations, and their occurrence may reflect the nearby presence of water rather than food resources (BMA, 2009). Potential squatter pigeon habitat at CVM has been mapped in Figure 11.

Ornamental snake was recorded during the 2020 wet season survey for the Horse Pit Expansion Project (BMA, 2021) in regrowth brigalow representative of RE 11.4.9. Habitat features included shallow gilgai with cracking clay soils (crack depths varied between shallow and deep), as well as coarse woody debris and/or ground litter. Potential ornamental snake habitat at CVM has been mapped in Figure 11.

The white-throated needletail is primarily an aerial species and has only been previously recorded flying over the CVM site during the EIS survey (BMA, 2009).

The short-beaked echidna occurs in a wide variety of habitats, including forest, woodlands, heath and grasslands, and was previously recorded on the CVM site during the EIS survey (BMA, 2009) and Cherwell Pit Development ecological surveys (E2M, 2020). As a habitat generalist, the short-beaked echidna has potential to occur in the remnant and regrowth vegetation communities within the CVM site.

It should also be noted that Troughton's sheathtail bat (*Taphozous troughtonii*) and little pied bat (*Chalinolobus picatus*) were recorded during studies for the CVM EIS. Though respectively listed as Endangered and Rare under the NC Act at the time of survey, these species are no longer listed under the NC Act.

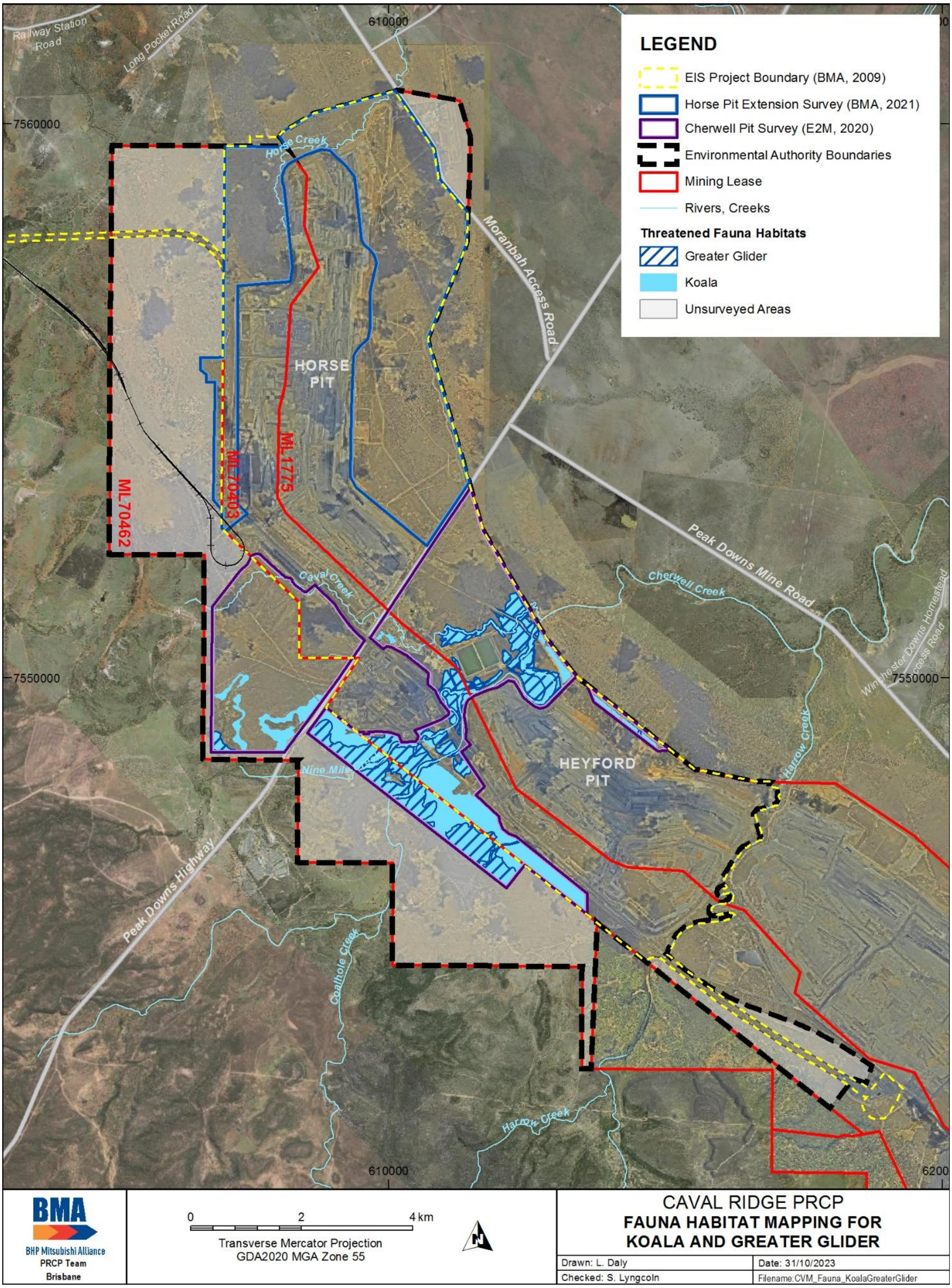

Figure 10: CVM fauna habitat mapping for koala and greater glider

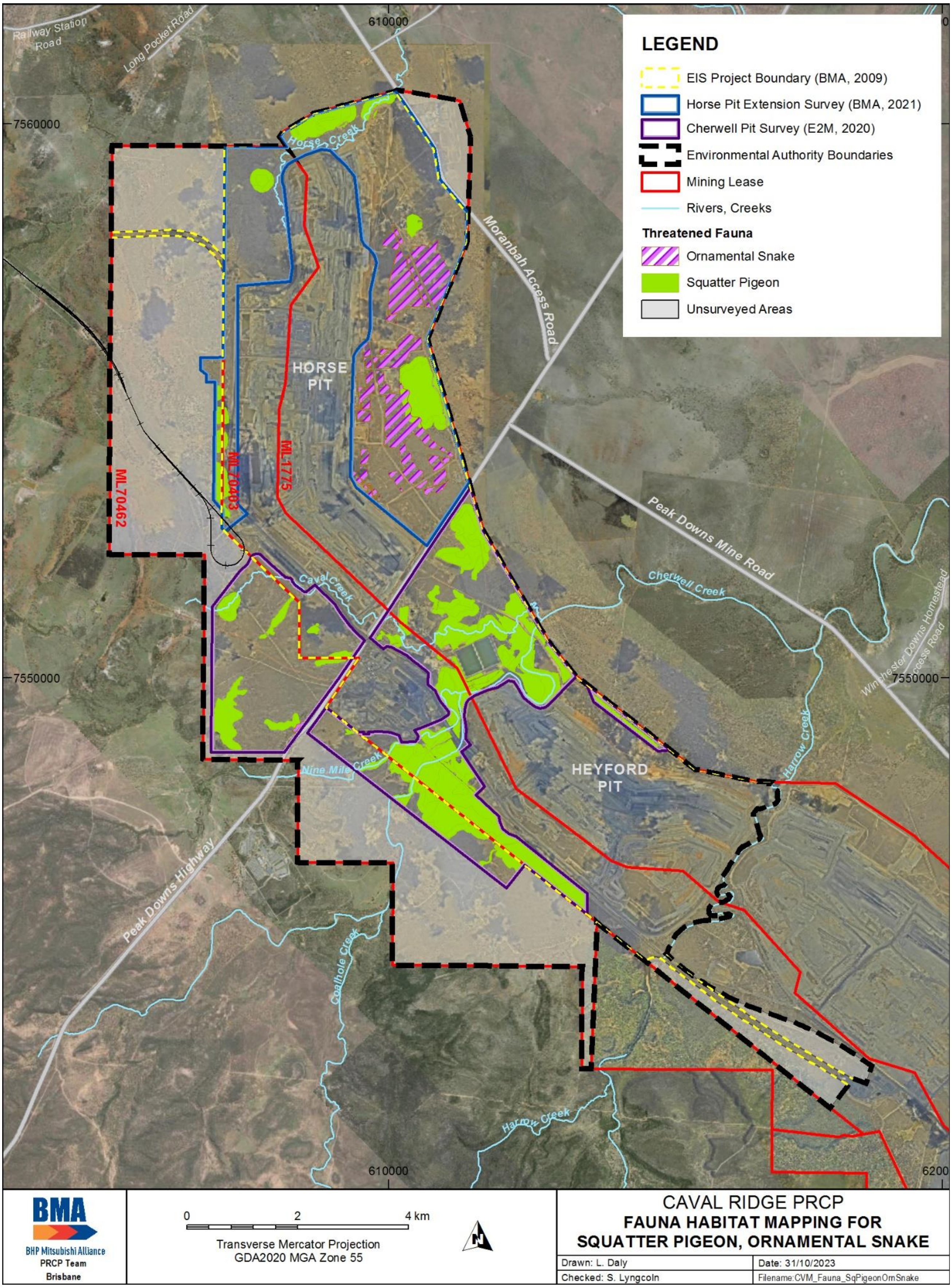

Figure 11: CVM fauna habitat mapping for squatter pigeon and ornamental snake

1.2.10 Pre-mining land use

Prior to mining, the CVM site was predominately used for low intensity cattle grazing, resulting in extensive tree clearing over most of the area. No areas were suitable for cropping (BMA, 2009). Prior to granting of the CVM EA, Heyford Pit was mined as part of the PDM operations.

The pre-mining land suitability for cattle grazing was assessed as part of the CVM EIS (BMA, 2009) and is discussed further in Section 3.1.1.

1.2.11 Contaminated land

The CVM area has supported a variety of anthropogenic land uses that have the potential to result in contamination of the tenement. Identified land uses, with the potential to have caused contamination, within the CVM tenement are listed below.

- Historical land uses within the mining tenement prior to granting of the CVM EA:
  - Kalari trucking workshop and yard
  - Cattle yards
  - Rural residential (including waste disposal/septic systems)
  - Rifle range
  - Small quarry
  - PDM operations
- Current land uses within the mining tenement:
  - Sewage treatment
  - Mineral processing
  - Waste storage, treatment and disposal
  - Explosive production
  - Chemical storage
  - Petroleum product and oil storage
- Surrounding land uses:
  - Moranbah Airport
  - Township of Moranbah
  - Non-BMA quarry operations
  - Rail lines and other transport infrastructure
  - Grazing (including cattle dips, rural residential, waste disposal, fuel storage, workshops, septic systems)
  - Mine/construction camps
  - Coal mining operations

The following properties, on which the CVM MLs are located, are listed on the Queensland Environmental Management Register (EMR) for the notifiable activity of Petroleum Product or Oil storage:

- Lot 14 on GV116
- Lot 18 on GV135

At the time of preparation of this PRCP, the properties on which CVM is located were not listed on the Contaminated Land Register and did not have a Site Management Plan (SMP) attached to the EMR listing.

The CVM approved ERAs include heavy industrial activities of: mining black coal; resource recovery and transfer facility operation; chemical storage; mineral processing; and sewage treatment. These heavy industrial activities include the storage, generation and use of potentially hazardous materials that if released to the environment could cause contamination. The CVM EA also provides for the conditional on-site disposal of various wastes within the tenement including:

- Rejects
- Bulk rubber
- Inert waste
- Poly-pipe and other plastic
- Fibreglass
- Treated and untreated timber
- Asphalt
- Asbestos
- Treated sewage effluent

The CVM tenement is a highly disturbed area that has been and continues to be subject to activities which have the potential to cause contamination and restrict future PMLUs. The management of contaminated land is undertaken in accordance with the requirements of the EP Act, which includes retaining the required properties on the EMR, and reporting of contaminant releases and environmental monitoring as per EA conditions.

1.2.12 Underlying landholders

BMA and/or related companies are the majority landowner, except for:

- Peak Downs Highway, a State Controlled Road owned by Department of Transport and Main Roads (TMR)
- Stock Route 404ISAA, held as Crown land by the Department of Resources (DoR)
- Moranbah Access Road and unnamed road parcels, owned by Isaac Regional Council (IRC)
- Freehold land holding within the north-east corner of ML70462

The underlying landholders for CVM are illustrated in Figure 12.

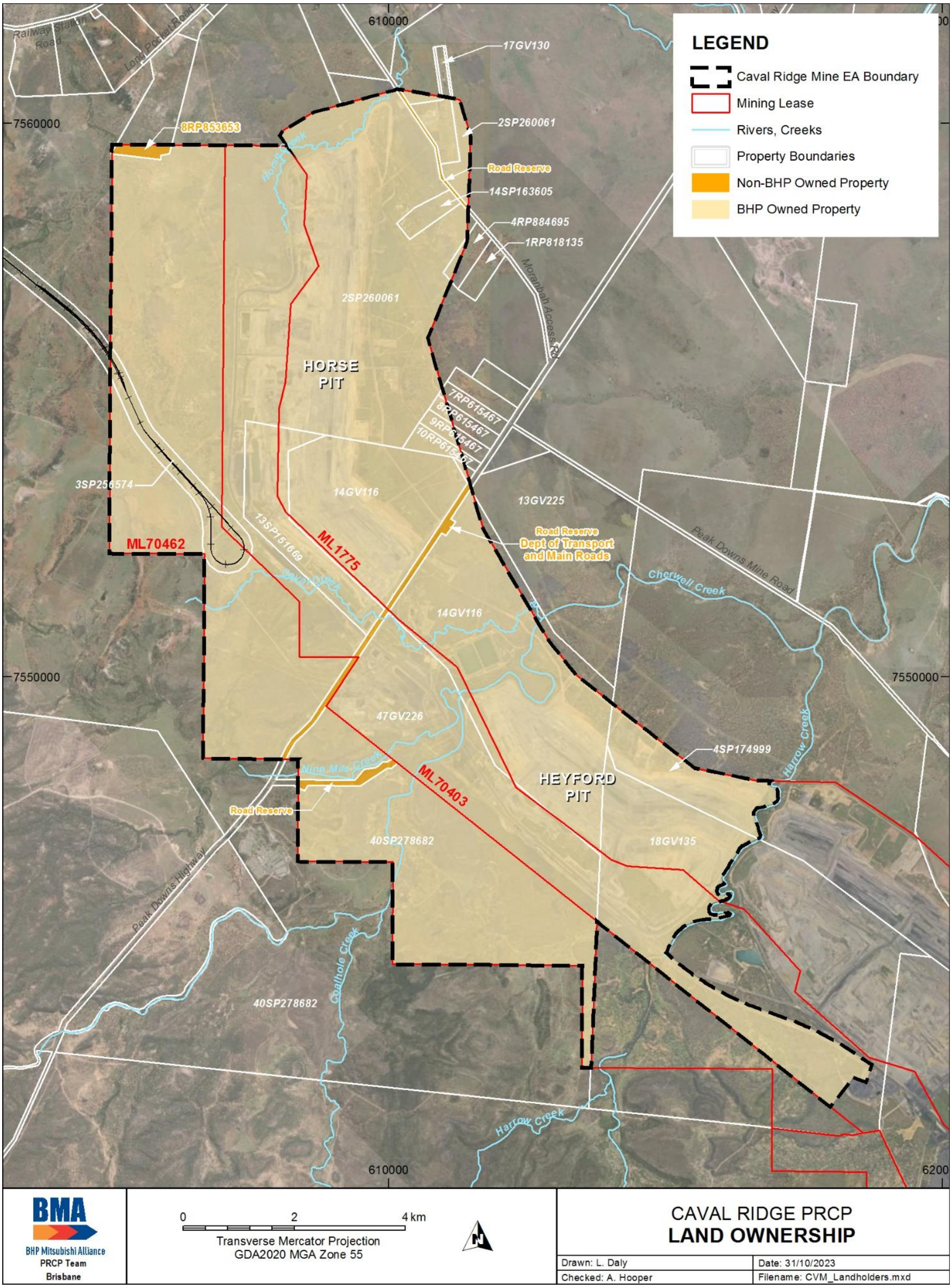

Figure 12: CVM Land ownership

1.3 Design for closure

As this PRCP for CVM is subject to transitional PRCP arrangements, it is not required to demonstrate how aspects of the mine site have been designed for closure for existing or approved disturbance (PRCP Guideline, Section 3.1).

However, this PRCP has been developed to manage progressive rehabilitation of the CVM site, aiming to minimise long-term management requirements as well as associated closure costs. Importantly, a focused design for closure underpins all sections of this plan, including:

- Engagement with relevant stakeholders to define suitable PMLUs and NUMAs
- Defining and implementing rehabilitation practices based on identified risks that could influence achievement of milestone criteria
- Demonstrating a successful rehabilitation trajectory towards achievement of these milestone criteria by ongoing site monitoring and maintenance

1.4 Rehabilitation and improvement planning

Legislative Requirement

In accordance with sections 126C(1)(b) and (c)(ii) of the EP Act, the rehabilitation planning part must include:

- *identification of all relevant activities on the mine site*
- *the predicted duration of each of the relevant activities proposed for the mine site*
- *the size/extent of the relevant activities*
- *whether the different relevant activities can be progressively rehabilitated.*

PRC Plan Guideline (Section 3.1)

Under section 126C(1)(j) of the EP Act, transitional PRC Plans must also include the following details about any existing rehabilitation already completed at the time of submission of the proposed PRC Plan:

- *a description of the rehabilitation works previously carried out*
- *when the rehabilitation works commenced and were completed*
- *whether the rehabilitation has been applied for or approved as progressively certified under the EP Act.*

1.4.1 Relevant activities requiring rehabilitation

The relevant activities at CVM that will require rehabilitation, the predicted duration and availability for progressive rehabilitation, are provided in Table 13. Any infrastructure that is beneficial to the PMLU may be retained and will not be available for rehabilitation.

Table 13: Relevant activities requiring rehabilitation at CVM

Relevant Activity	Predicted duration	Availability for progressive rehabilitation
Spoil dumps	Active dumping to spoil dumps will continue until the end of mining in 2046	• Progressive rehabilitation has commenced • Available for progressive rehabilitation as dump areas reach final position and they are no longer required for associated infrastructure or access requirements

Relevant Activity	Predicted duration	Availability for progressive rehabilitation
		• Progressive rehabilitation is maximised by scheduling rehabilitation as soon as practicable after land becomes available • Low-wall areas become available once mining in each pit is complete • Over 80% of the spoil dump area has been rehabilitated to revegetation by the end of mining
CHPP and associated infrastructure; coal stockpiles	Utilised until the end of coal processing	• Available for rehabilitation once coal processing is complete
Workshop; buildings and other infrastructure areas	Varying: with the latest utilised until the end of rehabilitation activities	• Dependent on the use and location, or unless deemed suitable to be retained for the PMLU: the majority will be available for rehabilitation at the end of the major rehabilitation activities; some areas may be available earlier, such as at the end of mining or coal processing
Mine dams	Varying: with the latest utilised until the end of rehabilitation activities	• Available for rehabilitation when no longer required for water management
Train load-out; associated infrastructure; and rail line (BMA owned)	Utilised until the end of coal loading	• Available for rehabilitation once coal loading is complete
Roads; laydown and general disturbance	Varying: with the latest utilised until the end of rehabilitation activities	• Dependent on the use and location, or unless deemed suitable to be retained for the PMLU: typically areas will be available for rehabilitation either at the end of mining or coal processing or after the major rehabilitation activities are complete
Exploration	Throughout the operational life	• Available for rehabilitation once exploration activities are complete
Diversions and crossings	Varying: with the latest utilised until the end of rehabilitation activities	• Dependent on the location in relation to mining and closure activities: typically crossings will be available for rehabilitation at the end of the major rehabilitation activities; some may be available earlier, such as at the end of mining or coal processing
Residual voids	Utilised until the end of mining	• Available for improvement once the PMLU low-wall spoil rehabilitation is complete for each pit and any partial backfill for flood mitigation is complete

1.4.1.1 EA progressive rehabilitation conditions

The CVM EA includes the following condition regarding the commencement of progressive rehabilitation:

- E4: "*Progressive rehabilitation must commence within two (2) years of when areas become available within the mining leases*."

All areas are included in the PRCP schedule for rehabilitation as soon as practicable after land becomes available. For infrastructure and general disturbance areas, rehabilitation is scheduled the year after the land becomes available to allow for final planning. Spoil dump areas are scheduled within two years after land becomes available to allow for final settlement, planning and availability of resources.

1.4.2 Rehabilitation areas and milestones

The rehabilitation areas (RA) and rehabilitation milestones (RM) included in the PRCP schedule for CVM are referred to throughout this PRCP.

A RA is defined in the PRCP Guideline "*as an area of land in the post-mine land use to which a rehabilitation milestone for the post-mining use relates*" and a RM is "*each significant event or step necessary to rehabilitate the land to a stable condition (section 112 of the EP Act)*".

The CVM RAs, as well as the relevant activities associated with each RA, are detailed in Table 14 and shown in Figure 23. The RMs are detailed in

Table 15. As required by the PRCP Guideline, only PMLU areas where disturbance has occurred or will occur, are mapped as a RA. Areas of ML70462, undisturbed creek areas and other minor areas on ML1775 and ML70403 are expected to remain undisturbed through the mine life and are therefore not mapped as a RA.

To support ongoing operations, exploration and minor ancillary activities may be required in areas not mapped as a RA. Minor ancillary activities can occur without a PRCP amendment and may include roads, access tracks and culverts, fences, underground services, low-impact telecommunication facilities, electrical sub-stations and switch yards, transmission grid works and supply network works, storage depots, pipelines and pumps, groundwater bores, gas drainage bores, monitoring and investigation works and exploration activities. Disturbance must be rehabilitated in accordance with the provisions detailed in the Eligibility criteria and standard conditions for exploration and mineral development projects (DEHP, 2016) or its successor, with the exception that land must be rehabilitated to a stable condition and achieve the proposed PMLU.

Table 14: Rehabilitation areas, associated PMLUs and relevant activities for CVM

Rehabilitation area (RA)	PMLU	Relevant activity
RA1	Woodland habitat	• Spoil dumps
RA2	Watercourse	• Diversions • Watercourse crossings
RA3	Cattle grazing	• CHPP and associated infrastructure • Administration, crib and general buildings • Workshop, fuel, oil and chemical storage • Coal stockpiles • Train load-out and associated infrastructure • Rail line • Mine dams • Roads • Laydown areas

Rehabilitation area (RA)	PMLU	Relevant activity
		• General infrastructure and disturbance
RA4	Woodland habitat	• Roads • Laydown areas • Conveyors • General infrastructure and disturbance

Table 15: Rehabilitation milestones for CVM

Rehabilitation milestone (RM)	
RM1	Infrastructure decommissioning and removal
RM2	Remediation and/or management of contaminated land
RM3	Landform development and reshaping
RM4	Surface preparation (cattle grazing)
RM5	Surface preparation (woodland habitat)
RM6	Surface preparation (watercourse)
RM7	Revegetation (cattle grazing)
RM8	Revegetation (woodland habitat)
RM9	Revegetation (watercourse)
RM10	Achievement of surface requirements (cattle grazing)
RM11	Achievement of surface requirements (woodland habitat)
RM12	Achievement of surface requirements (watercourse)
RM13	Achievement of post-mining land use to a stable condition (cattle grazing – RA3)
RM14	Achievement of post-mining land use to a stable condition (woodland habitat – RA1 and RA4)
RM15	Achievement of post-mining land use to a stable condition (watercourse – RA2)

1.4.3 Improvement areas and milestones

The improvement area (IA) and management milestones (MM) included in the PRCP schedule for CVM are referred to throughout this PRCP.

An IA is defined in the PRCP Guideline as an "*area of land in the NUMA to which a management milestone for the NUMA relates*" and a MM is "*each significant event or step necessary to achieve best practice management of the area and to minimise risks to the environment (section 112 of the EP Act)*".

The CVM IAs and associated relevant activities are detailed in Table 16 and the MMs are detailed in Table 17.

Table 16: Improvement areas and relevant activities for CVM

Improvement area	NUMA	Relevant activity
IA1	NUMA	• Residual voids

Table 17: Management milestones for CVM

Management milestone (MM)	
MM1	Achievement of structural stability
MM2	Achievement of surface requirements
MM3	Achievement of sufficient improvement

1.4.4 Existing rehabilitation

CVM has commenced approximately 158ha of progressive rehabilitation since 2016. These areas have undergone landform development and reshaping, surface preparation and revegetation. The majority of this area has not been included as progressed rehabilitation in the PRCP schedule due to changes to the mine plan or as a result of not tracking towards a stable condition.

The PRCP schedule for RA1 includes an area of approximately 14ha of progressive woodland habitat rehabilitation commenced in 2023 at Horse Pit, which is advancing to RM5. The reshaping of the area includes staggered dozer slots to increase surface roughness, bring rocks to the surface and support erosional stability. Seeding of the area is planned to be completed in November 2023 with the woodland habitat species and rates described in Section 6.1.8.7.

No rehabilitation areas have been applied for or approved as progressively certified under the EP Act.

2 COMMUNITY CONSULTATION

Legislative Requirement

In accordance with section 126C(1)(c)(iii) and (iv) of the EP Act, the rehabilitation planning part of the PRC Plan must include:

- *details of the consultation undertaken by the applicant in developing the proposed PRC Plan, and*
- *details of how the applicant will undertake ongoing consultation in relation to the rehabilitation to be carried out under the plan.*

PRCP Guideline (Section 3.5)

In developing the proposed PRC Plan, the community should at least be engaged on the plan for the mine, PMLUs or NUMAs, areas of disturbance, rehabilitation and management methods, progressive rehabilitation, and closure timeframes. Ongoing community consultation should continue throughout the stages of the mine life so that progressive rehabilitation and the socio-economic and environmental impacts related to mine closure can be discussed with the community.

Community consultation carried out through different processes (such as an EIS) may be used to address the requirements in section 126C(1)(c) of the EP Act. The details of this consultation must be provided in the rehabilitation planning part of the proposed PRC Plan).

Transitional PRC Plans are still required to meet the legislative requirements in section 126C(1)(c) of the EP Act. All proposed PRC Plans must contain a community consultation plan regardless of whether the site has an existing EA.

A community consultation plan (CCP) and community consultation register have been compiled to support the development of this PRCP. The complete plan and register - *Caval Mine PRCP Community Consultation Plan and Community Consultation Register* is provided in Appendix G.

2.1 Consultation to date

Initial consultation and engagement relating to CVM was undertaken during 2009 as part of EIS consultation. EIS consultation included engagement on rehabilitation and land uses. Since then, the following rehabilitation and closure-related engagement has taken place for CVM:

- During 2018 BMA engaged with DES on the PMLUs and associated acceptance criteria within the EA. These PMLUs and acceptance criteria were included in the 18 November 2019 CVM EA amendment, reflected as Table E1 (Rehabilitation Requirements).
- During October 2020 – October 2021 BMA engaged with DES and Department of Agriculture Water and the Environment (DAWE) in the preparation of the Horse Pit Extension Project EA amendment application, which included consideration of PMLUs and site-specific rehabilitation considerations.
- Since 2021, BMA has been providing regular PRCP briefings to the IRC as part of bi-annual and special purpose meetings. This has included briefing the IRC on the commencement of the CVM PRCP process in May 2022, with progress updates bi-annually through to November 2023.
- Since 2021, BMA has undertaken ongoing consultation with the Barada Barna Aboriginal Corporation (BBAC), who represent the Barada Barna People as Traditional Owners. Consultation to date includes various aspects related to rehabilitation. BBAC's feedback has included a request to work together with BMA to understand how they can get involved in rehabilitation execution activities over time, as guided by the PRCP schedules to be submitted for approval.

Historically, community consultation was conducted and resulted in the agreed PMLUs and NUMAs that are included in the conditions of the EA. Consultation and engagement conducted by BMA was to transition the PMLUs and NUMAs within the EA to the PRCP. In the majority of cases no feedback was received as part of consultation. Any feedback received was consistent with PMLUs and NUMAs as described in both the EA and the PRCP. A summary of all feedback is included in Appendix G.

BMA continues to engage with neighbouring landholders on land management, lease/licence conditions, and operational matters, as required.

As part of development of the CVM PRCP ongoing consultation has occurred, which includes letters via email to:

- IRC
- BBAC
- Adjacent landholders and agistment licensees
- Nearby agricultural landholders, business owners, residents and coal operations
- Smart Transformations Advisory Council (STAC) members representing community members, groups and businesses in Moranbah and Dysart
- Moranbah Traders Association representing local businesses (future consultation will be with Isaac Business Chamber)
- Authorised Holder Representatives of adjacent mining operations and petroleum licensees
- DoR

Information has also been provided to BMA employees, the community and groups though the online Coal Connect newsletter (a weekly newsletter to all internal coal personnel) and the Community Connect newsletter which is a hard copy and electronic bi-monthly newsletter distributed to more than 15,000 community members' letterboxes throughout the Bowen Basin.

2.2 Community consultation register

The community consultation register provided in Appendix G is compliant with section 126C(1)(c)(iii) of the EP Act and includes:

- Identification of each community member/stakeholder
- Previous engagements with the community
- Consultation date(s)
- Description of consultation type
- Information provided to the community
- Issues raised/ discussed by the community
- How issues have been considered
- Decisions/outcomes of engagement
- Commitments made by BMA

The stakeholders identified as part of this register are considered as having a genuine, demonstrable and legitimate interest in the ongoing rehabilitation and closure planning at CVM. Table 18 summarises these identified stakeholders, the current BMA relationships, as well as potential areas of interest with respect to the site's PRCP.

Table 18: CVM identified stakeholders, details on current BMA relationships, and potential PRCP areas of interest

Stakeholder	Existing BMA relationship	Potential areas of interest
Traditional owners		
• Barada Barna Peoples, represented by BBAC	• BMA has a constructive working relationship with Barada Barna Peoples and meets regularly. • Barada Barna Peoples native title to areas of land within the Isaac, Central Highlands and Mackay local government area (LGAs) was determined by the Native Title Tribunal in June 2016. • BMA reviewed its Cultural Heritage Management Plans (CHMPs) in 2016 following determination of the BBAC's native title claim. BMA has also undertaken negotiations with the Barada Barna Peoples on a comprehensive Indigenous Land Use Agreement (ILUA); CVM will fall within the proposed agreement area.	• Aspirations around rehabilitation and potential commercial opportunities as a PMLU • How operational management and/or rehabilitation could contribute to future use of the areas • Recognition and management of cultural heritage impacts • Native Title and land acquisition interests • PMLU, NUMAs and landform/landscape • Future access to and ownership of land • Environmental management/stewardship • Employment and business opportunities in rehabilitation, environmental management and monitoring
Landholders and licensees		
• Adjacent landholders • Licensees	• BMA has constructive working relationships, engaging on an as-needs basis with nearby property owners and agistment licence holders	• Environmental management /stewardship • PMLU, NUMAs and closure landforms/landscape • PRCP schedule • Future access to and ownership of land • Water usage, quality and access to groundwater and surface water (e.g. water allocations, water pipelines, etc.)

Stakeholder	Existing BMA relationship	Potential areas of interest
		• Potential impacts on land, water, property and future business value relating to PMLUs, and timing of impacts
Utility owners and stock routes		
Corporations and Government agencies: • Queensland Rail (QR) • Aurizon (rail) • Energex (power supply) • Powerlink (power supply) • Department of Transport and Main Roads (TMR) (Peak Downs Highway) • IRC • BMA (Moranbah Airport)	BMA has constructive working relationships and engages with utility owners as required (such as issue-specific or transactional engagement). This includes engagement on: • CVM rail infrastructure and balloon loop, which is owned by BMA from the main branch, and operated by Aurizon. (The Blair Athol railway line is owned by QR, and also operated by Aurizon). • Energex and Powerlink easements and 11 KV power lines. • Peak Downs Highway which BMA has an infrastructure agreement and compensation agreement with TMR. • Moranbah Access Road owned by IRC. • The stock route within the EA.	• Impact on assets/asset value • Remediation of impacts on assets • Any service disruptions and mitigations • Crossing/interface agreements • Timeframe for decommissioning utilities which only service CVM (e.g. rail loop, electricity transmission) • Cost of decommissioning utilities
BMA operations		
• CVM workforce (including contractors)	• BMA maintains ongoing communication with its workforce through 'toolbox' talks and a bi-monthly newsletter, Coal Connect.	• Timing of closure • Rehabilitation obligations • Employment continuity
• Thiess Pty Ltd (Theiss) Executive General Manager Australia	• Thiess has provided mining and maintenance services at CVM since 2018.	• Stakeholder (including employee/contractor) perceptions about closure

<table>
<tr><th>Stakeholder</th><th>Existing BMA relationship</th><th>Potential areas of interest</th></tr>
<tr><td colspan="3">Adjoining/nearby resource interests</td></tr>
<tr><td>• PDM (BMA)
• Moranbah North (Anglo American Metallurgical Coal Pty Ltd. (Anglo Coal))
• Winchester South (Whitehaven Coal WS Pty Ltd (Whitehaven Coal))
• Olive Downs (Pembroke Olive Downs Pty. Ltd. (Pembroke Resources))
• Eagle Downs (South 32 Eagle Downs Pty Ltd (South 32))
• Adani/Bravus (Adani)
• Vulcan Complex (Vitrinite Pty. Ltd (Vitrinite))
• Arrow Energy Holdings Pty Ltd (Arrow Energy) / CH4 Pty Ltd (CH4)
• QCoal /Energy Minerals Pty Ltd, Cherwell Creek Coal Pty Ltd</td><td>• BMA liaises with adjoining and nearby mining and resource interests on an as-needed basis, in relation to Mineral and Energy Resources (Common Provisions) Act 2014 (Queensland) requirements for petroleum overlap activities, and as part of industry associations and research partnerships.</td><td>• TLO access
• Future land use and ownership
• Collaboration on good industry rehabilitation and closure practices
• Cumulative impacts and opportunities of mine closures</td></tr>
<tr><td colspan="3">Local residents and businesses</td></tr>
<tr><td>• Moranbah and Dysart communities</td><td>• BMA utilises a wide range of communication, consultation and social investment strategies to develop and maintain relationships with Bowen Basin communities.</td><td rowspan="2">• Local employment and business opportunities, and future jobs
• Opportunities to participate in supply chain (e.g., environmental management, rehabilitation)
• With closure, loss of jobs and supply opportunities, and changes to demands for services (e.g., childcare and schools)</td></tr>
<tr><td>• Moranbah Traders Association (no longer active)</td><td>• The Moranbah Traders' Association was consulted as a channel for distribution of information. Future consultation will be with the Isaac Business Chamber.</td></tr>
</table>

Stakeholder	Existing BMA relationship	Potential areas of interest
• Moranbah and Dysart STAC members	• The Moranbah and Dysart STACs are sponsored by BMA and represent a broad cross-section of community and business interests.	• Potential for cumulative job losses if other mines close in a similar timeframe • Economic transformation (towards post-mining), and industry diversification • Educational and childcare opportunities • Wellbeing and health/healthcare provision • Economic and community sustainability • Environmental management • PMLUs and NUMAs • Community and economic transformation
Local Government		
IRC	• BMA has a long established and cooperative relationship with IRC. • BMA and IRC meet at least twice each year. • BMA has briefed IRC regarding PRCP requirements since 2021.	• Local employment • Stock routes (Isaac River) • Effects on Council services and infrastructure • Environmental management/stewardship • Rehabilitation progress and PRCP schedule • PMLUs, NUMAs and closure landforms • Management of closure impacts on employment and businesses • Alignment of rehabilitation plans with local and regional planning goals, and regional transformation/diversification • Economic transformation (towards post-mining) and community sustainability

Stakeholder	Existing BMA relationship	Potential areas of interest
		• Cumulative impacts of closure of multiple mining assets in a similar timeframe (e.g., job and population losses)
Government departments		
Queensland Government departments: • DoR - Office of the Minister, Deputy Director-General Georesources, Acting Director Native Title Services and Coal Hub, Rockhampton, Executive Director, Minerals and Coal • DES Office of the Minister, MERPF Act implementation team	• BMA has constructive working relationships with DoR and DES. • Corporate Affairs conducts as-needed engagement with Ministers and Members of Parliament. • Consultation on CVM's PRCP is not expected to be required by State Government stakeholders, but they are briefed as necessary. • DoR's Deputy Director-General Georesources has asked to be kept informed on PRCP.	• Legislative compliance • Resource development • Employment and growth opportunities • Public interest • Environmental management • Economic transformation (towards post-mining) • Financial assurance • Environmental risk management • Future PMLUs, NUMAs and closure landform • Company responses to stakeholder views • Industry best practice, and innovative future-looking approaches

2.3 Ongoing consultation

2.3.1 Consultation objectives, engagement type and frequency

The dedicated CCP compiled for the CVM PRCP (Appendix G), documents the consultation process to enable ongoing PRCP-related engagement with the relevant stakeholders. An overview of this process is presented in Table 19.

Table 19: Process to be followed for ongoing community consultation for the CVM PRCP

Stakeholders	Engagement type	Proposed consultation frequency
Consultation objective	**1. To engage key stakeholders in identifying community objectives and aspirations for post-mining land use and landform, and social value opportunities to be considered in the PRCP**	
• Landowners and lessees adjacent to CVM • BBAC • IRC • Moranbah and Dysart community members	Advise landowners, lessees, BBAC and IRC in writing when the PRCP is approved.	Once-off
	Meet with adjacent landholders, BBAC and IRC to provide an update on the PRCP and progress with rehabilitation, and invite their inputs and feedback on: • The approved PMLUs, NUMAs and post-mining landforms, including any particular values or opportunities in specific disturbed areas • Rehabilitation methods which would optimise future woodland habitat and/or grazing opportunities, and potential land management requirements • Shared value initiatives (e.g., infrastructure retention, capacity building, environmental management, or research partnerships) • Rehabilitation methods, schedule and progress towards milestones.	As requested, or as agreed with representatives
	As part of bi-annual meetings with IRC, and addressing BMA's portfolio rather than individual assets: • Provide an update on the status of the PRCPs and rehabilitation, and forecast upcoming PRCP consultation for BMA assets • Seek to understand Council's strategic analysis and planning for Isaac LGA and the CVM mining area • Share information to support understanding of challenges, opportunities and community aspirations of relevance to mine closure and rehabilitation • Co-operate if advocacy is required to achieve better PRCP outcomes in the Isaac LGA	Bi-annually, or as agreed with IRC

Stakeholders	Engagement type	Proposed consultation frequency
	• Build in consideration of the outcomes of Smart Transformation's projects as relevant, and the IRC's intended transformation approach.	
	Participate in Council, community or industry-led initiatives which aim to harness social value from mine closure and rehabilitation planning, and/or work towards economic transformation/transition.	As invited
	In cooperation with BBAC and other First Nations within Isaac LGA, and on a portfolio-wide basis: • Communicate the pipeline of opportunities relating to rehabilitation work and land management • Develop a shared understanding of business capabilities relevant to closure and rehabilitation works • Plan and implement an Indigenous business capability development program to match rehabilitation opportunities if this is required.	Once-off process
	Via Moranbah and Dysart STACs, and/or PRCP-specific workshops or focus groups, seek the involvement of community members and groups in articulating community aspirations for rehabilitation, PMLUs and economic transformation.	Once-off, portfolio-wide process
	Provide community updates on the CVM PRCP if there are any substantive changes and associated PRCP amendments required, via Community Connect	As relevant
Consultation objective	**2. To support transparent access to information about the CVM PRCP and implementation, enabling opportunities for BMA personnel and communities within the Isaac LGA to provide feedback on rehabilitation and closure outcomes**	
BMA employees and contractors	Keep the CVM workforce updated (e.g., via Coal Connect, an email newsletter to personnel) if there are changes to the PRCP	Ongoing engagement process

Stakeholders	Engagement type	Proposed consultation frequency
Nearby landholders, business owners and residents	Write to nearby landholders (within approximately 5 km) to advise of any substantive changes to the PRCP	As relevant
Moranbah and Dysart community members and groups	Using Community Connect (BMA's bi-monthly community newsletter) and community forums such as interagency meetings, the Moranbah and Dysart STACs, partnership meetings and community and business networks, provide community updates on the PRCPs (CVM-specific as relevant, and portfolio wide)	Ongoing engagement process
BMA licensees	Write to licensees to advise of any substantive changes to the CVM PRCP	As relevant
Local businesses and BMA suppliers	Provide information about the pending closure of CVM and potential future supply opportunities as part of closure and rehabilitation to local businesses, Traditional Owner businesses and BMA suppliers via C-RES	Five years prior to decommissioning; subsequent consultation to be agreed
Elected representatives and Government agencies	Provide updates via letters and/or meetings on PRCPs to: • Office of the Minister for Resources (Queensland) • Office of the Minister for Environment, Great Barrier Reef, Science and Youth Affairs (Queensland) • Shadow Minister for Resources • Shadow Minister for Environment, Great Barrier Reef, Science and Youth Affairs Resources • Member for Burdekin (Queensland Parliament) • DES PRCP Team • Director, Native Title Services and Coal Hub, Department of Resources • Deputy Director-General Georesources, Department of Resources	As requested, or as agreed with representatives

Stakeholders	Engagement type	Proposed consultation frequency
Consultation objective	**3. To engage with utility owners, and adjacent mining and energy tenement holders, to provide information about CVM closure planning that supports them to manage their assets and interests**	
• Anglo American Metallurgical Coal Pty. Ltd. • Whitehaven Coal WS Pty Ltd • Pembroke Olive Downs Pty. Ltd. • South 32 Eagle Downs Pty Ltd • Adani/Bravus • Vitrinite Pty. Ltd • Arrow Energy/CH4 P/L • Qcoal/Energy Minerals Pty Ltd, Cherwell Creek Coal Pty Ltd	Write to advise adjacent and nearby resource interests if there are any substantive changes to the closure and rehabilitation schedule in future iterations of the CVM PRCP. At a business level, BMA will participate in industry and research partnerships of relevance to PRCPs and rehabilitation.	As requested, or as agreed with representatives/mining operations
QR and Aurizon	Maintain correspondence with QR and Aurizon regarding progressive rehabilitation activities as they affect the Wotonga Blair Athol Railway and/or the CVM Railway and undertake consultation regarding the decommissioning of the TLO facility/rail interface.	As requested, or as agreed with representatives
Utility owners: • Energex • Powerlink • TMR	Maintain correspondence with Powerlink, Energex and DTMR regarding progressive rehabilitation activities as they affect powerlines and/or the Peak Downs Highway, and undertake consultation regarding crossing agreements if required	Initiated three-years prior to decommissioning
Department of Resources	Provide updates on the PRCP to the Director Native Title Services and Coal Hub, Rockhampton and the Deputy Director General, DoR, in writing or through regular meetings.	As requested, or as agreed with DoR representatives

Relationship with PRCP schedule
CVM has transitional provisions and approved land outcomes identified in the EA. Specific community engagement on the proposed PMLUs, NUMAs and rehabilitation approach has been undertaken prior to submission of the transitional CVM PRCP, and consultation will continue as per the process documented in the CCP. Any feedback received was consistent with PMLUs and NUMAs as described in both the EA and the PRCP. Consultation completed for the PRCP plan is outlined in Section 2.

3 POST-MINING LAND USES

Legislative Requirement

In accordance with section 126C(1)(d) of the EP Act, the rehabilitation planning part of the PRC Plan must state the extent to which each post-mining land use for land identified in the PRCP schedule for the plan is consistent with:

- *the outcome of consultation with the community in developing the plan, and*
- *any strategies or plans for the land of a local government, the State or the Commonwealth.*

PRCP Guideline (Section 3.2)

A PMLU is defined under section 112 of the EP Act as the purpose for which the land will be used after all relevant activities for the PRC Plan carried out on the land have ended. Relevant activity for a PRC Plan is defined in the EP Act as the relevant activities to be carried out on land the subject of the plan. It is not the intention of this definition to include third-party activities or assets that continue to exist once mining activities have ceased, such as third- party pipeline easements, power easements or overlapping tenures for other EAs.

The rehabilitation planning part of the PRC Plan must include a detailed description of the nominated PMLU(s) for the site. The description must include (where relevant), but is not limited to:

- *a description of the use of the land*
- *if applicable, the specific vegetation types (e.g. RE 13.2.9) or land suitability classification (e.g. Class 4)*
- *identification of any permanent or essential management infrastructure to be included as part of the PMLU*
- *completion criteria for measuring whether the PMLU has be successfully achieved*

Where a PMLU has been previously addressed in a land outcome document and is able to be transitioned into the PRCP schedule, the holder is not required to complete the information requirements under section 126C(1)(j) of the EP Act in this section for those PMLUs.

However, the legislative requirements under section 126C(1)(d) of the EP Act still apply. All PMLUs transitioned into the PRCP schedule must still meet the requirements of a PMLU explained in this section, particularly that the PMLU can be rehabilitated to a stable condition.

Where PMLUs have not been pre-approved, the applicant must include all of the requirements stated in this section.

3.1 Nominated PMLUs

A number of PMLUs are permitted for CVM under the EA (Table E1 in the CVM EA), of which the following three are proposed as PMLUs at CVM:

- Cattle grazing
- Woodland habitat
- Watercourse

The proposed PMLUs are illustrated in Figure 13 and have been recommended based on the closure landform, existing vegetation, ecological values, pre-mining land uses and the outcomes of the rehabilitation and closure studies supporting this PRCP. The proposed PMLUs are consistent with the CVM EIS which proposed a mosaic of self-sustaining vegetation communities and grazing land (BMA, 2009).

The PMLUs are underpinned by rehabilitation objectives that focus on achieving a safe, stable, non-polluting and sustainable post-mining landscape (as defined in the EA).

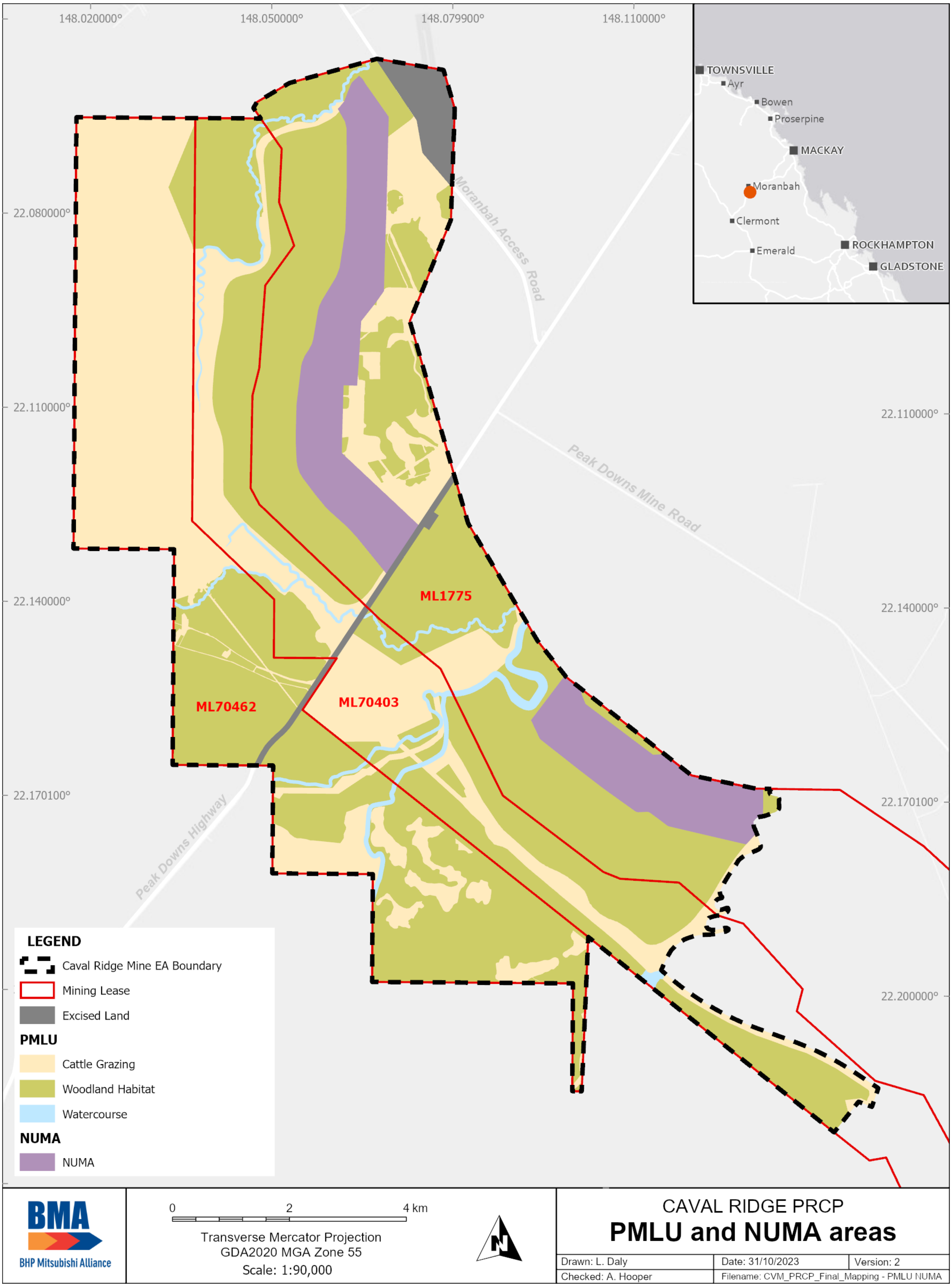

Figure 13: CVM PMLUs and NUMAs

3.1.1 Cattle grazing

The EA objectives, indicators and acceptance criteria for cattle grazing PMLU are listed in Table 20. The relevant acceptance criteria have been transitioned to the milestone criteria in the PRCP schedule for the final milestone of achieving the PMLU to a stable condition for cattle grazing (RM13) for RA3.

At CVM, cattle grazing PMLU is predominately planned for:

- Existing stock routes
- Lower gradient slope areas disturbed by mining activities
- Areas that require shallow rooted species
- Areas that are not adjacent to ecological values
- Areas where there was significant clearing prior to mining

Table 20: CVM EA post-mine land use objectives, indicators and acceptance criteria: cattle grazing

Goal	Objective	Indicator	Acceptance criteria
Safe to humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
Stable	Rehabilitation is geotechnically stable	Factor of Safety	≥1.5
	Rehabilitation is erosionally stable	Extent, slope gradient and groundcover	Groundcover >50% 70% of slopes ≤20%
Non-polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
	Deep drainage from rehabilitation achieves relevant water quality objectives for groundwater	EC	Not significantly different to: The EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or Local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
Able to sustain the agreed PMLU	Rehabilitation is suitable for sustainable cattle grazing	Land suitability assessment (LSA) for cattle grazing	Land suitability class ≤3 or not different from pre-mining class if ≥4. Assessment completed in accordance with LSA Framework for Open-Cut Coal Mine Rehabilitation 2018 (A rule-set for LSA sustainable beef cattle grazing on land rehabilitated after open-cut coal mining in the Bowen Basin Queensland) unless otherwise agreed in writing between the

Goal	Objective	Indicator	Acceptance criteria
			administering authority and the environmental authority holder.
		Leucaena stem density	<250 stems >2m height per ha (1 per 40m2), mean total area

3.1.1.1 Pre-mining cattle grazing land suitability class

The EA acceptance criteria refers to the pre-mining land suitability class. The pre-mining land suitability for cattle grazing was assessed as part of the CVM EIS (BMA, 2009) in accordance with the Guidelines for Agricultural Land Evaluation in Queensland (Queensland Department of Primary Industries, 1990).

Land suitability classes from this system are similar with the land suitability classes for the current Guidelines for Agricultural Land Evaluation in Queensland (2nd edn) (DSITI & DNRM, 2015) classification system. Both systems allow for land to be allocated into five possible classes (with land suitability decreasing progressively from Class 1 to Class 5).

The pre-mining land suitability for cattle grazing assessed in the CVM EIS indicated the presence of land suitability class 2, 3 and 4, and is land that has either moderate limitations or is marginal grazing land with severe limitations (BMA, 2009).

3.1.1.2 Post-mining cattle grazing land suitability class

The post-mining cattle grazing land suitability assessment referred to in the EA acceptance criteria was *A rule-set for land suitability assessment of sustainable beef cattle grazing on land rehabilitated after open-cut coal mining in the Bowen Basin Queensland*, developed by Short (2018).

The PRCP milestone criteria for achieving the PMLU to a stable condition for cattle grazing (RM13) will be assessed according to the land suitability framework presented in the *Rehabilitated mined land suitability for beef cattle grazing in the Bowen Basin: Technical Paper 1* (Short, 2023) from the Office of the Queensland Mine Rehabilitation Commissioner (OQMRC) (Table 21).

This land suitability framework has minor changes from the rule-set referred to in the EA (Table 20) and will be adopted for the PRCP to align with the leading practice paper. Land suitability decreases progressively from Class 1 (suitable - rehabilitation capable of attaining maximum grazing productivity) to Class 5 (unsuitable - rehabilitation that is not suitable for cattle grazing).

Reference sites (Section 8.4.1) will also be assessed according to the land suitability framework (Table 21) to enable a comparison between the performance of cattle grazing rehabilitation and the representative cattle grazing land suitability class of the broader area.

Table 21: Regional land suitability framework for beef cattle grazing PMLU rehabilitation in the Bowen Basin (Short, 2023)

Limitation	Indicator	Suitable			Unsuitable	
		Class 1	Class 2	Class 3	Class 4	Class 5
Water availability	Soil water storage (mm)	>75	75 - 60	<60 - 40	<40 - 30	<30
Nutrient deficiency	Available-P (mg/kg) in 0-0.1m depth increment	>20	20 - 14	<14 - 8	<8 - 4	<4
Nutrient availability and toxicity	pH in 0-0.1m depth increment	7.3 - 6.6	< 6.6 - 6.0 >7.3 - 7.9	<6.0 - 5.6 >7.9 - 8.4	<5.6 - 5.0 >8.4 - 9.0	<5.0 >9.0
Surface condition	Surface condition	Fine (peds <10mm)	Coarse (peds >10mm)	Surface crust	Very hard setting	Massive
Salinity	ECe (dS/m) in Effective rooting depth (ERD) (0-0.6m depth increment)	<2	2 - 4	>4 - 10	>10 - 16	>16
Rockiness	Gravel, 20 - 60mm (%) Cobble, 60 - 200mm (%) Stone, 200 - 600mm (%) Boulders, >600mm (%)	<20 <10 <2 0	20 - 50 10 - 20 2 - 10 <2	>50 - 70 >20 - 50 >10 - 20 2 - 10	>70 - 85 >50 - 75 >20 - 50 >10 - 20	>85 >75 >50 >20
Slope	Slope grade (%)	<5	5 - 10	<10 - 15	>15 - 20	>20
Microrelief	Vertical interval (m)	0	<0.2	0.2 - 0.4	>0.4 - 0.6	>0.6
Water erosion	Slope (%), ESP <6 (%) in 0-0.1m soil depth increment Slope (%), ESP >6-14 (%) in 0-0.1m soil depth increment Slope (%), ESP >14 (%) in 0-0.1m soil depth increment	<5 <3 <1	5 - 8 3 - 6 1 - 2	> 8 - 12 >6 - 10 >2 - 4	>12 - 18 >10 - 12 >4 - 6	>18 >12 >6

Limitation	Indicator	Suitable			Unsuitable	
		Class 1	Class 2	Class 3	Class 4	Class 5
Sub-soil erosion	ESP (%) at 0.5m depth	<6	6 - 14	> 14 - 23	>23 - 34	>34
Potentially acid forming materials	Strongly acid conditions (pH < 4.5) within (x) m depth	>3	3 - 2	<2 - 0.9	<0.9 - 0.6	<0.6

3.1.2 Woodland habitat

The EA objectives, indicators and acceptance criteria for a woodland habitat PMLU are listed in Table 22. The relevant acceptance criteria have been transitioned to the milestone criteria in the PRCP schedule for the final milestone of achieving the PMLU to a stable condition for woodland habitat (RM14) for RA1 and RA4.

At CVM, woodland habitat PMLU is planned for spoil dumps (RA1) and areas adjacent to areas of ecological value (RA4).

Table 22: CVM EA PMLU, indicators and acceptance criteria: woodland habitat

Goal	Objective	Indicator	Acceptance criteria
Safe to humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
Stable	Rehabilitation is geotechnically stable	Factor of safety	≥1.5 unless an alternative is justified by an appropriately qualified person
	Rehabilitation is erosionally stable	Groundcover (steep slopes, >15%)	80%
		Groundcover (lesser slopes, ≤15%)	50%
Non-polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
	Deep drainage from rehabilitation achieves relevant water quality objectives for groundwater	EC	Not significantly different to: a) the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or b) local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
Able to sustain an agreed post-mining land use	Native bushland characteristics	Species richness: Trees Shrubs Grasses	 ≥2 ≥3 ≥4
		Tree canopy cover	≥16 %

3.1.3 Watercourse

The EA objectives, indicators and acceptance criteria for a watercourse PMLU are listed in Table 23. These criteria were developed specifically for diversions. The relevant EA acceptance criteria have been transitioned to the milestone criteria in the PRCP schedule for the final milestone of achieving the PMLU to a stable condition for watercourse (RM15) for RA2.

The watercourses that transverse through CVM, and any associated diversions, are assigned a watercourse PMLU. These include Horse Creek, Caval Creek, Nine Mile Creek, Cherwell Creek and Harrow Creek (Section 1.2.4).

The lateral limits of the watercourse PMLU were defined based on the following considerations:

- Aerial imagery of the creeks and drainage diversion/ structures and associated riparian vegetation (Section 1.2.8)
- Flood modelling (Section 6.1.2)
- Diversion designs (Section 6.1.7)

The disturbed areas within the watercourse PMLU include the diversions (Caval Creek and Cherwell Creek) and various creek crossings in natural watercourse reaches.

Table 23: CVM EA PMLU objectives, indicators and acceptance criteria: watercourse

Goal	Objective	Indicator	Acceptance criteria
Safe to humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
Stable	Rehabilitation is erosionally stable	Geomorphic index (Index of Diversion Condition (IDC) method)	Greater or equal to upstream or downstream values
Non-polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
Able to sustain an agreed post-mining land use	Riparian vegetation	Riparian vegetation index (IDC method)	Greater or equal to upstream or downstream values

3.2 Community considerations

The PMLUs of cattle grazing, woodland habitat and watercourse as presented in the EA and this PRCP, is consistent with the previous engagement completed to date and as part of the consultation completed for the development of the PRCP. Consultation completed for the PRCP is outlined in Section 2.

3.3 Regional planning integration

The PMLUs at CVM consider pre-mining land uses, current adjacent land uses (cattle grazing and coal mining) and already approved PMLUs in the CVM EA (Section 3.1).

Under the Isaac Regional Planning Scheme (Isaac Regional Council, 2021), CVM is located in a *rural zone*. This includes primary production uses (such as cropping, intensive horticulture, aquaculture, grazing, intensive animal industries, animal husbandry and animal keeping), renewable energy facilities and extractive industries, outdoor recreation and small-scale tourism facilities. The purpose of the rural zone includes providing "*for other uses and activities that are compatible with: (i) existing and future rural uses and activities; and (ii) the character and environmental features of the zone…*" (Isaac Regional Council, 2021).

Land use performance outcomes (PO11) for this rural zone include ensuring development:

'(a) is consistent with the rural character of the locality;

(b) supports the primary rural function of the zone;

(c) protects rural, natural and scenic values of the locality; and

(d) includes boundary re-alignments where used to align with mining or petroleum tenements'.

Concurrently, the Queensland Government, via its Mackay, Isaac and Whitsunday Regional Plan (DLGP, 2012), maps CVM in a regional landscape and rural production area, which includes land used for agriculture, natural economic resources (including extractive resources), water catchment, traditional uses, conservation areas and native forests.

The defined uses for both of these regional plans are consistent with the PMLUs proposed for CVM.

Relationship with PRCP schedule
The proposed PMLUs for CVM are consistent with pre-mining land uses, current adjacent land uses and PMLUs already approved as part of the CVM EA. These PMLUs can also be aligned to future land use development outcomes defined as part of State and regional plans. The PMLU extents consider the closure landform, growth media, pre-mining land uses, existing vegetation, ecological values, watercourses and surrounding public infrastructure. The EA acceptance criteria – agreed and approved as part of prior approvals - for cattle grazing, woodland habitat and watercourses have been refined to reflect site-specific rehabilitation needs and are transitioned to the milestone criteria for achieving these PMLUs.

4 NON-USE MANAGEMENT AREAS

Legislative Requirement

In accordance with sections 126C(1)(d), (g) and (h) of the EP Act, for each proposed non-use management area, the rehabilitation planning part of the PRC Plan must:

- *state the reasons the applicant considers the area cannot be rehabilitated to a stable condition*
- *include copies of reports or other evidence relied on by the applicant for each proposed non-use management area*
- *state the extent to which the proposed non-use management area is consistent with the outcome of consultation with the community in developing the plan, and*
- *state the extent to which the non-use management area is consistent with any strategies or plans for the land of a local government, the State or the Commonwealth.*

PRCP Guideline (Section 3.3)

A NUMA is defined in the EP Act as an area of land the subject of a PRC Plan that cannot be rehabilitated to a stable condition after all relevant activities for the PRC Plan carried out on the land have ended. Proposed NUMAs must be justified under the criteria set out in section 126D(2) of the EP Act.

The rehabilitation planning part of the PRC Plan must also include:

- *information demonstrating that the proposed footprint of each NUMA is as small as practicable*
- *an assessment of the NUMA location options, having regard to the constraint of the resource location, with an analysis of the potential environmental harm and sensitivity of the surrounding environment of each option*
- *a description of the proposed location of each NUMA and the environmental values of the surrounding environment*
- *evidence showing how the proposed location will prevent or minimise environmental harm.*

In accordance with section 126D(1)(c) of the EP Act, the applicant must develop and implement management milestones within the PRCP schedule which achieve best practice management and minimise environmental harm for any NUMAs contained in the proposed PRC Plan. As part of the development of management milestones, the applicant must conduct a NUMA specific risk assessment to identify and quantify risks and associated controls. The risk assessment should have an overarching goal of identifying and controlling any significant risks to the community and the environment.

The proposed PRC Plan must include a detailed description of the nominated NUMA(s) for the site. The description must include, but is not limited to:

- *description of the land at surrender*
- *any relevant safety features*
- *completion criteria for measuring whether the NUMA has achieved sufficient improvement.*

Where a NUMA has already been identified in a land outcome document and is able to be transitioned into the PRCP schedule, the applicant is not required to comply with sections 126C(1)(g) or (h) or 126D(2) or (3) of the EP Act. NUMAs transitioned into the PRCP schedule are not required to complete the information requirements under section 126C(1)(j) of the EP Act in this section for those NUMAs. However, the legislative requirements under section 126C(1)(d) of the EP Act still apply.

Where a NUMA has not been pre-approved and is proposed as part of the transition into the PRC Plan, the applicant must include all of the requirements identified in this section.

As outlined in Section 754 (3) of the EP Act and Section 6.3.2 of the PRCP Guideline *"a NUMA will be taken to be pre-approved if a land outcome, the same or substantially similar to a NUMA, is contained in a land outcome document"*. Residual voids are authorised under Schedule E (Condition E5 and E6) of the EA as the LOD. BMA has transitional arrangements for residual voids as pre-approved NUMAs.

As per the PRCP Guideline, if a NUMA has already been identified in a LOD, the applicant is not required to comply with Sections 126C(1)(g) or (h), or Section 126D(2) or (3) of the EP Act and is not required to complete the information requirements under Section 126C(1)(j) of the EP Act for the approved NUMAs. However, CVM is still required to meet the legislative requirements under Section 126C(1)(d) of the EP Act.

As the LOD does not state the area or the location of the proposed NUMAs, the PRCP Guideline requires this PRCP to include detail on how the total area will be minimised and how the location of the proposed NUMAs will minimise risk to the environment.

4.1 Nominated NUMAs

The CVM NUMAs include the Horse Pit and Heyford Pit residual voids (Figure 13). Due to the pit progression down dip, the residual voids are located along the eastern approval limits within ML1775.

The extent of the NUMAs is designed to achieve an area that is safe and structurally stable and includes: the residual void below ground level (high-wall, end-walls, low-wall and floor); the associated wall set-back distance from the void wall crests to achieve a factor of safety (FoS) of 1.5; and a safety bund and fence.

The total proposed NUMA area is 1091ha. This NUMA area has been minimised by reducing the number of ramp voids through backfilling during the mining operations, and backfilling sections of the final voids at the end of mining.

The NUMAs will incorporate safety features to prevent intentional access, including:

- A safety bund and fencing constructed at the NUMA extents to prevent human and livestock access
- Signage at regular intervals along the fence

4.2 Minimising environmental impacts

Numerous studies have been undertaken as part of this PRCP to assess, refine and optimise the CVM NUMA locations and extent to minimise the potential for environmental harm. These studies resulted in the iterative refinement of the NUMA design as documented below.

The preliminary NUMA locations and extent were based on mining the full resource extent of the approved area and were used as the basis for the following void studies:

- Void in floodplain modelling (Section 5)
- Initial void water balance modelling
- Initial void water quality modelling
- Initial void geotechnical assessment

Based on the outputs of these initial PRCP studies, the high-wall and end-wall were redesigned to increase the distance from the approval boundary and watercourses for all voids, to achieve structural stability of FoS≥1.5 within the NUMA extents and to limit interaction with the floodplain.

The refined NUMA locations and reduced extent, were then used as the basis for the following studies:

- Updated void water balance modelling (Section 6.3)
- Updated void water quality modelling (Section 6.3)
- Updated void geotechnical assessment (Section 6.3)
- Groundwater modelling (Section 6.1.1)
- Rehabilitation flood modelling (Section 6.1.2)

The final NUMA locations and extent were further optimised based on the outcomes of all the final studies. This resulted in the final modifications to minimise the potential for environmental harm:

- Horse: partial void backfill on the northern end-wall to mitigate the risk of flooding into the residual void up to the 0.1% AEP (annual exceedance probability) flood level (Sections 6.1.2 and 6.1.5.2)
- Heyford: partial void backfill on both the north-western and south-eastern end-walls to mitigate the risk of flooding into the residual void up to the 0.1% AEP flood level (Sections 6.1.2 and 6.1.5.2)

The studies presented in this PRCP support the final locations and extent of the NUMAs. The NUMAs will not present an unacceptable risk of environmental harm outside of the tenure boundary due to:

- Flooding into the residual voids being mitigated up to the 0.1% AEP flood level (Section 6.1.2)
- The residual voids acting as long-term groundwater sinks, which contain potential contaminant migration via groundwater within the tenure boundaries (Sections 6.1.1.2 and 6.3.2.3)
- Minimising potential for interconnectivity between the deeper Permian and shallower aquifers (Section 6.3.2.2)
- Long-term pit water levels remaining below the spill point, and therefore, minimising the risk of residual voids overtopping and releasing void water to surface waters and/or the receiving environment (Section 6.3.2.1)
- The design of the NUMA extent to achieve structural stability, resulting in no geotechnical damage beyond the NUMA (Section 6.3.1)
- Revegetation of the NUMA low-wall to within 10m above the modelled maximum residual void lake elevation. The modelling of the residual void lake maximum elevations will be undertaken on establishment of the residual voids and will consider any changes to the catchments, landforms and the results of additional monitoring data. The 10m elevation distance between the vegetation and void lakes provides a buffer for the vegetation from the saline void lakes.

Consideration has also been given to alternative NUMA solutions, such as partial or complete backfilling of the residual voids in excess of the backfill planned for flood mitigation. These considerations include the following:

- Complete backfilling of the residual voids will create flow-through or source conditions from the spoil and backfilled voids and increase the height of recovered groundwater, increasing the potential risk of interconnecting aquifers and impacting off-tenement areas such as the Isaac River Quaternary alluvium.
- Partial backfilling of residual voids (i.e. reducing the depth of the residual void) also increases the height of groundwater recovery, increasing the potential for flow-through or source conditions and increasing the potential risk of interconnecting aquifers and impacting off-tenement areas. EIS studies completed within a similar nearby environmental setting for the Winchester South mine (Whitehaven Coal, 2022), indicated partial backfilling to reduce the depth of the residual void in the Bowen Basin environment, creates a surface lake of higher elevation, that also progresses towards brine levels of salinity over time. Saline residual void lakes of higher elevation have the potential to create additional complete exposure pathways to receptors through interconnecting of aquifers, releases to groundwater systems driven by increased hydraulic heads and overtopping into surface water systems.
- Retaining the residual voids as presented in this PRCP (i.e. with backfill required for flood mitigation), maintains the strength of the groundwater sinks: maximising the retention of groundwaters that have percolated through disturbed spoil profiles/other operational areas; minimising the potential for connection of aquifers of different qualities; and minimising the potential for overtopping during extreme weather events.

Therefore, the retention of the residual voids as presented in this PRCP, maintains the strength of the groundwater sink and is key to managing risk of potential environmental harm outside of the CVM tenure boundary.

4.3 Community considerations

Residual voids as NUMAs as presented in the EA and this PRCP, is consistent with the previous engagement completed to date and as part of the consultation completed for the development of the PRCP. Consultation completed for the PRCP is outlined in Section 2.

4.4 Regional planning integration

Both the local Isaac Regional Planning Scheme (Isaac Regional Council, 2021) and the broader Mackay, Isaac and Whitsunday Regional Plan (DLGP, 2012) identify mineral and extractive resource industries - in particular, coal and coal seam gas, as significant components of the current and future regional economic development.

Relationship with PRCP schedule
The proposed NUMAs for CVM are designed to be safe, structurally stable and minimise the risk of environmental harm. Retention of residual voids as pre-approved NUMAs, as part of the rehabilitated landscape, is consistent with the CVM LOD.

5 VOIDS IN FLOOD PLAINS

Legislative Requirement

In accordance with section 126D(3) of the EP Act, if land the subject of the proposed PRCP schedule will contain a void situated wholly or partly in a flood plain, the schedule must provide for the rehabilitation of the land to a stable condition.

PRCP Guideline (Section 3.4)

Section 41C of the EP Regulation states the decision considerations for a void situated wholly or partly in a flood plain. A void is considered to be located in a flood plain if the flood plain modelling shows that, when all relevant activities carried out on the land have ended, the land is the same height as, or lower than, the level modelled as the peak water level 0.1% AEP for a relevant watercourse under the guideline Australian Rainfall and Runoff (2019) (ARR).

Where a land outcome document has a pre-approved land outcome for a void with a location specified, flood plain modelling is not required. If a void has been identified as a NUMA in a land outcome document but the location is not identified, the applicant is required to carry out flood plain modelling in accordance with this section of the guideline. While the provision in the EP Act relating to voids located within a floodplain having to rehabilitate to a stable condition does not apply, the PRC Plan must include how the proposed location of the void minimises risks to the environment. Therefore, the flood plain modelling is required to support the assessment of the proposed location of the void.

If there are no land outcomes identified in a land outcome document, the applicant is required to carry out flood plain modelling in accordance with this section of the guideline.

A voids in flood plain assessment has been undertaken by appropriately qualified persons (AQP) to support the development of this PRCP. The detailed report – *Caval Ridge Mine Transitional PRCP Voids in Flood Plain Assessment* (SLR, 2023a), is provided in Appendix H

5.1 Background

The CVM closure landform includes two residual voids as pre-approved NUMAs (Horse Pit and Heyford Pit) (Figure 13). The locations of these voids are not identified in the LOD (EA EPML00562013) and therefore, in accordance with the PRCP Guideline transitional PRCP provisions, a voids in flood plain assessment has been undertaken.

As a conservative approach, the void extents used for modelling were the preliminary extents of the final voids - prior to any final landform design considerations and partial backfill of the final void that provides for flood protection. These preliminary extents are considered the maximum possible, and the final proposed residual void extents have been reduced and refined based on the outcomes of the studies undertaken to support this PRCP to reduce the environmental impact (Section 4.2). Further details on the closure landform and rehabilitation approach are provided within Sections 6.1.5 and 6.3.

5.2 Watercourses

A ‘relevant watercourse’ is defined as (State of Queensland, 2022a):

(a) a watercourse classified as stream order 4 or higher under the Strahler stream order classification system; or

(b) if a watercourse mentioned in paragraph (a) is permanently diverted under—

> *(i) a condition, or proposed condition, of an environmental authority mentioned in the Water Act 2000, section 98; or*

(ii) a water licence or proposed water licence under the Water Act 2000;

(iii) the watercourse as permanently diverted.

Four ‘relevant watercourses’ with a Strahler stream order of four or greater are present within CVM and/or the catchments, which have the potential to influence flooding within CVM (see Section 1.2.4. for description of watercourses present at CVM). The ‘relevant watercourses’ that were modelled as part of the voids in flood plain assessment include:

- Nine Mile Creek
- Cherwell Creek
- Harrow Creek
- Grosvenor Creek

5.3 Void in flood plain landform

The intent of the voids in flood plain modelling is to represent the flood plain within the tenement without ‘artificial features’ as defined by State of Queensland (2022). A single source of pre-mining topographical information was not available, as CVM was operational at the time of the voids in flood plain modelling and mining in Heyford Pit had been previously undertaken as part of PDM operations. The pre-mining digital elevation model (DEM) landform used for the purpose of voids in flood plain modelling within this PRCP, was developed using a combination of BMA LiDAR datasets and publicly accessible Geoscience Australia one second Shuttle Radar Topographic Mission Hydrological DEM topographical data.

As required for this assessment, off-tenement artificial features that have the potential to impact the flood plain were assessed for their potential to influence flood hydraulics at CVM and where appropriate, have been included within the modelled landform. The following off-tenement artificial features were assessed as potentially influencing flooding and have been included in the model:

- Harrow Creek Diversion
- PDM Harrow Pit void (northern void along the CVM/PDM EA boundary)
- PDM Harrow spoil dump (northern dump along the CVM/PDM EA boundary)
- PDM/CVM haul road

5.4 Modelling

Hydrologic modelling was undertaken to estimate runoff hydrographs at various locations throughout the catchments. As the catchments of Nine Mile Creek, Cherwell Creek, Harrow Creek and Grosvenor Creek are tributaries of the Isaac River, a Watershed Bounded Network Model (WBNM) of the Isaac River upstream of its junction with Devlin Creek was developed along with sub-models for CVM (Nine Mile, Cherwell and Harrow creeks) and Grosvenor Creek. Calibration of the hydrologic model was undertaken against the results of a Flood Frequency Analysis of data from the Goonyella (130414A) and Deverill (130410A) stream gauges and showed the hydrological model results were suitable for the purpose of this assessment.

Hydraulic modelling was undertaken for the areas covered by the hydrologic sub-models of CVM (Nine Mile, Cherwell and Harrow creeks) and Grosvenor Creek to assess the pre-mining flood extents. In accordance with the recommendations of the Australian Rainfall and Runoff (ARR) Guideline (Ball, et al., 2019), a suite of design storm events was simulated in the hydraulic models for the 0.1% AEP event for durations between 1 and 72 hours. Verification of the hydraulic model outputs was undertaken by comparison to the results of hydrologic model, which indicated the model outputs were suitable for the purpose of this assessment.

Further details of the voids in flood plain modelling are contained in Appendix H.

5.5 Results

The results of the CVM model show the preliminary maximum extent of the Heyford Pit void encroaches the flood plain associated with a 0.1% AEP event. The intersection of the initial Heyford Pit void and the flood plain occurs at four locations at the ends of the NUMA area.

Based on the results of the flood modelling, the south-east end-wall of Heyford Pit was moved to reduce the extent of the Heyford Pit residual void, compared to the preliminary maximum void extent used for the voids in flood plain modelling. The final landform, provided within this PRCP also includes partial backfilling of the ends of Heyford Pit to assist with removing the residual void from the floodplain and from ingress of floodwaters up to and including a 0.1% AEP plus climate change. Therefore, the final Heyford Pit residual void as presented within this PRCP does not encroach onto the 0.1% AEP event flood plain.

Relationship with PRCP schedule
Not applicable to the PRCP schedule as both residual voids are not classed as voids in flood plains (as per section 41C of the *EP Regulation 2019*).

6 REHABILITATION AND MANAGEMENT METHODOLOGY

Legislative Requirement

In accordance with section 126C(1)(e) and (i), the rehabilitation planning part of the PRC Plan must:

- *For each proposed post-mining land use for land, state the proposed methods or techniques for rehabilitating the land to a stable condition in a way that supports the rehabilitation milestones under the proposed PRCP schedule.*
- *For each proposed non-use management area, state the proposed methodology for achieving best practice management of the area to support the management milestones under the proposed PRCP schedule for the area.*

PRCP Guideline (Section 3.6)

The proposed rehabilitation or management methodologies will underpin the development of the milestone criteria and support how the proposed PMLU will be achieved or the NUMA will be managed. As per section 126C(1)(j) of the EP Act, the administering authority requires information describing how the proposed rehabilitation or management methodologies have been developed and will be implemented.

This section identifies a number of studies or reports that must be provided in the proposed PRC Plan. If any of the required information outlined below is not relevant to the specific operation, the applicant must provide justification in the PRC Plan outlining why the information is not required.

PRCP Guideline (Section 3.6.1)

This section outlines the range of information that the administering authority considers is necessary to underpin the development of the rehabilitation or management methodologies applicable to new and existing mines for most domains. The applicant must include the information as appendices to the rehabilitation planning part.

6.1 General rehabilitation practices

6.1.1 Hydrogeology

PRCP Guideline (Section 3.6.1)

Assess the hydrogeology of the site and all connected strata, and develop a conceptual model of the mine site's groundwater systems. This information must be integrated into the design of rehabilitation strategies and choice of PMLU or NUMA.

A hydrogeological assessment including conceptual and numerical modelling, has been undertaken to support the development of this PRCP. The detailed report – *Caval Ridge Mine Transitional PRC Plan Hydrogeology Assessment* (SLR, 2023b), is provided in Appendix E.

The key hydrogeological units present within and immediately surrounding CVM is detailed in Section 1.2.5 and include:

- Cainozoic sediments:
  - Quaternary alluvium
  - Quaternary to Tertiary colluvium and weathered units (collectively regolith)
- Tertiary basalt
- Permian coal measures:
  - Interburden/overburden units
  - Coal seams

6.1.1.1 Groundwater modelling

To support the assessment of potential groundwater impacts, numerical groundwater modelling was undertaken in accordance with the Australian Groundwater Modelling Guidelines (Barnett, et al., 2012) the Murray Darling Basin Commission (MDBC) Groundwater Flow Modelling Guideline (Aquaterra, 2001) and the Independent Expert Scientific Committee (IESC) Explanatory Note for Uncertainty Analysis (IESC, 2018). The numerical model was developed using a geographical user interface in conjunction with MODFLOW-USG, which is distributed by the United States Geological Survey.

The objectives of the predictive groundwater numerical modelling were to:

- Assess groundwater inflow to the residual voids
- Simulate the level and rate of recovery of the void lakes, and the level and rate of mining-related groundwater drawdown recovery in the groundwater system surrounding the residual voids
- Identify areas of potential risk, where groundwater impact mitigation/control measures may be necessary post-closure

The groundwater modelling completed for this PRCP builds upon existing modelling that has been undertaken in the region and utilises BMA and regional data obtained through data sharing agreements. This has allowed the model to assess regional cumulative groundwater impacts. The groundwater model setup, underlying assumptions/ limitations, model performance, calibration and model results are detailed in the SLR (2023b) hydrogeological assessment contained in Appendix E.

The groundwater model utilised the final CVM landform design that is detailed within this PRCP.

Climate change considerations have been included within the modelling and have been based on the BMA (2023b) Climate Change Adaptation in Mine Water Planning and Hydrologic Assessments Guideline. This included the review of three relevant climate models (ACCESS1-0Q, GFDL-CM3Q and MPI-ESM-LRQ) for both the 4.5 and 8.5 representative concentration pathways (RCPs). From the climate model review, three climate scenarios (Table 24) representative of the modelled maximum reasonable range of influence on the voids, were used to generate three sets of groundwater model predictions.

Table 24: Modelled climate scenarios as part of the groundwater assessment

Climate model	Intergovernmental Panel on Climate Change RCP Scenario
ACCESS1-0Q	4.5
ACCESS1-0Q	8.5
MPI-ESM-LRQ	8.5

The predominant identified influence from climate change on groundwater was associated with the void lake levels and their effect on groundwater hosted within the in-pit spoil dumps prior to recovery. Upon stabilisation of the void lakes and groundwater elevations, the simulated groundwater levels maintain gradients towards the voids for all of the assessed climate scenarios. Additional information on the model results for the other climate change scenarios assessed are detailed in Appendix E.

Void lake levels established as part of the water balance modelling (Appendix L), were included within the groundwater model as part of an iterative modelling approach between the groundwater model and the water balance model (Section 6.3). The modelling results identify the residual voids develop into long-term sinks for all climate change scenarios modelled, with stabilised lake levels remaining below the recovered groundwater levels and the base of the shallow geological formations.

In the immediate vicinity of the residual voids, the numerical groundwater modelling shows that post-stabilisation, inward groundwater gradients establish and are maintained long-term. The post-mining drawdown in the water table is driven by the on-going evaporation from the void lakes and the discharge of groundwater to the void lakes. The steepest water table gradients occur on the northern and southern ends of the residual voids, i.e. along strike, whereas gradients east and west of the residual voids are somewhat shallower, particularly west of the residual voids within the spoil. Water table drawdown to the east of CVM extends up to 2km for Heyford Pit but does not significantly extend outside of the CVM area for Horse Pit.

The water table remains close to pre-mining groundwater elevations in the area along Cherwell Creek between Horse and Heyford residual voids. The water table in this area is driven by shallow geological formations that are primarily recharged via precipitation and overland flows. Due to the residual void water levels remaining below the pre-mining groundwater levels and the lowest point of the base of the shallow geological formations, interaction between groundwaters hosted in the shallow geological formations and pit lake waters is not expected.

Predicted groundwater levels for the Q, P, H and D Seams of the Permian coal measures indicate that groundwater levels in the Permian sequence are predicted to remain drawn down in the long term, driven by the ongoing groundwater discharge to the void lakes and governed by the pit lake elevations. The Q Seam is predicted to remain ‘dry’ in the long term across most of CVM where it is not mined, with non-saturation present up to approximately 2km east of Heyford Pit. The P Seam displays a south-southwest flow gradient where saturated east of Horse Pit residual void, but a southeasterly flow gradient where saturated east of Heyford Pit residual void consistent with pre-mining conditions. Predicted H Seam groundwater levels show similar patterns to the P Seam, however levels are approximately 10 to 20m lower in the H Seam than the P Seam close to CVM, and there is generally a greater predicted extent of saturation across CVM. Therefore, head gradients are significantly steeper in the H Seam than the P Seam within the CVM area. D Seam head gradients are similarly steep to the H Seam, and the drawdown of D Seam groundwater levels extends to the east of CVM. Maps showing the modelled predicted stabilised groundwater levels at CVM are included in Appendix E Figures 7-5 to 7-9.

The model results demonstrate that the vast majority of groundwater level drawdown in the Permian coal measures occurs during mining operations. Comparatively little additional drawdown occurs post-closure, with some groundwater level recovery evident for the D Seam adjacent the southern end of Horse Pit residual void. Furthermore, the modelling demonstrates very little effect on groundwater levels from the residual void inflow flux variability in the early post-closure period. Post-mining groundwater drawdown within surrounding bores is considered primarily related to a delayed response to regional scale influences represented in the model (i.e. other mining activities) given the fact that other operations and supply bores access groundwater from the Fort Cooper coal measures, a geologic unit not present at CVM.

Climate change sensitivity within the groundwater model identified little difference between the predicted groundwater levels outside the immediate surrounds of the residual voids for the drier, wetter and mid climate change scenarios assessed. Differences in groundwater levels between the climate scenarios are apparent only in the proximity of the residual voids. Void lake levels are modelled to vary up to 30m between the climate change scenarios, which drive the changes to modelled groundwater levels immediately surrounding the residual voids.

6.1.1.2 Residual void groundwater inflow

The groundwater model results indicate that in the initial period after mining (predominantly within the first ~100 years), depending on weather conditions, variability in the groundwater flux to the residual voids is expected.

Periods of outflows of predominantly rainfall derived surface waters from the residual voids to the surrounding spoil hosted groundwater system may also occur during this initial period prior to stabilisation of the groundwater levels. The groundwater fluxes to the voids are largely controlled by the void lake levels which are more dynamic and respond to climatic conditions (i.e. episodic and relatively large rainfall events) more rapidly. The groundwater levels recover more slowly, and therefore, periods of outflows from the residual voids to the immediately surrounding groundwater aquifers may occur. The model results indicated that outflows only occur from the residual voids to the in-pit spoil dumps, which have a higher hydraulic conductivity and have groundwater recovery more closely tied to the residual void lake levels.

Within the period where outflows from the void to the spoil may occur (first ~100 years after the completion of mining/dewatering), the predominant source of water within the voids will be direct precipitation and surface runoff from immediately surrounding the void. Therefore, the initial TDS of the void lakes is expected to be relatively low during the period in which outflows may occur. Only after long term establishment of the inward flow groundwater would the TDS concentrations be expected to climb over time to brine type conditions, due to the effects of evapo-concentration (Appendix L). In the period where outflows are modelled to occur to the spoil, TDS concentrations in the void lakes (up to ~15,000mg/L) are within the range that have been recorded within the Permian groundwater hosted aquifers. Also, the modelled pH of the void lakes remains relatively constant over time and are expected to be neutral to slightly alkaline. Therefore, during the period in which groundwater outflows may occur from the void lakes to the spoil hosted aquifers, the TDS and pH are not considered to present an unacceptable risk of environmental harm.

Model results indicate that more than 99% of the long term groundwater inflow to the voids comes via the spoil, with between 65% and 77% of this inflow originating mainly as local recharge applied to the spoil, and between 23% and 35% coming from natural geological formations before moving through the spoil into the residual void lakes. The portion of the spoil dumps, which will support future groundwater units, are those which have been placed in the pits behind the active mining void below natural ground level. The low permeability of the insitu Permian interburden floor at the base of this spoil, which dips down towards the residual void, and the hydraulic gradient created by the void lake evaporative losses, will result in groundwaters within the spoil migrating towards the residual voids. The capturing of the of spoil hosted groundwater within the sink conditions of the residual void minimises the potential for environmental harm beyond the tenement boundary from any potential contaminants mobilised from the spoil and co-disposed wastes within.

Groundwater levels surrounding the final voids are controlled by the predicted residual void lake levels. The void lake levels in turn are primarily driven by evaporation outflows and inflows from direct precipitation and surface water runoff. Equilibrium groundwater inflows to the void lakes only represents approximately 11 to 13% of the total void lake inflows. The groundwater model simulations have shown that once equilibrium conditions are reached, groundwater gradients towards the voids are maintained and the voids continue to act as sinks capturing groundwater transported leachate from the spoil.

6.1.1.3 Groundwater flow path simulation

To assist with the understanding of potential contaminant migration patterns through groundwater, an analysis of the water movement within the closure landform, based on currently available groundwater data, has been undertaken. The simulation was undertaken over a 2,249-year groundwater recovery period post-mining. The simulation was undertaken by placing a number of particles within the model surface in the recovery groundwater model and the mod-PATH3DU code (Papadopulos & Associates, Inc., 2018) used to simulate particle pathways along the groundwater flow field during recovery. The mod-PATH3DU code automatically moves the particles from the model surface to the shallowest saturated layer at the commencement of the simulation.

The predicted movement of water particles in the 2,249-year recovery simulation are shown in Appendix E Figures 7-15 and 7-16. The particle movement simulation indicates that groundwater at CVM, including that flowing through the spoil of the final landform and that beneath the MIA and CHPP, would remain within the CVM final landform in the long-term and be captured within the residual voids. Groundwater was not shown to flow towards the surrounding environment or off tenement. Both residual voids continue to act as groundwater sinks and groundwater would not flow from the residual voids off-site.

To validate the flow path simulation model results, RM2 includes contaminated land investigations at the completion of mining activities (Table 63). These investigations will assess the suitability of the site for the nominated PMLUs. These contaminated land investigations will provide additional definition and, where required, remediation around potential source areas and preferential pathways can be provided by the more regional flow path simulation.

6.1.1.4 Post-mining conceptual site model

An evaluation of the source-pathway-receptor (SPR) linkages based on the modelling results for the post-mining environment, where groundwater conditions have stabilised, has identified the following key features:

- Residual void lake formation, with lake levels stabilising significantly below the pre-mining groundwater elevations and any shallow post-Permian strata regardless of climate scenario modelled, including the base of surficial weathering and shallow hydrostratigraphic units (i.e., alluvium, basalt and regolith).
- Residual groundwater drawdown within the Moranbah coal measures from the approved CVM mining operation, with ongoing evaporative discharge from the residual void lakes, resulting in continued inwards hydraulic flow gradients in the coal measures to the residual voids and no outflow in the long term regardless of climate scenario modelled.
- Residual voids continue to capture any seepage from spoil dumps and other operational areas.
- Little to no additional impact on surficial aquifers including the Isaac River alluvium caused by the final closure landform.
- Little to no impact on environmental receptors caused by the final closure landform.
- Little to no impact on anthropogenic receptors caused by the final closure landform.

A visualisation of the post-mining conceptual site model, after stabilisation of the groundwater, is provided in Figure 14.

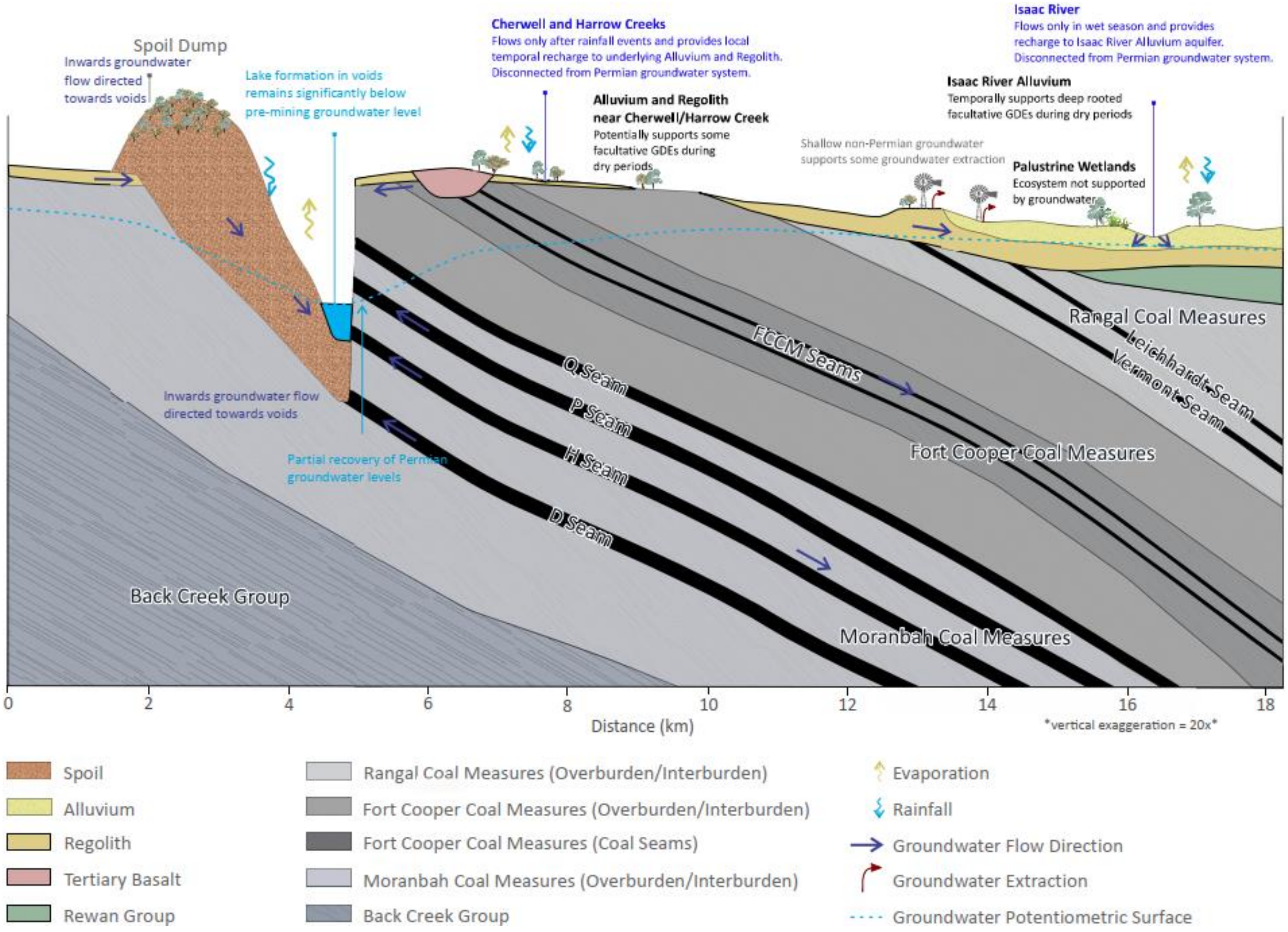

Figure 14: CVM post-mining conceptual site model (SLR, 2023b)

Relationship with PRCP schedule
Groundwater, once stabilised, will flow to the residual voids which will act as sinks. Seepage from the spoil dumps, MIA and CHPP will be collected within the residual voids, and any contaminants within the residual voids are not predicted to impact areas beyond the mining tenements. Modelled groundwater drawdown around the residual voids is a result of the mining activities, with the closure landform not resulting in additional drawdown. The closure landform will have little to no additional impact to environmental or anthropogenic receptors. Groundwater is not anticipated to require any active management post-mining. Confirmation of groundwater quality, and the relationship between the void lakes and groundwater to demonstrate the development of the residual voids as sinks, will be completed through planned rehabilitation monitoring.

The information in this section is relevant to the following highlighted RAs and RMs in the PRCP schedule														
RA1				RA2				RA3				RA4		
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The information in this section is relevant to the following highlighted IAs and MMs in the PRCP schedule		
IA1		
MM1	MM2	MM3

The following Milestone Criteria will contribute to achievement of sufficient improvement:	
MM3	• Certification from an AQP that the residual void will not present an unacceptable risk of environmental harm outside of the tenure boundary

6.1.2 Flooding

PRCP Guideline (Section 3.6.1)

Section 3.4 of this guideline requires flood plain modelling for the purpose of voids located within a flood plain being rehabilitated to a stable condition. In addition to this, the applicant must also assess the flooding susceptibility and influence across the site. If flooding is a consideration, develop a hydrologic model of the catchment and a hydraulic model of the proposed mining area. Knowledge of flooding is integral to the rehabilitation planning process, including the placement and design of mine domains.

A rehabilitation flood assessment, including consideration of flow alteration, simulated flood levels for a range of design storm events and development of a flooding risk profile, has been undertaken to support the development of this PRCP. The detailed report - *Rehabilitation Flood Modelling, Caval Ridge Mine* (SLR, 2023c), is provided in Appendix I.

The flood modelling was undertaken on an iterative approach with the closure landform design development. Information from the initial round of rehabilitation flood modelling was used to inform further development of the closure landform design. The amended landform design included refinements comprising of partial backfill of the residual voids, increased stand-off distances from tenure boundaries and watercourses, removal of culverts and other infrastructure from watercourses/floodplains, and changes to landforms to provide required protection from flood waters. Upon finalising the landform design, the flood modelling was re-run and the flood risk profile and other interpretations amended to reflect the final closure landform design, which is presented within this PRCP.

6.1.2.1 Modelling

CVM site hydrology and fluvial networks are summarised in Section 1.2.4. The predominant creeks at CVM that have the potential to affect flooding conditions include:

- Horse Creek
- Cherwell Creek (including Caval Creek and Nine Mile Creek tributaries)
- Harrow Creek

For the purposes of the flood modelling, a final landform DEM was developed utilising topographic datasets, including publicly available data for areas outside of CVM, LiDAR data from both CVM and PDM operations and the final rehabilitated landform design.

A WBNM (Version 2017) was adopted to estimate runoff hydrographs through CVM. The WBNM software is an industry standard rainfall-runoff routing program. Storm Injector Version 1.3.2.0 was utilised to assist in the setup and analysis of the ARR guideline design storm ensembles and to review model results. The WBNM model was simulated for 50%, 20%, 10%, 2%, 1%, and 0.1% AEPs with a range of storm durations between 1 hour to 24 hours and ten temporal patterns for each duration as per the ARR guideline.

The effects of climate change were considered as part of the hydrologic analysis, in line with the BMA Climate Change Adaptation in Mine Water Planning and Hydrologic Assessments Guideline (BMA, 2023b), through sensitivity analysis carried out with respect to the modelled design rainfall Intensity-Frequency-Duration data. The upper (28% increase in rainfall intensity) represents a worst case green-house gas emission projection of RCP 8.5 and 90th percentile global warming sensitivity. The lower (5% increase in rainfall intensity) represents an optimistic case green-house gas emissions projection of RCP 4.5 and 10th percentile global warming sensitivity. These two scenarios have been selected to represent a reasonable range of potential storm intensity changes resulting from climate change.

Hydraulic models covering CVM were developed using flow hydrographs produced by the hydrologic models for Horse, Cherwell and Harrow creek catchments. A range of design storm events was simulated in the hydraulic models for a range of AEPs, including 50%, 10%, 5%, 2%, 1%, 0.1% and probable maximum precipitation (PMP).

Further details on the hydrologic and hydraulic models, sensitivity analysis and calibration/validation are contained in Appendix I.

6.1.2.2 Flood levels and rehabilitation domains

Maps of the flood levels for each of the modelled creeks and AEPs are included Appendix I.

Horse Creek modelled peak flood levels indicate that flood extents do not interact with the Horse Pit residual void up to and including the 0.1% AEP flood level (including climate change). The final landform design for the northern end of Horse Pit includes the removal of haul roads and levees and backfilling of the northern end of the void. This landform design provides adequate protection of the residual void from ingress of flood waters.

Flood waters within Horse Creek will also potentially interact with the adjacent Horse Pit spoil dumps. The maximum predicted depth of flood waters against the spoil dumps adjacent to Horse Creek is 2 to 3m in a 0.1% AEP flood event. The velocities of the flood waters against the spoil dumps are low (less than 2m/s) with higher velocities concentrated within the watercourse channel.

The Cherwell Creek (including Caval and Nine Mile creeks) modelled peak flood levels indicate that flood extents do not interact with either Horse Pit or Heyford Pit residual voids up to and including the 0.1% AEP flood level (including climate change). The final landform design for the northern end of Heyford Pit includes the removal of roads and levees and backfilling of the northern end of the void. This landform design provides adequate protection of the residual void from ingress of flood waters.

Flood waters within Cherwell Creek will also potentially interact with the southern end of the Horse Pit spoil dump and the northern portion of the Heyford Pit spoil dump. The maximum predicted depth of flood waters against the spoil dumps are on the northern end of the Heyford spoil dump with depths greater than 5m in a 0.1% AEP flood event. The velocities of the flood waters against the spoil dumps are low (less than 2m/s) with higher velocities concentrated within the watercourse channel. Landform design considerations to protect the spoil dumps is provided in Section 6.1.5.

Although Harrow Creek is predominantly located within PDM to the south, the modelled peak flood levels indicate that flood extents do not interact with the Heyford Pit residual void up to and including the 0.1% AEP flood level (including climate change). The final landform design for the southern end of Heyford Pit includes the backfilling of the south-western corner of the void. This landform design provides adequate protection of the residual void from ingress of flood waters.

Flood waters within Harrow Creek are not anticipated to interact with the Heyford Pit spoil dumps.

Modelling of the PMP indicates that the majority of the gently undulating area surrounding CVM would be inundated. In a PMP rainfall event, depths of flood waters would exceed 5m both within and on lands surrounding each of the creeks. Due to the depth and distribution of the flood waters in a PMP event, flood waters would be expected to ingress into the residual voids and interact with a majority of the rehabilitation landforms. As the CVM operations do not include tailings storage facilities (TSFs) and the rehabilitated landforms do not include regulated dam structures, potential damage from a PMP flood event will predominantly be associated with flooding of the residual voids. Other flood damage from a PMP event would generally be consistent with that experienced in surrounding areas.

6.1.2.3 Alteration of flow upstream and downstream

The hydrologic modelling undertaken to support this PRCP included the comparison of flows within the pre-mining landform to those within the final rehabilitated landform.

The downstream comparison of pre-mining and rehabilitation peak flows at various AEPs are presented in Table 25. The results indicate a reduction of flows between 1-2% within Cherwell Creek and 4-5% within Horse Creek. These results correlate with the reduction in catchment areas associated with the residual voids.

Upstream of the site, the pre-mining scenario and rehabilitation scenario are identical, therefore no alteration to upstream flows has been identified.

Table 25: Modelled downstream pre-mining flows and final rehabilitated landform flows

Location	AEP (%)	Rehabilitation scenario flow (m3/s)	Pre-mining scenario flow (m3/s)	Change (m3/s)	Change (%)
Cherwell Creek (inc. Caval Creek, Nine Mile Creek and Harrow Creek)	1	2,830	2,887	-57	-2
	2	2,295	2,339	-44	-2
	5	1,629	1,657	-28	-2
	10	1,198	1,218	-20	-2
	20	809	827	-18	-2
	50	418	424	-6	-1
Horse Creek	1	364	382	-18	-5
	2	301	315	-14	-4
	5	264	275	-11	-4
	10	190	198	-8	-4
	20	131	137	-6	-4
	50	47	49	-2	-4

6.1.2.4 Flooding risk profile

A flood risk profile was developed based on the rehabilitation flood modelling results and ISO 31000 methodology. Details of the flood risk profile are detailed in Appendix I and the CVM PRCP risk assessment is summarised in Section 7.

Through the iterative landform and modelling approach, the closure landform was refined to minimise the potential for environmental harm and to create a stable landform. As a result of this process, the flood risk profile identified low risk levels associated with flooding and the CVM closure landform. Therefore, no critical controls were required.

Relationship with PRCP schedule
The interaction between flooding and the proposed final closure landform presents low risk. The closure landform provides an appropriate level of protection from inundation to the residual voids, flooding does not adversely impact on the stability of the final closure landform and cumulative flows from the CVM rehabilitated area are similar to pre-mining conditions.

The information in this section is relevant to the following highlighted RAs and RMs in the PRCP schedule														
RA1				RA2				RA3			RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The information in this section is relevant to the following highlighted IAs and MMs in the PRCP schedule		
IA1		
MM1	MM2	MM3

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
RM1	• Assessment of mine water dams is completed by an AQP and identified sediment and water management actions are completed • Mine water dams are decommissioned • Watercourse crossings and culverts removed
RM3	• Landforms requiring reshaping are reshaped to be free-draining with maximum 12% slopes (RA3) or maximum 15% slopes (RA4) • Disturbed natural watercourse bed and banks returned to a profile similar to the pre-disturbance condition (RA2)
The following Milestone Criteria will contribute to achievement of sufficient improvement:	
MM3	• Certification from an AQP that the residual void will not present an unacceptable risk of environmental harm outside of the tenure boundary

6.1.3 Waste characterisation

PRCP Guideline (Section 3.6.1)

Characterise mine wastes in a report that describes the likely physical behaviour and chemical reactivity of the waste materials under the conditions in which they would be stored. The report must address the constituent elements present, and their likely future speciation and mobility.

All mined material should be classified on its propensity to be potentially acid or non-acid forming, to generate neutral metalliferous or saline drainage, and its susceptibility to weathering.

A material characterisation assessment has been undertaken to support the development of this PRCP. The detailed report – *Caval Ridge Mine PRCP Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste* (BHP, 2023), is provided in Appendix J.

6.1.3.1 Background

CVM has two main types of mineral waste, and the geochemical characteristics and potential hazards associated with mineral waste materials on site are discussed by type:

- Spoil (overburden and interburden) currently comprises approximately 94% of all mineral waste at CVM and includes weathered waste (Tertiary and Permian-age – in approximately equal proportions) and fresh (unweathered) waste (all Permian-age). Approximately 85% of spoil is fresh and the remaining (approximately 15%) is weathered/oxidised. Spoil comprises several subtypes of material, the most relevant from a geochemical perspective being carbonaceous spoil (less than 4% of all present and future spoil) and non-carbonaceous spoil (greater than 96% of all present and future spoil) subgroups. For the geochemical assessment, spoil samples have been sourced from drill-holes (primarily as drill-core).
- Rejects are generated at the CHPP from processing ROM coal. Rejects is comprised of fine rejects, which represent fine-grained sand, silt and clay-sized waste; and coarse rejects, which represent coarser and rockier waste typically associated with seam roof, partings and floor material. Rejects is primarily generated as mixed plant reject (MPR), which comprises approximately 80% coarse rejects and 20% fine rejects mixed together at the CHPP, and disposed into spoil as MPR. From time to time to time, to meet operational requirements, fine rejects and coarse rejects are disposed into spoil separately (i.e. not as MPR). Rejects comprises approximately 8% of all mineral waste at CVM. For the geochemical assessment, almost all rejects samples have been sourced from the CHPP (representing fresh material). Rejects are disposed within spoil dumps together with overburden and interburden waste.

Coal is generally not considered mineral waste, with the exception of small quantities of sub-economic seams or coal loss through mining that may report to the spoil dumps, and remnant coal exposed on pit highwalls (such as in residual voids).

Mineral waste (and coal) samples have undergone environmental geochemical characterisation and assessment with regard to their potential to generate acid and metalliferous drainage (AMD), which comprises acid drainage (AD), neutral and metalliferous drainage (NMD) and/or saline drainage (SD) - salinity due to sulphate derived from sulphide oxidation. Additionally, samples have been assessed with regard to their potential to generate salinity (non-oxidative) and, for spoil materials, their sodicity and dispersion potential. With respect to AD, each sample has been broadly characterised as either non-acid forming (NAF) or potentially acid forming (PAF).

Mine domains representing potential sources of AMD and salinity at CVM and having a direct relevance to mineral waste characterisation and management at CVM at closure, are residual voids and spoil dumps. CVM does not have any TSFs.

6.1.3.2 Geochemical assessment approach

The geochemical characteristics of each waste type have been assessed with respect to their ability to generate AMD by leveraging on historical geochemical data (defined as pre-2019), augmented with data acquired through an aggressive sampling and analytical program (2019 onwards) designed to close identified knowledge gaps and fulfil the PRCP requirements. Overall, the geochemical data available to assess the geochemical properties of key mineral waste types and associated landforms include:

- 815 samples of interburden, overburden, roof / floor and partings – collected from drill-holes – and tested to assess the AMD hazard; and 601 samples tested to define the salinity hazard, with a subset of overburden/interburden samples assessed for dispersivity and sodicity.
- 104 samples of rejects tested to assess the AMD hazard; and 91 samples tested to define the salinity hazard. Most samples were collected from the CHPP, with a small number of samples collected directly from rejects disposal areas shortly after disposal (prior to burial by spoil).

The environmental testing protocol included a variety of analytical techniques that are consistent with industry and regulatory accepted guidelines (e.g GARD Guide (INAP, 2009)). The overburden/interburden samples were selected from drill cores that are representative of the vertical and lateral variability encountered at CVM. Rejects samples from the CHPP were collected over several years to ensure that the mineral waste variability was captured at the plant.

6.1.3.3 Geochemical classification of mineral waste

The test work results were used to understand the geochemical properties of each individual material type (source) and assign a geochemical classification. This data (and AMD classifications) were then used to infer the geochemical hazard posed by each mineral waste type in their relative proportions within each landform.

The key findings from the geochemical assessment are:

- Rejects represents the material type that is characterised by the highest proportion of samples classified at potential for AMD. Approximately 50% of the rejects samples tested have been characterised as having potential for AMD as either AD and/or NMD and/or SD. There is a high level of conservatism applied to these proportions, as over 20% of the samples had an ‘uncertain’ AMD classification and have been conservatively classified as being at potential for AMD. Laboratory leaching tests suggest that contact water from rejects classified at potential for AD is characterised by weakly acidic pH, and moderately elevated concentrations of soluble metals and metalloids for one or more of aluminium (Al), iron (Fe), copper (Cu), manganese (Mn), nickel (Ni) and/or zinc (Zn). Reject samples classed as NAF – which represents at least 50% of the reject samples – have low concentrations of soluble metals and metalloids. As a bulk single source material, rejects are expected to have a moderate to moderate-high capacity to generate AMD.
- Spoil comprises approximately 94% of all mineral waste at CVM. Of this, less than 5% of spoil samples were classified as having potential to generate AMD, with most of these being fresh carbonaceous samples closely associated with coal seam roof, floor and partings or were spoil samples located very close to seams. As such, many of these samples may ultimately report to the CHPP as rejects. Laboratory leach extracts from PAF samples show that contact water is likely weakly acidic, and can contain moderate soluble metals and metalloid concentrations for one or more of Al, Fe, Cu, Mn, Ni and/or Zn – similar to PAF rejects.
- Over 95% of spoil samples (comprising non-carbonaceous and carbonaceous material) were classified as NAF with negligible potential to generate AMD as either AD and/or NMD and/or SD. Spoil samples classed as NAF (i.e. bulk spoil) have low concentration of soluble metals and metalloids. Non-carbonaceous spoil is expected to have a low capacity to generate AMD; while carbonaceous spoil, which comprises less than 4% of spoil, is expected to have a low-moderate to moderate capacity to generate AMD.
- Coal is not regarded as waste and ROM coal remains on-site for a relatively short period of time. However, some minor coal seams/plys will report directly as waste, and remnant coal (seams) will be exposed on the highwalls of residual voids at closure. The assessment has shown that coal samples have variable geochemical properties, with approximately 30% of the samples conservatively classed as PAF. Similar to other source material tested, coal samples at potential for AMD can release moderate concentrations of metals and metalloids in contact with water, under laboratory conditions. Based on the geochemical properties and samples assessed for this report, it expected that as a bulk source material, coal will have a moderate to high capacity to generate AMD.
- Spoil and rejects can generate contact water that is slightly to moderately saline (i.e. EC less than 2000 µS/cm), largely as the result of non-oxidative processes (i.e. from the dissolution of salts and not oxidation of pyrite). However, most spoil and rejects samples were non-saline to slightly saline. Spoil is also ‘strongly sodic’ with potential for dispersion (based on the high sodicity values). Emerson aggregate class

testing found that about 23% of the spoil samples tested displayed 'some dispersion'. The remaining bulk of the samples had Emerson aggregate class values suggesting the samples were non-dispersive. Sodicity and dispersivity testing was not undertaken on rejects as these materials will not remain exposed on the final landform surface.

6.1.3.4 Geochemical risk of final landforms

Final closure landforms comprise spoil dumps and residual voids. Each of these landforms contain variable proportions of spoil, rejects and coal. In particular, based on operational practices and life of asset waste management, at closure it is expected that:

- Spoil landforms will comprise spoil (overburden, interburden) and rejects
- Highwalls will comprise exposed overburden, interburden and coal seams (including seam roof, partings and floor)
- Pit floors will comprise exposed coal (conservative assumption)

A geochemical source hazard assessment was applied to the source material types comprising carbonaceous and non-carbonaceous spoil, rejects and coal (where relevant). The source hazard score is a formula devised by the authors that leverages on the geochemical test work results to estimate the propensity (ability) to generate AMD, the AMD capacity (severity) and the quantity (volume/tonnage/%) of material that could produce AMD within each landform. The AMD score for each landform was then used to estimate the likelihood of each landform to generate AMD.

The potential environmental risk posed by each landform (containing variable proportions of each mineral waste type) was determined for each landform using a SPR approach – whereby the environmental geochemical risk is determined taking into account the geochemical source hazard of the landform, the plausible environmental and human health receptors of AMD from the landform and the plausible pathways between the source (landform) and the receptor. The outcome of this assessment informed development of appropriate management and rehabilitation measures for relevant landforms at closure.

Potential pathways and receptors for AMD and salinity have been identified for all final landforms at CVM. Details on the identification of pathways and receptors are found in Section 6.1.1 (Hydrogeology) and Appendix E.

For the purpose of this SPR assessment, the following mechanisms for AMD and salinity to enter plausible pathways and report to plausible receptors have been identified:

- Source - spoil landform:
  - Surface water run-off (pathway) from a spoil landform reports to a nearby creek (receptor)
  - Seepage from a spoil landform enters a shallow permeable strata (pathway) and reports to a nearby creek (receptor)
  - Seepage from a spoil landform enters groundwater (pathway) and reports to the nearest residual void (receptor)
- Source – residual void highwall and floor
  - Runoff from the highwall of a residual void (pathway) reports to the residual void (receptor)

The outcomes of the SPR are summarised below:

- There are two spoil landforms at CVM: Horse landform, comprised of approximately 90% spoil and 10% rejects; and Heyford landform, comprised of approximately 94% spoil and 6% rejects. With respect to AMD and non-oxidative salinity, the overall SPR risk rating from both final spoil landforms is Low.
- There are two residual voids at CVM (Horse and Heyford), each corresponding to its respective spoil landform. The final receptor for seepage from the spoil landform (for each spoil landform) and run-off from the highwall (of each residual void) is the void lake / residual void. The AMD assessment has found that it's unlikely that undiluted salinity or AMD from a flooded post-closure residual void floor would impact on residual void water quality to any significant degree, as other processes such as evapoconcentration are the key drivers of void lake water quality (SLR, 2023b). Therefore, the AMD SPR risk rating on the overall water quality of the residual voids is Low.

Water reporting to residual voids is expected to remain within the residual voids (excluding evaporative loss). Modelling undertaken (SLR, 2023b) shows that seepage from the void lake (of each void) into groundwater, if any, would be limited (Section 6.1.1).

6.1.3.5 Management and rehabilitation measures

The geochemical characterisation, SPR, and residual risk assessment conducted in support of this PRCP informed the following mineral waste management and rehabilitation measures with regards to AMD and salinity management:

- Residual voids: will remain as NUMAs.
- Spoil dumps: will be reshaped, covered with soil and seeded. No specific AMD management measures are proposed for the spoil as operational mixing will be sufficient to manage the very small quantity of spoil that has been characterised with potential for AMD. Monitoring in accordance with the PRCP schedule will be conducted to ensure that spoil landforms can achieve their nominated PMLU.
- Rejects: Managed during operations (disposed within spoil) and progressively covered by spoil. No additional remediation for the rejects (at closure) is required. Within the final landform, rejects will be buried (by spoil) at least 5m below final landform surface, or an alternative depth determined by an AQP.
- ROM pad: Remove remnant coal from the ROM pad and dispose within spoil. The former ROM pad will be reshaped, covered with soil, ripped and seeded.
- Coal stockpile: Remove remnant coal from the coal stockpile pad and dispose within spoil. The pad will be covered with soil, ripped and seeded.

Relationship with PRCP schedule
The environmental risks posed by the mineral wastes likely to be present at closure are Low. As such, no specific AMD management measures (e.g., alkaline amendment or capping systems) are expected to be required to manage mineral waste during rehabilitation and closure.

The information in this section is relevant to the following highlighted RAs and RMs in the PRCP schedule														
RA1				RA2				RA3			RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	**RM13**	**RM14**	**RM15**

The information in this section is relevant to the following highlighted IAs and MMs in the PRCP schedule		
IA1		
MM1	MM2	**MM3**

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
RM13	• Rainfall runoff from rehabilitated areas is not significantly different to upstream values for the following: pH, EC and turbidity, as per Caval Ridge Mine PRCP, 1 December 2023, v1, Appendix N
RM14	• Rainfall runoff from rehabilitated areas is not significantly different to upstream values for the following: pH, EC and turbidity, as per Caval Ridge Mine PRCP, 1 December 2023, v1, Appendix N

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
RM15	• Rainfall runoff from rehabilitated areas is not significantly different to upstream values for the following: pH, EC and turbidity, as per Caval Ridge Mine PRCP, 1 December 2023, v1, Appendix N
The following Milestone Criteria will contribute to achievement of sufficient improvement:	
MM3	• Certification from an AQP that the residual void will not present an unacceptable risk of environmental harm outside of the tenure boundary

6.1.4 Soil and capping material

PRCP Guideline (Section 3.6.1)

The rehabilitation and management methodology should include that soil assessment activities are supplemented by additional surveys conducted at appropriate intervals to assess soil resources in planned disturbance areas. In addition to the assessment of soils, the proposed rehabilitation methodologies in the rehabilitation planning part must also address topsoil management. Topsoil management must ensure sufficient topsoil quantity and quality is available in those instances that waste rock or tailings cannot support the proposed PMLU. Integrated soil and waste rock characterisation and mapping should form the foundation of the rehabilitation strategies. The available soil resources and capping material should be assessed prior to the commencement of operations.

A growth media assessment has been undertaken to support the development of this PRCP. The detailed report – *Caval Ridge Mine Materials Characterisation Study* (Landloch, 2023), is provided in Appendix F. Soil surveys have been conducted for the proposed mining footprint (refer to Section 1.2.6).

6.1.4.1 Quality of available resources

The key chemical and physical properties of the stockpiled topsoil within the soil management groups and spoil material available for rehabilitation at CVM is summarised in Table 26.

Table 26: Key physiochemical properties of stockpiled soil management groups and spoil material

Rehabilitation resource	Properties
Clay topsoil	• Generally mild to moderate alkalinity (pH 7.4 – 8.4) • Low salinity but occasionally moderate (EC <0.45dS/m) • Non-sodic to marginally sodic (ESP 2 – 9%). Stripping below 20cm will increase sodicity • Moderate to high CEC and ability to retain nutrients (>12meq/100g) • Clay content of approximately 30 – 55% • Low permeability (<3mm/hr), indicating that movement of water to depth will be limited • Moderate to high water holding capacity (approximately 150 - 180mm/metre of depth) • Very high erodibility
Sand/loam topsoil	• Generally neutral to moderate alkalinity (pH 6.6 – 8.4) • Low salinity (<0.45dS/m) • Non-sodic to marginally sodic (ESP <8%). Sodic stockpiles are likely to include subsoil • Low CEC and ability to retain nutrients (<12meq/100g).

Rehabilitation resource	Properties
	• Clay content of less than 25% • Reasonably high permeability (approximately 20mm/hr), indicating that movement of water to depth will be reasonably rapid • Moderate water holding capacity (approximately 125 – 140mm/metre of depth). • High erodibility
Fresh Permian spoil (including rock)	• Strongly alkaline (pH >8.5) • Salinity is low based on EC (<0.45 dS/m) and chloride-based salts (<300mg/kg) • Non-sodic to sodic (ESP 2 – 15%) • Low CEC and ability to retain nutrients (<6meq/100g). • Reasonably high permeability (>12mm/hr), indicating that movement of water to depth will be reasonably rapid and that deep-rooted plant species may be able to extract water from depths up to 3 metres • Low water holding capacity (<70 mm/metre of depth) • Low to moderate erodibility. Negligible soil loss on gradients below 10% • Slake durability >70% and in some cases >90%

6.1.4.2 Quantity of available resources

The rehabilitation at CVM requires growth media to support vegetation establishment for the planned PMLUs. There is sufficient quantity of topsoil available on-site for the growth media for rehabilitation of disturbed areas to cattle grazing, woodland habitat and watercourse PMLUs. The volume of topsoil available for rehabilitation includes the volume of topsoil currently stockpiled at site (4,523,548m^3 (as at April 2023)) and the future topsoil to be stripped (estimated at 1,009,635m^3 for the future mining pit), totalling 5,533,183m^3.

The volume of growth media resources required for rehabilitation of the existing disturbance (where topsoil has been stripped) plus the future spoil areas is shown in Table 27. These volumes only include disturbance areas where topsoil has been stripped or is planned to be stripped and needs to be replaced, therefore the areas shown in Table 27 do not align to the total area of the RAs. Potential future disturbance areas, particularly within ML70462 and ML70403, have not been included in the topsoil balance calculations, as these areas are expected to be minor and will be topsoil neutral. The volume shown for watercourse is conservative as it assumes all diversion areas require topsoil.

Table 27: CVM required growth media volumes for PMLUs

Growth Media	PMLU	Area (ha)*	Cover depth (m)	Volume required (m^3)
Topsoil	Cattle grazing	594	0.15	891,000
	Woodland habitat	2,806	0.15	4209,000
	Watercourse	75	0.15	112,500
	Total	**3,475**	**-**	**5,212,500**

* Existing disturbed areas where topsoil has been stripped + future spoil areas

6.1.4.3 Resource management

During mining operations, topsoil is stripped according to the recommended depths from the pre-mining soil surveys. The topsoil is either used direct on rehabilitation areas or stockpiled progressively for later use in rehabilitation. Topsoil is stripped with caution to ensure as little contamination with subsoils occurs as possible. Existing topsoil stockpiles are located throughout the CVM site which can be accessed for loading and haulage to rehabilitation areas. The location of current topsoil stockpiles are shown in Appendix F. Stockpile locations and volumes will vary throughout the life of the operation as stockpiled topsoil is used on rehabilitation and new stockpiles are created as mining advances. The spatial location of stockpiles is recorded in a geographic information system and a volume inventory is maintained.

An assessment of the growth media characteristics will be completed by an AQP (as per condition A5 of the EA) to determine the amelioration requirements to suit the revegetation plan. After application of the required ameliorants, areas will be ripped along the contour to key in the growth media with the underlying spoil, reduce compaction, improve water infiltration and create surface roughness to slow surface runoff.

The required growth media depth, amelioration options and the surface treatment requirements to support the establishment of vegetation for each PMLU, are shown in Table 28. Opportunities to utilise other methods may be investigated.

Table 28: Growth media ameliorant options and surface treatments for the CVM PMLUs

PMLU	Growth media	Ameliorant options	Surface treatments
Cattle crazing	Topsoil – minimum depth of 150mm is sufficient to store moisture and nutrients to initiate and sustain pasture growth	• Elemental Sulphur • Manures • Urea • Diammonium phosphate • Superphosphate • Fertiliser • Gypsum • Incorporated organic matter • Surface mulching (e.g., hay mulch)	• Ameliorate growth media as recommended by an AQP (if required) • Rip along contour • Direct seed as per seed mixes and rates for cattle grazing revegetation (Section 6.1.8.5)
Woodland habitat	Topsoil - depth of 100mm to 150mm limits the effects of competition on woodland species due to the potential loads of exotic pasture species	• Elemental Sulphur • Manures • Superphosphate • Fertiliser • Gypsum • Incorporated organic matter • Surface mulching (e.g., hay mulch)	• Ameliorate growth media as recommended by an AQP (if required) • Deep rip along contour to incorporate rock • Direct seed as per seed mixes and rates for woodland habitat revegetation (Section 6.1.8.6)
Watercourse	Topsoil - minimum depth 150mm to encourage a vegetative cover to provide erosion resistance	• Elemental Sulphur • Manures • Superphosphate • Gypsum	• Ameliorate growth media as recommended by an AQP (if required) • Rip along contour as required

PMLU	Growth media	Ameliorant options	Surface treatments
		• Incorporated organic matter • Surface mulching (e.g., hay mulch)	• Direct seed as per seed mixes and rates for watercourse revegetation (Section 6.1.8.7)

Relationship with PRCP schedule
There is a sufficient quantity of suitable quality topsoil available on-site to use as the growth media for rehabilitation of disturbed areas to cattle grazing, woodland habitat and watercourse PMLUs. An AQP will complete and assessment of the topsoil to determine the required ameliorants and treatment for the nominated PMLU.

The information in this section is relevant to the following highlighted RAs and RMs in the PRCP schedule														
RA1				RA2				RA3			RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
RM4	• Topsoil placed at minimum depth of 150mm • Assessment of growth media characteristics is completed by an AQP • Ameliorant and physical treatments are applied as identified in RM4 • Rip along contour
RM5	• Topsoil placed at a depth of 100mm to 150mm • Assessment of growth media characteristics is completed by an AQP • Ameliorant and physical treatments are applied as identified in RM5 • Deep rip along contour
RM6	• Topsoil placed at minimum depth of 150mm • Assessment of growth media characteristics is completed by an AQP • Ameliorant and physical treatments are applied as identified in RM6 • Rip along contour

6.1.5 Landform design

> ***PRCP Guideline (Section 3.6.1)***
>
> *The final landform design must be based on the proposed PMLUs and NUMAs and demonstrate that the land will be safe and structurally stable.*

A landform design assessment has been undertaken to support the development of this PRCP. The detailed report – *Erosion and Landform Evolution Simulations to Support Waste Landform Design: Caval Ridge Mine* is provided in Appendix K.

Landform design considers the landform development and reshape of all relevant activity areas after the removal of infrastructure, and prior to placement of growth media and seed.

The final closure landform design has been refined based on the outcomes of the studies undertaken to support this PRCP. The mining limits achieve geotechnical stability of the residual voids (Section 6.3.1), residual voids are mitigated from the risk of flooding (Section 6.1.2) and spoil dump slope angles achieve erosional stability (Section 6.1.5.3).

6.1.5.1 3D design

The conceptual 3D closure landform design for CVM is provided in Figure 15.

6.1.5.2 Method of determining landform design

Landform structures

The relevant activities and areas (Section 1.4.1) considered when determining the landform design are detailed in Table 29.

Removal of infrastructure (Section 6.5) and contaminated land requirements (Section 6.5.3) will be completed where required, prior to reshaping of the final landform. After reshaping of the final landform, the required growth media and ameliorants are applied to support the PMLU (Section 6.1.4), the area is seeded (Section 6.1.8), and monitoring and maintenance completed to ensure rehabilitation is tracking to a stable condition (Section 8).

Table 29: Landform structures at CVM and proposed designs

Landform structure	Landform design
Spoil dumps	• Maximum dump heights up to 170m above ground level to fit the quantities of waste scheduled to be mined • 20m dump lift heights • Dump slopes to be reshaped to be free-draining with maximum 15% slopes or up to maximum 30% slopes with rock on the final landform surface (refer to erosion modelling Section 6.1.5.3)
Infrastructure and general areas – CHPP and associated infrastructure, administration, workshop, stockpile areas, laydown areas, roads, dams, drains, rail area, train load-out and associated infrastructure	• Area will be reshaped to be free-draining with maximum 12% slopes for cattle grazing PMLU • Area will be reshaped to be free-draining with maximum 15% slopes for woodland habitat PMLU
Residual voids	• Set-back of the high-wall and end-wall to achieve structural stability of FoS ≥1.5 within the NUMA extents (Section 6.3.1) • Flood mitigation to a level 1m above the 0.1% AEP flood levels where required to prevent flood ingress (Section 6.1.2): - Horse Pit: partial void backfill on the northern end-wall - Heyford Pit: partial void backfill on the northern and southern end-walls

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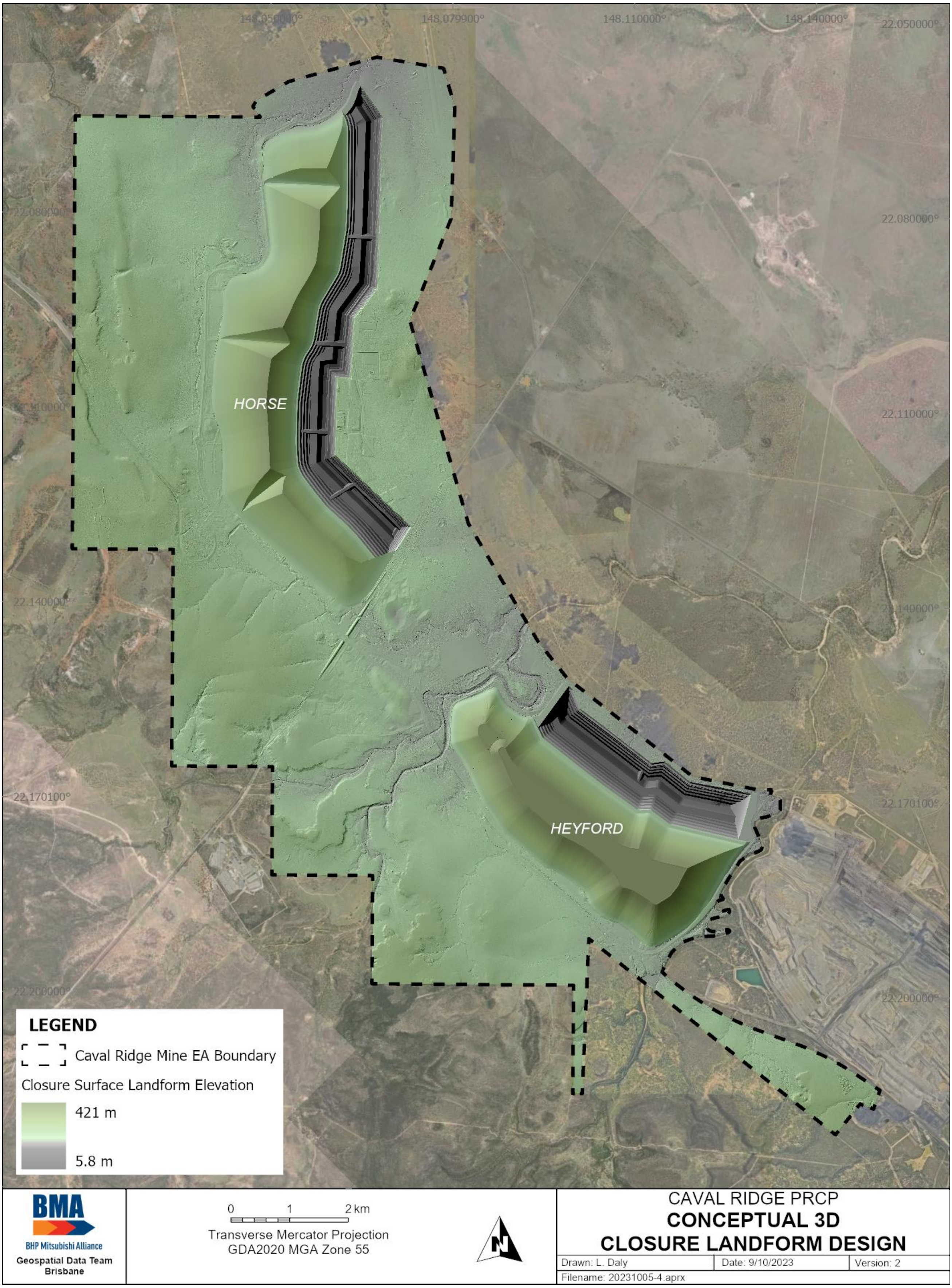

Figure 15: CVM closure landform design

Materials available for landform rehabilitation

The landform at CVM utilises materials available on-site that will achieve the required landform stability. Rock will be utilised on the steeper landform surface to improve the erosion resistance (Section 6.1.5.3). Rock will be sourced from the mined overburden and interburden, with sufficient quantity available on-site for the planned rehabilitation. Rock will be used directly on rehabilitation areas or stockpiled when required to ensure sufficient quantity for the planned rehabilitation.

Growth media details to support revegetation are included in Section 6.1.4.

Hydrological and hydrogeological assessments

Except for the catchment into the residual void, the final landform will predominately be water shedding. Rehabilitation will include:

- Reshaping of the spoil dumps with no permanent berms or water management on slopes
- Reshaping of the rehabilitated mine dams to be free-draining
- Removal of any road culverts and fill material from within the watercourse extents

A rehabilitation flood assessment, including hydrologic and hydraulic modelling has been completed for the CVM closure landform (Section 6.1.2). The flooding risk profile developed as part of this assessment identified the risks to the landforms from flooding to be low with mitigation measures in place. Mitigation includes partial final void backfill to mitigate the risk of flooding into the residual voids up to the 0.1% AEP flood level as detailed in Table 29.

The flood water interaction with the spoil dumps is at the extremity of the flooding extent where flood waters have relatively low velocities and depths (Section 6.1.2). Outer landform slopes that interact with flood waters up to a 0.1% AEP will incorporate controls designed by an AQP, if required, at the time of final landform surface design. These landform controls will take into consideration the latest flood modelling results that are reflective of the final landform design at the time and will minimise potential instability of the landform from interaction with floodwaters.

A hydrogeological assessment (Section 6.1.1), including numerical modelling, and pit lake water balance modelling (Section 6.3.2) identified the residual voids, once stabilised, will through evaporative losses continue to act as a sinks. Therefore, groundwater gradients in the proximity of the residual voids will maintain flows towards the pit lakes and retain any contaminants within the residual voids.

6.1.5.3 Long-term landform stability

Material testing, erosion modelling and landform evolution modelling has been completed to establish the slope profiles for the materials at CVM to ensure long-term landform stability (Appendix K).

The landform study included:

- Simulations of runoff and erosion for a range of landform options using the Water Erosion Prediction Program (WEPP)
- Derivation of parameters for the SIBERIA landform evolution model
- Landform evolution simulations using SIBERIA for the 3D landform of CVM spoil dumps, which were designed based on the WEPP results

The runoff and erosion simulations using the WEPP model and the landform evolution simulations using the SIBERIA model indicate that the proposed dumps and slope profiles (Table 29) at CVM can be expected to be stable over the long-term, provided the target levels of vegetation cover are achieved.

To establish the required level of vegetation cover as soon as possible and limit the window of erosion risk, the following measures are planned:

- Ripping along the contour to key the growth media with the underlying spoil, reduce compaction, improve water infiltration and create surface roughness to slow water flow (Section 6.1.4.3)
- Application of seed at the optimal time when there is sufficient soil moisture in the profile to assist germination and sustain establishment (Sections 6.1.8.5, 6.1.8.7 and 6.1.8.9)

- Inclusion of a sterile cover crop in the seed mix, which establishes quickly on the exposed surfaces and works to provide a root system that will stabilise the surface (Sections 6.1.8.5, 6.1.8.7 and 6.1.8.9)
- Surface mulching where appropriate, to provide instant groundcover (e.g. hay mulch) (Section 6.1.4.3)
- Monitoring as scheduled and maintenance as required (Section 8).

6.1.5.4 Method of construction

The majority of the spoil dumps are dumped within the mined-out pit extents and comprise of dragline spoil at the base of the dump (~80m high) with haul trucks dumping ~20m lifts above the dragline spoil.

6.1.5.5 Quality assurance/quality control

The proposed actions referenced in Table 29 are the key controls that will be put in place to manage the landform risks associated with achieving the PMLUs. Quality assurance and quality control (QA/QC) activities are built into all necessary execution and verification activities of these controls. Monitoring and reporting processes will verify controls and ensure that controls are executed effectively (Section 8).

6.1.5.6 Trial methodology

Modelling has indicated the proposed landforms will be stable and monitoring will verify if the landforms are on a path towards achievement of the milestone criteria and eventual certification; or whether corrective actions, maintenance or changes to the rehabilitation methodology is required.

6.1.5.7 Limitations and assumptions

The limitations and assumptions of the final landform design include:

- The final landform is dependent on the mining schedule, which can change due to increased geological knowledge, market factors and technology. These changes may result in differences to the landform, such as varying heights, ramp locations or access bridges within the final voids, but the key considerations to ensure long-term stability, such as slope profiles and materials, will be maintained in the final closure landform design.
- The landform has been designed with maximum dump heights to ensure all modelling is conservative. It is not anticipated that all areas of the spoil dumps will reach these heights
- A swell factor of 25% has been assumed for the dump scheduling. This is a standard factor based on experience in the Bowen Basin
- Angle of repose of the spoil dumps is 37°
- Landform evolution modelling has been completed for up to 300 years based on the best available inputs at this time
- Due to the size of the spoil dumps and dumping in lifts, the majority of settlement of the 'constructed' landforms is expected to occur during placement with only minor settlement expected after rehabilitation.
    - According to ACARP project C19022 (Williams, 2015), spoil settlement consists of three components: self-weight settlement (80% occurs during placement and decreases exponentially with time); collapse settlement (most occurs during placement); and degradation settlement (variable timeframe depending on material, but most may occur during placement and approaches a limit over time). The landform will be monitored to ensure a free-draining landform is maintained where required.

Relationship with PRCP schedule
The landform has been designed to conservatively represent the final closure landform and minimise risk, with slopes appropriate for the materials available on-site.

The information in this section is relevant to the following highlighted RAs and RMs in the PRCP schedule														
RA1				RA2				RA3			RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The information in this section is relevant to the following highlighted IAs and MMs in the PRCP schedule		
IA1		
MM1	MM2	MM3

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
RM3	• Landforms reshaped with maximum 30% slopes (RA1) • Rock placed a minimum thickness of 0.5m on >20% slopes (RA1) • Landforms requiring reshaping are reshaped to be free-draining with maximum 12% slopes (RA3) or maximum 15% slopes (RA4) • Disturbed natural watercourse bed and banks returned to a profile similar to the pre-disturbance condition (RA2)
RM14	• Rehabilitation of RA1 is assessed as geotechnically stable by an AQP with FoS≥1.5, unless an alternative is justified by an AQP
The following Milestone Criteria will contribute to achievement of sufficient improvement:	
MM1	• The required high-wall, end-wall and low-wall set-back to achieve a FoS ≥1.5 is determined by an AQP
MM3	• Certification from an AQP that the residual void is safe to humans and livestock • Certification from an AQP that the residual void will not present an unacceptable risk of environmental harm outside of the tenure boundary

6.1.6 Cover design

PRCP Guideline (Section 3.6.1)

A cover design is required for the surface treatment of a mine landform or other waste material. Hence, the cover system design must be appropriate for the type(s) of waste the project will generate and reflect a risk-based approach. Where waste has the potential for AMD, neutral mine drainage or saline mine drainage, an appropriate cover system must be designed.

The cover design should include:

- *identification and specification of the objectives of the cover system*
- *a detailed description of the design including the thickness of each layer*
- *a detailed description of construction methodology including any proposed staging of the cover system*
- *a quantitative assessment that identifies the location and quantity of proposed capping material available on-site*
- *proposed QA/QC for the construction of the cover system including the timely implementation of corrective actions where deviations from the design are identified.*

A cover system is required where there is potential for materials to cause AMD, NMD or SD. A cover design must ensure contaminants are not released to the receiving environment.

As detailed in Section 6.1.3, CVM has two main types of mineral waste which includes spoil and coal rejects (fine and coarse rejects). The spoil is placed predominantly in in-pit spoil dumps and the rejects is buried within the spoil. Considering the waste materials, quantities and the methods of disposal during operations, the geochemical assessment concluded that no additional management measures are required (Section 6.1.3).

Relationship with PRCP schedule
The geochemical assessment of the mineral waste materials on-site concluded that materials are managed during operations and no additional management measures are required.

The information in this section is relevant to the following highlighted RAs and RMs in the PRCP schedule														
RA1				RA2				RA3			RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:
• No criteria required.

6.1.7 Water management

> ***PRCP Guideline (Section 3.6.1)***
>
> *The rehabilitation planning part must include a description of the following:*
>
> - *a description of the contaminants that pose a risk to environmental values of the receiving environment*
> - *source, pathway and fate of contaminants that have the potential to impact environmental values*
> - *infiltration and seepage intervention and collection controls*
> - *surface water diversions and long-term management requirements*
> - *dewatering requirements*
> - *ongoing water management and reduction requirements (i.e. treatment).*

The landform design for CVM is intended to provide rehabilitated landforms that meet the nominated PMLU milestone criteria and NUMA management milestones without the need for ongoing water management. The following, which are discussed in more detail in the relevant sections of this PRCP, are key considerations that have been taken into account in the assessment of ongoing water management requirements post-mining:

- With the exception of the catchment of the residual voids, the final landform surfaces will predominately be free-draining with runoff allowed to flow to the surrounding creeks (Section 6.1.5)
- All mining-related dams will be decommissioned and removed, and the rehabilitated areas will be free-draining (Sections 6.1.5 and 6.5)
- Final residual voids will remain as NUMAs and will continue to act as groundwater sinks (Section 6.3)
- Rehabilitated landforms provide flood protection up to a 0.1% AEP flood event to the residual voids (Section 6.1.2)
- There are no TSFs at CVM as tailings are dewatered and the fine and coarse rejects are co-disposed within the spoil dumps (Section 6.2)
- Mineral waste/geochemical risks associated with the geochemical sources, once pit lakes have formed, have identified AMD source hazard scores of Low (Section 6.1.3)

- Modelling of flow paths through particle tracking of groundwaters within and surrounding the mining operations indicate the groundwater within the tenement will migrate toward the residual voids (NUMAs) and not into surrounding environments (Section 6.1.1)
- The assessment of diversions at CVM identified they were of suitable design and condition supporting progression to a closure state with ongoing maintenance and monitoring throughout the remaining operational phase (Sections 6.1.7.1 and 6.1.8.10)
- Conceptual site models that assess SPR linkages have been prepared for relevant technical studies including hydrogeology (Section 6.1.1) and waste characterisation (Section 6.1.3)

6.1.7.1 Contaminants and sources

CVM operations include heavy industrial type operations that maintain the processing facilities, vehicles and equipment required for the extraction and processing of coal. These heavy industrial type operations include the storage, use and disposal of a variety of hazardous materials. CVM has relatively modern facilities within the MIA and CHPP area, and no significant loss of hazardous contaminants is known to have occurred resulting in contamination of the land or water resources on-site. However, the predominant industrial types of hazardous materials identified to have a potential to cause contamination, which could impact PMLUs and/or the surrounding environment include:

- Hydrocarbons: including diesel, oils, greases, methyl isobutyl carbinol (MIBC) and other solvents
- Aqueous Film-Forming Foam: historical use of products containing Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)
- Nitrogen: associated with explosive formulation
- Carbonaceous material: potential saline and acidic/alkaline leachate

Current operational water management includes the segregation and containment of water from mine operational areas. This water is collected within on-site mine dams and recycled within the mine operations, or transferred to other BMA operations, or released under the conditions of the EA. MAW includes runoff from CHPP area, MIA and water removed from the pits. MAW dams have the potential to accumulate impacted water and sediments and therefore are a potential secondary source of contamination. Contaminants of concern within the dams include those potential contaminants listed above for the mine industrial operations, as well as metals and salinity.

Geochemical risks relating to AMD for the final landforms and residual voids, once pit lakes have been established, has been assessed as ‘Low’ (Section 6.1.3.4). Therefore, once established, post-mining landforms and the residual voids are not considered to present an unacceptable AMD risk and are unlikely to result in the mobilisation of metals, metalloids, salinity (from oxidation processes) or other contaminants into the surrounding environment.

At the completion of mining operations, a contaminated land investigation will be undertaken to assess the area for potential contamination (Section 6.5.3). This investigation will assess the site for the range of potential contaminants that are utilised during operations and provide an assessment of the risk presented to the PMLUs and the environment.

6.1.7.2 Pathway of contaminants

The final landform surfaces will predominantly be free-draining directly to the surrounding watercourses. Any contaminants present at the surface of the post-mining landform have the potential to be mobilised through surface water runoff, generation of airborne particulate and through direct contact with the PMLUs. Contaminated land assessments will inform required remediation works to manage identified unacceptable risks associated with potential pathways to surface contamination.

Prior to rehabilitation, runoff from areas containing the MIA, CHPP and coal handling areas is captured within the mine water system. The mine water system will be decommissioned and rehabilitated as part of mine closure. Modelling of flow paths though groundwater particle tracking indicates that all groundwater within the tenement - including those areas containing the MIA, CHPP, mine dams and spoil dumps, will continue to migrate towards the residual voids post-mining.

During the initial stabilisation phase of the groundwater and pit lakes, the more rapid recovery and higher climate influence on the pit lakes (when compared to groundwater) may result in some variability in the flux between groundwaters and pit lakes. Outflows from the residual void are limited to climate-driven events that result in periodic outflows into the spoils. Flow path modelling indicates that these events do not result in loss of groundwaters beyond the tenement, with groundwaters returning to the residual voids which, once stabilised, will continue to act as sinks post-closure (Section 6.3).

6.1.7.3 Fate of contaminants

Any contamination remaining post-mining that presents an unacceptable risk to the nominated PMLUs or the environment will be subject to investigation and remediation. Where appropriate, draft SMPs will be prepared in accordance with the requirements of the EP Act. The SMPs will be submitted to the administering authority for consideration where any ongoing management of contamination is required.

Where contamination is contained within the subsurface, the strong sinks created by the residual voids will continue to collect any potentially contaminated seepage and groundwater.

6.1.7.4 Surface water diversions and management requirements

CVM has diversions within three watercourses – Horse Creek, Caval Creek and Cherwell Creek, which were designed and constructed to enable open-cut mining. Each diversion was assessed against the EA PMLU goals of being safe, stable, non-polluting and self-sustaining. The assessments concluded that the CVM diversion reaches, in their current alignment, are expected to progress towards the EA PMLU goals and acceptance criteria. The diversion details, water licences, assessment outcomes and forward work plan commitments for relinquishment are summarised in Table 30.

Table 30: CVM surface water diversion details and forward work plans

Details	Horse Creek	Caval Creek	Cherwell Creek
Water licence	Located within an unmapped portion of Horse Creek (as defined by the Water Act 2000) and therefore isn't required to be licenced	606715	49428L – Diversion Stage 1 104779 – Diversion Stage 2
River catchment	Isaac River	Isaac River	Isaac River
Upstream catchment area	13.75 km2	15.0km2	150.0km2
Year of construction	2013	2013	1991, 1995, 2000 and 2012
Diversion length	4.4km	3.7km	2.1km (combined)
Diversion assessment outcome	Diversion in its existing alignment achieves or will continue to progress towards the defined EA watercourse PMLU goals. Diversion will be relinquished in its existing alignment following implementation of the forward work plan commitments.	Diversion in its existing alignment achieves or will continue to progress towards the defined EA watercourse PMLU goals. Diversion will be relinquished in its existing alignment following implementation of the forward work plan commitments.	Diversion in its existing alignment achieves or will continue to progress towards the defined EA watercourse PMLU goals. Diversion will be relinquished in its existing alignment following implementation of the forward work plan commitments.
Operational phase	Routine monitoring and maintenance of the diversion during the operational phase of the mine.	Routine monitoring and maintenance of the diversion during the operational phase of the mine.	Routine monitoring and maintenance of the diversion during the operational phase of the mine.
Forward work plan - diversion construction	N/A	N/A	N/A

Details	Horse Creek	Caval Creek	Cherwell Creek
Forward work plan – infrastructure	Removal and rehabilitation of adjacent levee, sediment dams and haul road.	Removal and rehabilitation of mine infrastructure near the diversion including the dragline crossing, conveyor and haul road, and associated culvert crossings.	Removal and rehabilitation of mine infrastructure including haul road crossing and culverts, conveyor crossing, dragline crossing and 12N dam spillway.
Forward work plan – final landform	Regrade, topsoil, and revegetate adjacent spoil dumps.	Regrade, topsoil, and revegetate adjacent spoil dumps. Final landform to ensure 0.1% AEP flood immunity to residual voids.	Regrade, topsoil, and revegetate adjacent spoil dumps. Final landform to ensure 0.1% AEP flood immunity to residual voids.

6.1.7.5 Ongoing water management

Disturbed areas within natural watercourses will be reshaped into defined bed and banks and blended in with adjacent undisturbed areas.

Upon attainment of the rehabilitation milestone criteria, no ongoing water management will be required at CVM. This includes no infiltration and seepage intervention and collection controls; no dewatering requirements; and no ongoing water management and reduction requirements.

Relationship with PRCP schedule
The final landform surfaces (excluding the residual void catchments) will predominately be free-draining and are not anticipated to require any on-going water management. A contaminated land investigation will be undertaken at the completion of operations to assess the area for potential sources of contamination that could impact environmental values. Where required, remediation and management of any identified contamination will be undertaken to minimise the potential for unacceptable levels of impacts to water resources. Flow path modelling indicates there is no loss of groundwaters beyond the mining tenement, with the residual voids acting as sinks post-mining. The three CVM creek diversion reaches, in their current alignment, are expected to progress towards the rehabilitation objectives with ongoing maintenance and monitoring throughout the remaining operational phase.

The information in this section is relevant to the following highlighted RAs and RMs in the PRCP schedule														
RA1			RA2				RA3				RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The information in this section is relevant to the following highlighted IAs and MMs in the PRCP schedule		
IA1		
MM1	MM2	MM3

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
RM1	• Assessment of mine water dams is completed by an AQP and sediment and identified water management actions are completed • Mine water dams are decommissioned • Watercourse crossings and culverts removed
RM2	• Contaminated Land Investigation Document completed in accordance with the *Environmental Protection Act 1994*, including: - Site Suitability Statement confirming the suitability of the property for the PMLUs - Audit Certification • Contaminated Land Investigation Document including a Site Investigation Report and, where required, a Validation Report and/or a draft Site Management Plan

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
RM3	• Landforms requiring reshaping are reshaped to be free-draining with maximum 12% slopes (RA3) or maximum 15% slopes (RA4) • Disturbed natural watercourse bed and banks returned to a profile similar to the pre-disturbance condition (RA2)
RM13	• Rainfall runoff from rehabilitated areas is not significantly different to upstream values for the following: pH, EC and turbidity, as per Caval Ridge Mine PRCP, 1 December 2023, v1, Appendix N
RM14	• Rainfall runoff from rehabilitated areas is not significantly different to upstream values for the following: pH, EC and turbidity, as per Caval Ridge Mine PRCP, 1 December 2023, v1, Appendix N
RM15	• Rainfall runoff from rehabilitated areas is not significantly different to upstream values for the following: pH, EC and turbidity, as per Caval Ridge Mine PRCP, 1 December 2023, v1, Appendix N • Geomorphic index score: greater than or equal to upstream or downstream values (IDC method)
The following Milestone Criteria will contribute to achievement of sufficient improvement:	
MM3	• Certification from an AQP that the residual void will not present an unacceptable risk of environmental harm outside of the tenure boundary

6.1.8 Revegetation

PRCP Guideline (Section 3.6.1)

The revegetation plan must propose activities that will establish self-sustaining vegetation communities that are appropriate for the intended PMLU (e.g. natural ecosystems, grazing, forestry and some agricultural and other land uses). Revegetation should, therefore, not only establish a ground cover, but also, in some domains, establish associated fauna habitat and other ecological services.

The rehabilitation planning part must include details of the site preparation required for rehabilitation activities.

6.1.8.1 Revegetation objectives

The revegetation objectives of the planned PMLUs of cattle grazing, woodland habitat and watercourse are consistent with the rehabilitation requirements of the EA and monitoring:

- Cattle grazing:
  - Groundcover >50%
  - To establish cattle grazing pasture with land suitability class ≤3 (Short, 2023) or not different from pre-mining if ≥4, or not different from reference sites if ≥4
  - To establish cattle grazing pasture with land condition assessed as Good (A) or Fair (B) as described in the Queensland Reef Protection Regulations Farming in Reef Catchments Grazing Guide – Figure 3 (DES, 2022a)
- Woodland habitat:
  - Groundcover ≥50% on rehabilitated slopes ≤15%; ≥80% on rehabilitated slopes >15%
  - To establish woodland habitat with native bushland characteristics of ≥2 trees, ≥3 shrubs and ≥4 grasses, and ≥16% tree canopy cover

- Watercourse:
    - To establish watercourse riparian vegetation index ≥ upstream or downstream values

The CVM revegetation objective for the NUMAs is:

- NUMA low-wall (to within 10m above the modelled maximum residual void lake elevation):
    - To establish total vegetation cover of ≥30%

The above revegetation objectives for groundcover consider groundcover to be anything in contact with the soil surface, for example live cover, standing dry cover, organic litter (including leaves, hay, woody debris) or rocks.

No infrastructure is proposed to support the revegetation plan.

6.1.8.2 Species of conservation significance

CVM has no obligations requiring specific inclusion of species of conservation significance in the revegetation planning. Nonetheless, areas adjoining undisturbed Endangered or Of Concern regional ecosystems or threatened species habitats will be rehabilitated to a woodland habitat PMLU wherever possible. This approach will provide connectivity between rehabilitated areas and existing vegetation and habitat values. Similarly, areas rehabilitated to a watercourse PMLU will connect existing riparian habitat values for several conservation significant species.

6.1.8.3 Fauna habitat and use requirements

There are no existing obligations to establish fauna habitat and/or fauna use in the rehabilitation areas for CVM. However, areas adjoining undisturbed threatened fauna species habitats will be rehabilitated to a woodland habitat PMLU wherever possible, and disturbed areas of watercourses will be rehabilitated to a watercourse PMLU.

Woodland habitat and watercourse revegetation will provide longer term connectivity values for threatened fauna species, including koala and greater glider (Figure 10) as well as squatter pigeon and ornamental snake (Figure 11).

6.1.8.4 Revegetation seed provenance

The provenance (where the seed comes from) is considered important for all species. Seeds will be sourced as locally as possible from natural populations. Although the local provenance boundary locations may differ between species, seed should ideally be obtained from the Brigalow Belt North bioregion.

Proof of provenance will be sought from the seed supplier(s) along with germination and viability certificates for all purchased seeds.

6.1.8.5 Cattle grazing revegetation species and seeding rates

Areas of cattle grazing are predominately planned for the lower gradient areas disturbed by mining activities, areas that require shallow rooted species and/or areas where there was significant clearing prior to mining (RA3).

The growth media for cattle grazing will be pre-stripped topsoil, spread over rehabilitated landforms at a depth ≥150mm, and ameliorated as recommended by an AQP (refer to Section 6.1.4).

The recommended revegetation species mix for cattle grazing PMLU is based on seeding native and naturalised exotic species that are preferred, palatable and productive (3P) grasses and legumes, cognisant of grazing best management practice (DES, 2022a; Future Beef, 2022a and 2022b). Preferred pasture species have been recommended based on species known to occur on CVM, as well as a selection of pasture species suitable for the soil management group described in Section 6.1.4.

A seeding rate of 16kg/ha of coated pasture seed and 4kg/ha of uncoated legume seed is recommended for a cattle grazing PMLU (Table 31). All seed mixes will also include 5kg/ha of Japanese millet (*Echinochloa esculenta*) or similar as a sterile cover crop to protect topsoil from erosion. The cover crop will establish quickly on the exposed surfaces and work to provide a root system that will stabilise the surface and prevent erosion until new seedlings have established.

Species availability may vary, however at least four preferred pasture grass species and two legumes listed in Table 31 are required. The cattle grazing seed mix composition and seeding rates may be adjusted based on the results of ongoing rehabilitation monitoring.

Pasture seed mixes are recommended to be sown in the warmer months of the year from September to March, when the probability of rainfall is highest. Seeding may be undertaken at other opportune times, such as for unseasonal climatic conditions.

Table 31: Recommended species list and seeding rates for cattle grazing pasture

Scientific name	Common name	Clay topsoil	Sand/loam topsoil	Seeding rate (kg/ha)
Astrebla lappulacea, A, squarrosa, A. elymoides	Mitchell grasses (curly, bull and hoop)	✓	-	2[c] (per species)
Bothriochloa bladhii	forest blue grass	-	✓	4[c]
Bothriochloa insculpta cvv. Bisset*	Bisset creeping blue grass	✓	✓	4[c]
Chloris gayana cvv. Callide*	Callide Rhodes grass	✓	✓	4[c]
Chloris gayana cvv. Katambora*	Katambora Rhodes grass	✓	✓	4[c]
Dichanthium sericeum subsp. sericeum	Queensland blue grass	✓	-	4[c]
Digitaria brownii	cotton panic	-	✓	2[c]
Heteropogon contortus	black spear grass	✓	✓	2
Megathyrsus maximus var. *pubiglumis**	green panic	-	✓	4[c]
*Panicum coloratum var. makarikariense**	bambatsi Panic	✓	-	4[c]
*Setaria incrassata**	purple pigeon	✓	-	4[c]
*Urochloa mosambicensis**	Sabi grass	-	✓	4[c]
Grass species - Total seed weight coated (kg/ha)				**16 [c]**
*Stylosanthes seabrana**	stylo	✓	-	2
*Macroptilium bracteatum**	burgundy bean	✓	-	2
*Stylosanthes hamata**	shrubby stylo	-	✓	2
*Chamaecrista rotundifolia**	Wynn cassia	-	✓	2
Rhynchosia minima var. minima	rhynchosia	✓	✓	2

Scientific name	Common name	Clay topsoil	Sand/loam topsoil	Seeding rate (kg/ha)
Rhynchosia minima var. australis	rhynchosia	✓	✓	2
Legume species - Total seed weight uncoated (kg/ha)				**4**
Echinochloa esculenta	Japanese millet	✓	✓	5 [c]

[c] *Seeding rate for coated seed. If not coated, use half the prescribed rate; * Naturalised exotic pasture species*

6.1.8.6 Woodland habitat revegetation

Areas of woodland habitat PMLU are planned on rehabilitated landforms associated with the spoil dumps (RA1), as well as those areas disturbed by mining activities adjacent to areas of ecological value (RA4).

The approach to woodland habitat revegetation, and the woodland habitat monitoring method discussed in Section 8.2, has considered the following recent OQMRC publications:

- Evaluating methods for assessing native ecosystem mine rehabilitation success (Spain C. , Nuske, Gagen, & Purtill, 2023)
- Native ecosystem rehabilitation in Queensland Implications for leading practice (OQMRC, 2023)

The spoil dumps associated with RA1 are elevated, sloped anthropogenic landforms, comprised of spoils consisting of a mix of mudstones, claystones, siltstones and sandstones. These landforms vary from pre-mining landforms and do not align with any specific land zone under the regional ecosystem framework (Wilson & Taylor, 2012).

Woodland habitat revegetation of the spoil dumps aims to achieve a ‘hybrid’ ecosystem as defined by Spain, Nuske, Gagen and Purtill (2023). This will be achieved through revegetation with key framework tree, shrub and grass species known to occur within representative REs within and surrounding CVM, as well as species that are better adapted to the macro climatic (i.e. drought, fire, flooding rains, climate change) and micro climatic factors associated with the final spoil landform (i.e. growth media, physical and chemical variation, variation in slope, aspect, altitude).

For RA4, where the final landform is similar to the pre-mining landform, the revegetation aims to achieve woodland habitat similar to the surrounding vegetation communities.

The growth media for woodland habitat at CVM includes pre-stripped topsoil. Woodland habitat growth media will be ameliorated, if recommended by an AQP, prior to deep ripping and seeding (Section 6.1.4). The topsoil depth will be 100mm to 150mm to limit the effects of competition on woodland species due to the potential loads of exotic pasture species (i.e., buffel grass) (Emmerton et al., 2016a) and to provide the best chance of successful establishment of woody species (Emmerton et al., 2016b; Spargo and Doley, 206).

The representative REs known to occur within or surrounding CVM (Section 1.2.8.1) on hilly, rocky terrain and/or substrates with poorer soils that best align with the woodland habitat rehabilitation landforms include:

- RE 11.5.9 - *Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains and/or remnant surfaces
- RE 11.5.9b - *Eucalyptus crebra, E. tenuipes, Lysicarpus angustifolius +/- Corymbia* spp. woodland. Occurs on Cainozoic sandplains formed on plateaus and broad crests of hills and ranges.
- RE 11.5.3 - *Eucalyptus populnea +/- E. melanophloia +/- Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces
- RE 11.10.3 - *Acacia shirleyi* or *A. catenulata* open forest on coarse-grained sedimentary rocks. Crests and scarps.

The woodland habitat revegetation species are known to occur in the representative REs based on their listing in the relevant Regional Ecosystem Technical Descriptions (Queensland Herbarium, 2018).

The species selection for the woodland habitat revegetation areas has also considered ecological functional groupings according to the role or function they perform in both rehabilitation and non-mined environments (Table 32) (Emmerton, et al, 2016a) (Emmerton, et al, 2016b). Short lived wattles (*Acacia* spp.) have been excluded from the species mix as they are unlikely to provide the necessary structure and longer-term ecological function. Intermediate lifespan wattles have been limited in the seed mix. Framework tree species and shrubby understorey species are maximised to provide longer-term ecosystem resilience, structure and function. Competitive pasture species have been excluded from the seed mix and only non-aggressive grass species are recommended (Emmerton, et al, 2016b).

Table 32: Life form and functional groups assigned to species based on their structural form or ecological function

Life form and functional group	Code	Explanatory notes
Framework trees		
Eucalypt/ Bloodwood (Corymbia) species	E/C	*Eucalyptus, Corymbia*, occasionally Angophora species (of any height) which can form an upper storey and often form recognisable vegetation communities but may exist within other communities.
Non-eucalypt, non-acacia species	NE/NA	Non-eucalypt, non-wattle species (of any height) which can form recognisable communities, or which may exist in isolation and are capable of becoming part of the upper storey.
Long lived acacias	LLA	Wattle species which may form recognisable communities or exist as part of the upper storey in other communities
Woody understorey components		
Shrubby understorey	SU	A shrub is defined as: a woody plant that is multi-stemmed from the base (or within 200 mm from ground level) up to 8m in height or if single stemmed, less than 2m tall (Eyre, et al., 2015). It therefore may include species which are sometimes regarded as small to medium trees.
Groundcover shrubs	GCS	Shrubs which form a groundcover.
Vines/creepers	V/C	Vines or creepers that are perennial and have a woody component.
Intermediate lifespan acacias	ILA	Sub-dominant acacias which do not form a community in undisturbed natural ecosystems but can become dominant in rehabilitation areas.
Short lifespan wattles	SLA	Wattles prevalent as an understorey in eucalypt communities with some level of disturbance and relatively short lived (≤10 years).
Introduced woody perennials	IWP	Introduced woody species potentially becoming weeds in some circumstances.
Groundcover components		
Competitive pasture grasses	CPG	Aggressive introduced pasture grass species (considered to detract from ecosystem values).
Introduced grasses	IG	Less competitive naturalised species (less aggressive than the CPG group).

Life form and functional group	Code	Explanatory notes
Native grasses	NG	Perennial and annual native grasses. Includes grass like plants (e.g. *Cyperus, Dianella, Lomandra*).

6.1.8.7 Woodland habitat seed species and seeding rates

The recommended woodland habitat species are listed in Table 33 along with the associated life form and functional group, preferred growth media and recommended seeding rates.

The woodland habitat revegetation plan includes 6 kg/ha of framework tree species, 4 kg/ha of woody understory species and 7kg/ha of grasses. Planting will also include the addition of a sterile cover crop (e.g., Japanese millet or similar) seeded at 5kg/ha to provide initial groundcover.

Seed availability may vary; however, seed mixes should ensure that at least six species from each of the main revegetation groups listed in Table 33, including framework tree species, woody understorey species and grasses, are sown at the overall recommended rate to achieve the required species richness.

For RA4, rehabilitation should aim to achieve woodland habitat similar to the surrounding vegetation communities. The revegetation seed mix for RA4 is to be recommended by an AQP based on the location of the rehabilitation in relation to the surrounding vegetation community and should consider the species and the rates listed in Table 33.

Revegetation species and rates for woodland habitat may be adjusted by an AQP, to ensure continuous improvement of the rehabilitation outcomes, based on the results of ongoing monitoring (Section 8).

The preferred seeding timing for woodland habitat is either April/May or September/early October when there is sufficient soil moisture in the profile. Sowing in cooler months offers longer periods of surface moisture resulting from rain events, as well as reduced grass competition. Seeding may be undertaken at other opportune times, such as for unseasonal climatic conditions.

Table 33: Recommended species list and seeding rates for woodland habitat

Species name	Common name	Life form and functional group code	Clay topsoil	Sand/ loam topsoil	Seed rates (kg/ha - uncoated weight)
Acacia rhodoxylon	rosewood	LLA	-	✓	0.3 - 1
Acacia shirleyi	lancewood	LLA	-	✓	0.3 - 1
Allocasuarina littoralis	black she oak	NE/NA	-	✓	0.3 - 0.5
Allocasuarina luehmannii	bull oak	NE/NA	-	✓	0.3 - 0.5
Alphitonia excelsa	red ash	NE/NA	✓	✓	0.3 - 0.5
Angophora leiocarpa	smooth barked apple	E/C	-	✓	0.3 - 0.5
Atalaya hemiglauca	whitewood	NE/NA	✓	✓	0.3 - 0.5
Callitris glaucophylla	cypress pine	NE/NA	✓	✓	0.3 - 0.5
*Corymbia citriodora subsp. citriodora**	lemon scented gum	E/C	✓	✓	0.3 - 1

Species name	Common name	Life form and functional group code	Clay topsoil	Sand/ loam topsoil	Seed rates (kg/ha - uncoated weight)
Corymbia clarksoniana	Clarkson's bloodwood	E/C	✓	✓	0.3 - 1
Corymbia dallachiana	Dallachy's gum	E/C	✓	✓	0.3 - 0.5
Corymbia erythrophloia	red bloodwood	E/C	✓	✓	0.3 - 0.5
Eucalyptus crebra	narrow leafed ironbark	E/C	✓	✓	1 - 2
Eucalyptus decorticans	gum-top ironbark	E/C	-	✓	0.3 - 0.5
Eucalyptus exserta	Queensland peppermint	E/C	-	✓	0.3 - 0.5
Eucalyptus melanophloia	silver leafed ironbark	E/C	✓	✓	0.3 - 1
Eucalyptus populnea	poplar box	E/C	✓	✓	0.3 - 0.5
Lysiphyllum carronii	red bauhinia	NE/NA	✓	✓	0.3 - 0.5
Framework tree species - Total seed weight uncoated (kg/ha)					**6.0**
Acacia conferta	crowded-leaf wattle	SU	-	✓	0.3 – 0.5
Acacia excelsa	ironwood wattle	ILA	✓	✓	0.3 - 0.5
Acacia sericophylla	desert oak	ILA	-	✓	0.3 – 0.5
Alstonia constricta	bitterbark	SU/NE/NA	✓	✓	0.3 – 0.5
Breynia oblongifolia	coffee bush	SU	✓	✓	0.3 – 0.5
Capparis lasiantha, C. canescens, C. loranthifolia.	wait-a-while	V/C	✓	✓	0.3 – 0.5
Carissa ovata	currant bush	GCS	✓	✓	0.3 – 0.5
*Cassia brewsteri**	Leichhardt bean	SU	✓	✓	0.3 – 0.5
*Dodonaea viscosa**	sticky hop bush	SU	✓	✓	0.3 – 0.5
Eremophila mitchelli	false sandlewood	SU	✓	✓	0.3 – 0.5
Erythroxylon australe	cocaine tree	SU	✓	✓	0.3 – 0.5
Geijera parvifolia	wilga	SU/NE/NA	✓	✓	0.3 – 0.5
Grevillea striata	beefwood	SU/NE/NA	-	✓	0.3 – 0.5
Grewia latifolia	dogs balls	SU	✓	✓	0.3 – 0.5
Hakea lorea	bootlace oak	SU/NE/NA	✓	✓	0.3 – 0.5

Species name	Common name	Life form and functional group code	Clay topsoil	Sand/ loam topsoil	Seed rates (kg/ha - uncoated weight)
Jasminum didymum	native jasmine	V/C	✓	✓	0.3 – 0.5
Petalostigma pubescens	quinine	SU/NE/NA	✓	✓	0.3 – 0.5
Pittosporum angustifolium	Gumby Gumby	SU/NE/NA	✓	✓	0.3 – 0.5
Senna artemisioides	silver cassia	SU	✓	✓	0.3 – 0.5
Woody understory species - Total seed weight uncoated (kg/ha)					**4.0**
Aristida spp (i.e. A. calycina, A. latifolia, A. ramosa, A. caput-medusae, A. jerichoensis, A. personata, A. calycina)	three awned spear grass	NG	-	✓	1-2
Bothriochloa decipiens var. decipiens	pitted blue grass	NG	✓	✓	0.5 - 1
Bothriochloa ewartiana	desert bluegrass	NG	✓	✓	0.5 - 2
Chrysopogon fallax	golden beard grass	NG	✓	✓	0.5 - 1
Cymbopogon refractus	barbwire grass	NG	✓	✓	0.5 - 1
*Cynodon dactylon var. dactylon**	couch	IG	✓	✓	2
Dichanthium sericeum subsp. sericeum	Queensland bluegrass	NG	✓	✓	0.5 - 1
Panicum effusum	hairy panic	NG	✓	✓	0.5 - 1
Panicum queenslandicum	Yabila grass	NG	✓	-	0.5 - 1
Themeda triandra	kangaroo grass	NG	✓	✓	1-2
Grass species - Total seed weight uncoated (kg/ha)					**7.0**
Echinochloa esculenta	Japanese millet	Cover crop	✓	✓	5.0

**Species adapted to moderate to high salinity tolerance* (DERM, 2011)

6.1.8.8 Watercourse revegetation

Watercourse revegetation activities will be implemented to establish riparian vegetation associated with a watercourse PMLU where natural watercourses have been disturbed by mining activities for the following areas:

- Future creek diversions
- Existing creek diversions requiring additional revegetation activities

- Natural watercourses which have been disturbed by mining activities e.g., crossings

The existing creek diversions and drainage structures have been previously revegetated in accordance with the following revegetation plans:

- Caval Creek Diversion – Caval Ridge Project Revegetation Plan (Carter, Barnett, & Reid, 2011)
- Cherwell Creek Levee Design – Caval Ridge Project Revegetation Plan (Conn & Carter, 2013)
- Horse Creek (clean water diversion) Stage 1 – Caval Ridge Project Revegetation Plan (Carter & Reid, 2012)

The existing creek diversions will remain in their current alignment post-closure (Section 6.1.7) and will continue to be monitored in accordance with Section 8.3.

The revegetation zones for natural watercourses (Figure 16) are defined as follows:

- Upper bank: defines the lateral limits of both sides of the watercourse or diversion. It does not include the land adjacent. The upper bank generally extends down the riparian profile and is dominated by taller *Eucalyptus* spp., with a mixed woody and grassy understorey.
- Mid bank: occurs between the upper and lower banks and will vary in size depending on the watercourse geomorphology or diversion design. The mid bank may include benches created from high flow events. The vegetation on the mid bank comprises a mix of species including scattered *Eucalyptus* spp., as well as species that are more adapted to periodic inundation of water and can withstand some disturbance from floods (e.g., *Melaleuca* spp.).
- Lower bank (including bank toe): commences at the edge of the low flow channel or stream bed and extends up the bank to the area affected by more regular lower flows. The vegetation in the lower bank is dominated by scattered trees adapted to wetter environments (i.e., *Melaleuca* spp) and a high ground cover of grasses, reeds, sedges and rushes.

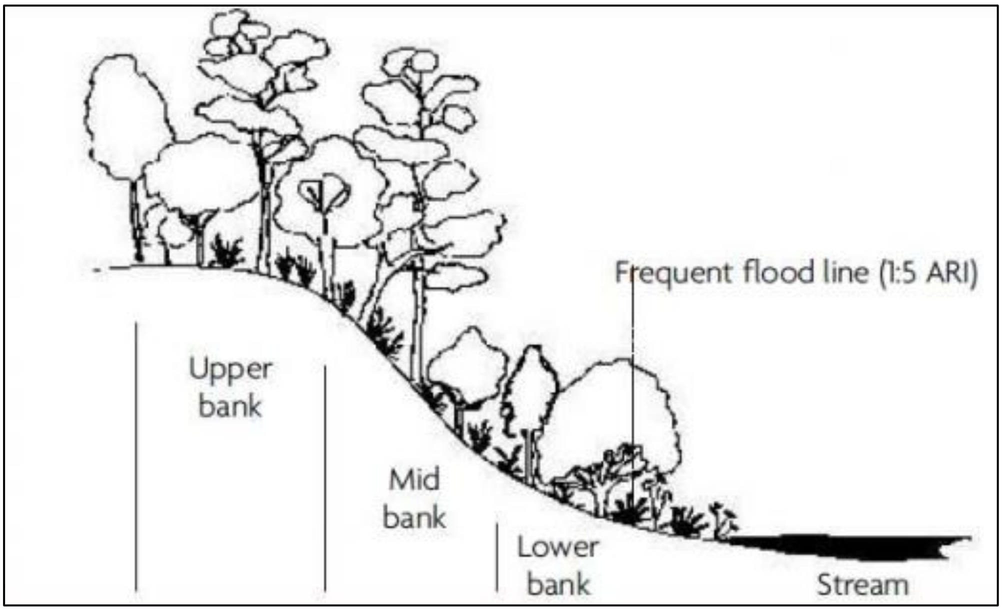

Figure 16: Typical riparian revegetation plantings zone (Vegetation Matters, 2014)

The growth media for watercourse PMLU will be pre-stripped topsoil, spread over the bank areas of the rehabilitated landforms at a depth ≥150mm, and ameliorated if recommended by an AQP (Section 6.1.4).

6.1.8.9 Watercourse revegetation species and seeding rates

The watercourse revegetation species are based on selecting framework trees, woody understorey and groundcover species associated with the regional ecosystems of the natural watercourses occurring on the CVM site, RE 11.3.1 and RE 11.3.25 (Section 1.2.8.1).

The recommended watercourse revegetation species and seeding rates are listed in Table 34 and Table 35. The planned seeding rate for upper and mid banks is 17kg/ha comprised of 6kg/ha uncoated framework tree, 4kg/ha uncoated woody understorey species and 7kg/ha uncoated grasses and other groundcover species.

The planned seeding rate for lower banks is 15kg/ha comprised of 5kg/ha uncoated framework tree and 10kg/ha uncoated ground species. The revegetation on the lower banks has been designed to establish a higher percentage of ground cover species, including grasses and rushes. Competitive pasture species have been excluded from the seed mix and only non-aggressive grass species are recommended. Short lived wattle species have also been excluded in the seed mix.

Planting in all revegetation zones will also include the addition of a sterile cover crop (e.g. Japanese millet or similar) seeded at 5kg/ha.

The preferred seeding timing for watercourse revegetation is August to October. There is low chance of frost and less likelihood of significant rainfall in this period allowing the best opportunity for vegetation to establish in a relatively non-erosive period. Seeding may be undertaken at other opportune times, such as for unseasonal climatic conditions.

Table 34: Recommended species list and seeding rates for watercourse revegetation – upper and mid banks

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
*Acacia stenophylla**	river myall	LLA	0.5 - 1
Alphitonia excelsa	red ash	NE/NA	0.5 - 1
Angophora floribunda	rough barked apple	E/C	0.5 - 1
Angophora leiocarpa	smooth barked apple	E/C	0.5 - 1
Angophora subvelutina	broadleaf apple	E/C	0.5 - 1
*Casuarina cristata**	belah	E/C	0.5 - 1
*Casuarina cunninghamiana**	river she oak	NE/NA	0.5 - 1
*Corymbia tessellaris**	Moreton Bay ash	NE/NA	0.5 - 1
Eucalyptus camaldulensis subsp. *obtusa**	river red gum	E/C	1 - 2
Eucalyptus coolabah subsp. *coolabah*	Coolabah	E/C	1 - 2
Eucalyptus melanophloia	silver leaved ironbark	E/C	0.5 - 1
Eucalyptus populnea	poplar box	E/C	0.5 - 1
Eucalyptus tereticornis subsp. *tereticornis**	Queensland blue gum	E/C	0.5 - 1
Lysiphyllum hookeri	white bauhinia	NE/NA	0.5 - 1
*Melaleuca bracteata**	black tea tree	NE/NA	0.5 - 1
Terminalia oblongata	yellowwood	NE/NA	0.5 - 1

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
Framework tree species - total seed weight uncoated (kg/ha)			**6**
Carissa ovata	current bush	GCS	0.5 - 1
Acacia excelsa	ironwood wattle	ILA	0.5 - 1
Acacia fasciculifera	scaly bark	ILA	0.5 - 1
*Cassia brewsteri**	Leichardt bean	SU	0.5 - 1
Dodonaea viscosa	sticky hop bush	SU	0.5 - 1
Eremophila mitchellii	false sandalwood	SU	0.5 - 1
Erythroxylum australe	cocaine tree	SU	0.5 - 1
Ficus coronata	creek sandpaper fig	SU	0.5 - 1
Ficus fraseri	white sandpaper fig	SU	0.5 - 1
Ficus opposita	sandpaper fig	SU	0.5 - 1
Grevillea striata	beefwood	SU	0.5 - 1
Grewia latifolia	dogs balls	SU	0.5 - 1
Hakea lorea	bootlace oak	SU	0.5 - 1
Mallotus philippensis	red kamala	SU	0.5 - 1
Petalostigma pubescens	quinine	SU	0.5 - 1
Woody understorey species - total seed weight uncoated (kg/ha)			**4**
Cymbopogon refractus	barbwire grass	NG	0.2 - 0.5
Bothriochloa bladhii	forest blue grass	NG	0.5 - 1
Capillipedium spicigerum	scented top	NG	0.2 - 0.5
*Cynodon dactylon**	couch	IG	2
Dichanthium sericeum subsp. sericeum	Queensland bluegrass	NG	0.5 - 1
Digitaria brownii	cotton panic	NG	0.5 - 1
Eulalia aurea	silky brown top	NG	0.2 - 0.5
Eustrephus latifolius	wombat vine	V/C	0.5 -1
Heteropogon contortus	bunched speargrass	NG	0.5 -1

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
Jasminum simplicifolium subsp. australiense	stiff jasmine	V/C	0.2 - 0.5
Lomandra longifolia	mat rush	NG	0.2 - 0.5
Panicum effusum	hairy panic	NG	0.2 - 0.5
Paspalidium distans	shot grass	NG	0.2 - 0.5
Rhynchosia minima	Rhynchosia	V/C	0.2 - 0.5
Themeda triandra	kangaroo grass	NG	0.5 - 1
Ground species - total seed uncoated (kg/ha)			**7**
Echinochloa esculenta	Japanese millet	Cover crop	5

** Species adapted to moderate to high salinity tolerance (DERM, 2011)*

Table 35: Recommended species list and seeding rates for watercourse revegetation – lower banks

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
*Casuarina cunninghamiana**	river she oak	NE/NA	0.5 -1
*Melaleuca bracteata**	black tea tree	NE/NA	0.5 -1
Melaleuca fluviatilis	weeping tea-tree	NE/NA	0.5 -1
*Melaleuca linariifolia**	snow in summer	NE/NA	0.5 -1
*Melaleuca leucadendra**	broad-leaved tea tree	NE/NA	0.5 -1
*Melaleuca viminalis**	red bottlebrush	NE/NA	0.5 -1
Melaleuca trichostachya	flax-leaf paperbark	NE/NA	0.5 -1
Lophostemon suaveolens	swamp box	NE/NA	0.5 -1
Framework tree species - total seed weight uncoated (kg/ha)			**5**
Cymbopogon refractus	barbwire grass	NG	0.5 -1
Dichanthium sericeum subsp. sericeum	Queensland bluegrass	NG	1 - 2
Themeda triandra	kangaroo grass	NG	0.5 -1
Bothriochloa bladhii subsp. bladhii	forest blue grass	NG	1 - 2

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
Lomandra longifolia	spiny-headed mat rush	NG	2 - 3
Eustrephus latifolius	wombat vine	V/C	0.5 - 1
*Cyperus spp. (C. gracilis, C. polystachyos)***	sedge	NG	2 - 3
*Cynodon dactylon**	couch	IG	2 - 3
Ground species - total seed weight uncoated (kg/ha)			**10**
Echinochloa esculenta	Japanese millet	Cover crop	5

** Species adapted to moderate to high salinity tolerance (DERM, 2011); ** Bank toe area only*

6.1.8.10 Reference sites

Existing reference sites for cattle grazing, woodland habitat and watercourse PMLUs are detailed in Section 8.4.

6.1.8.11 NUMA low-wall revegetation

Revegetation within the NUMA is planned on the low-walls to within 10m above the modelled maximum residual void lake elevation. The 10m elevation distance between the vegetation and void lakes provides a buffer for the vegetation from the saline void lakes. The low-walls will predominately be Permian age mudstones, claystones, siltstones and sandstones.

Due to the lack of vehicular access and the steep terrain of the NUMA low-walls, alternative methods, such as aerial seeding with drones may be utilised.

The preferred seeding timing for NUMA low-wall revegetation will be after sufficient rainfall, generally in either April/May or September/early October, or at other opportune times.

6.1.8.12 NUMA low wall seed species and seeding rates

The revegetation species for the NUMA low-walls are focussed on tree and shrub species with known tolerances for moderate salinity, sodicity and low nutrients, as well as low rainfall and/or drought conditions.

The NUMA low-wall revegetation species are listed in Table 36 along with their associated life form, ecological functional group and recommended seeding rates. The low-wall revegetation plan includes 10kg/ha of tree and shrub species with ≥50% of the mix to be comprised of *Casuarina* and *Allocasuarina* species. The remainder of the species mix is to include long lived *Acacia* species and other shrub species to support diversity and early colonisation as well as *Eucalyptus* and *Corymbia* species for longer term ecological structure and function.

Table 36: Recommended species list and seeding rates for NUMA low-wall

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
Acacia catenulata	bendee	LLA	1 - 2
Acacia rhodoxylon	rosewood	LLA	1 - 2

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
Acacia shirleyi	lancewood	LLA	1 - 2
Allocasuarina littoralis	black she oak	NE/NA	1 - 2
Allocasuarina luehmannii	bull oak	NE/NA	1 - 2
Alphitonia excelsa	red ash	NE/NA	0.2 - 0.5
Capparis lasiantha, C. canescens, C. loranthifolia.	wait-a-while	V/C	0.2 - 0.5
Carissa ovata	currant bush	GCS	0.2 - 0.5
Casuarina cristata	belah	NE/NA	2 - 3
Corymbia citriodora subsp. Citriodora	lemon scented gum	E/C	1 - 2
Corymbia dallachiana	Dallachy's gum	E/C	0.2 - 0.5
Dodonaea viscosa	sticky hop bush	SU	0.2 - 0.5
Eremophila mitchelli	false sandlewood	SU	0.2 - 0.5
Erythroxylon australe	cocaine tree	SU	0.2 - 0.5
Eucalyptus cambageana	Dawson’s gum	E/C	0.2 - 0.5
Eucalyptus crebra	narrow leafed ironbark	E/C	0.2 - 0.5
Eucalyptus exserta	Queensland peppermint	E/C	0.2 - 0.5
Eucalyptus populnea	poplar box	E/C	0.2 - 0.5
Grevillea striata	beefwood	SU	0.2 - 0.5
Grewia latifolia	dogs balls	SU	0.2 - 0.5
Petalostigma pubescens	quinine	SU	0.2 - 0.5
Senna artemisioides	Silver Cassia	SU	0.2 - 0.5
Tree and shrub species - total seed weight uncoated (kg/ha)			**10**

**Incorporate in seed mix when seeding area is close to the void lake*

Relationship with PRCP schedule
The revegetation approach for the PMLUs focuses on selection and establishment of suitable species based on the growth media and rehabilitated landforms. Woodland habitat and watercourse rehabilitation considers the inclusion of framework tree species, woody understorey and grass species from regional ecosystems occurring within or surrounding CVM on similar landforms and substrates. The recommended species will best support achievement of the cattle grazing, woodland habitat and watercourse PMLUs and the NUMA low wall revegetation objectives.

The information in this section is relevant to the following highlighted RAs and RMs in the PRCP schedule														
RA1				RA2				RA3			RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The information in this section is relevant to the following highlighted IAs and MMs in the PRCP schedule		
IA1		
MM1	MM2	MM3

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
RM7	• Completed seeding in accordance with recommended cattle grazing species mixes and seeding rates in Table 31
RM8	• Completed seeding in accordance with recommended woodland habitat species mix and seeding rates in Table 33 • Completed seeding in accordance with woodland habitat seed mix as recommended by an AQP (RA4)
RM9	• Completed seeding in accordance with recommended watercourse species mix and seeding rates in Table 34 and Table 35
RM10	• Groundcover >50%
RM11	• Groundcover: - >15% slopes ≥80% - ≤15% slopes ≥50%
RM12	• Groundcover: - >15% slopes ≥80% - ≤15% slopes ≥50%
RM13	• Groundcover >50% • Land suitability class ≤3, or not different from pre-mining class if ≥4, or not different from reference sites if ≥4. Where assessment of rehabilitation is in accordance with Short (2023)
RM14	• Groundcover:

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
	- >15% slopes ≥80% - ≤15% slopes ≥50% • Species richness: trees ≥2; shrubs ≥3; grasses ≥4 • Tree canopy cover ≥16% • Evidence of recruitment from at least one upper storey tree species, excluding Acacia salicina (Sally wattle), regenerating as a seedling or sucker (<5 cm Diameter at Breast Height)
RM15	• Riparian vegetation index score: greater than or equal to upstream or downstream values (IDC method)
The following Milestone Criteria will contribute to achievement of sufficient improvement:	
MM3	• NUMA low-walls down to 10m above the modelled maximum residual void lake elevation: total vegetation cover ≥30%

6.2 Tailings storage facilities

PRCP Guideline (Section 3.6.2)

The tailings require characterisation to determine the geochemistry, rheology and geotechnical parameters that influence the rehabilitation or management strategies and the capacity of the site to support revegetation.

The design for a TSF must include relevant elements:

- *lining of TSF (i.e. embankments and base of structure)*
- *leak detection systems*
- *cellular design of TSF*
- *seepage collection systems*
- *design storage allowance*
- *spillway location*
- *designing TSF for progressive rehabilitation.*

Not applicable, as there are no TSFs at CVM.

6.3 Voids

PRCP Guideline (Section 3.6.3)

The information requirements of this domain are dependent on the nature of the proposed PMLU or NUMA for the void. For mine sites with voids, the rehabilitation planning part must include a void closure plan, which includes options for minimising final void area and volume; final void dimensions; pit wall geotechnical and geochemical stability, final slope angles, void hydrology, groundwater modelling, water balance and predicted long-term water quality.

A geotechnical report should focus on how the void will achieve post-closure slopes that will exhibit stability characteristics consistent with the planning and design of the post-closure mine void.

If floodwaters are likely to move over backfilled material, an assessment of the hydraulic properties must be conducted to assess whether instability may occur.

The rehabilitation and management strategies in the plan must include the supervision, verification and auditing of engineering works carried out to achieve the post-closure void landform, to ensure construction is consistent with the geotechnical design.

The rehabilitation and management strategy must also include confirmation that the post-closure landform demonstrates the level of stability as specified by the design.

A void closure plan has been compiled to support the development of this PRCP. The detailed plan – *Caval Ridge Mine Void Closure Plan September 2023* (WSP, 2023) is provided in Appendix L.

As per the EA, a residual void is "*an open pit resulting from the removal of ore and/or waste rock that will remain following the cessation of all mining activities and completion of rehabilitation processes"*. Therefore, for this PRCP, a residual void is considered to be the remaining mined out pit below ground level after backfill.

For CVM, there are two residual voids in the final closure landform:

1. Horse Pit
2. Heyford Pit

These residual voids are pre-approved as NUMAs (Section 3). The NUMA extents achieve an area that is safe and structurally stable and include additional set-backs from the void low-wall, high-wall and end-wall crests if required to achieve wall geotechnical stability (FoS=1.5), and a safety bund and fence.

6.3.1 Geotechnical stability

The void closure plan (Appendix L) includes a geotechnical stability analysis of the proposed residual void high-walls, end-walls and low-walls. The analysis determined the FoS of the walls and the set-back distances, for long-term pit wall stability for the high-walls, end-walls and low-walls, to meet the minimum FoS of 1.5.

Additional set-back distance from the void wall crests are included within the NUMA extent to ensure stability and that no assets (BMA, third-party, or of significant environmental value) are within this boundary at closure.

The low-wall analysis results are shown in Table 37. The as-dumped design of the residual void low-walls meets the minimum FoS for all residual voids and therefore no additional set-back distance from the low-wall crest is required.

Table 37: Summary of CVM residual void low-wall stability analysis

Pit	Low-wall spoil height (m)*	Low-wall floor dip (°)	Minimum FoS		Additional set-back required at NUMA boundary (m)
			Overall slope (global stability)	Slope outside NUMA (local stability)	
Horse Pit (north)	259	5	2.1	2.3	0
Horse Pit (central)	298	10	2.1	2.3	0
Horse Pit (south)	280	9	1.8	2.4	0
Heyford Pit	396	7	1.6	2.2	0

*Spoil height is the full low-wall from toe of low-wall to the spoil dump crest (includes NUMA and RA1 low-wall area)

The high-wall and end-wall analysis results are shown in Table 38.

The as-mined design of the Heyford residual void high-wall and end-walls has a FoS=1.47 and therefore an additional set-back distance from the high-wall crest has been included in the final closure landform design for Heyford Pit to ensure the minimum FoS of 1.5 is achieved. The total distance from the high-wall toe to the NUMA extent for Heyford Pit is 273m.

Table 38: Summary of CVM residual void high-wall stability analysis

Pit	Depth of Tertiary / Weathered (m)	Depth of Fresh Permian (m)	FoS at wall crest	Distance from toe of wall to achieve FoS=1.5 (m)
Horse Pit	22	129	1.79	215
Heyford Pit	22	184	1.47	273

6.3.2 Void hydrology

6.3.2.1 Water balance

A dedicated void water balance model – based on the final closure landform design (Section 6.1.5), was completed for the period 2056 to 2199 (144 years) to understand water balance behaviour (including climate change considerations) within the residual voids over time (Appendix L). Key findings are summarised in Table 39.

Key findings show that after 2130 the water levels start to stabilise for all voids, with a simulated mean inflow being very similar to the mean outflow. This indicates that the mean water balance has reached an equilibrium. As the water levels remain below the groundwater levels for all residual voids (and well below the voids' spill points), the voids will not overtop; and environmental harm beyond the tenure boundary is not expected. Therefore, no management activities are required.

Table 39: Summary of CVM water balance model findings

Pit	Spill Level (m AHD)	Mean water flows (2180-2199)		Long-term mean void lake level range (m AHD)
		Inflows (ML/yr)	Outflows (ML/yr)	
Horse Pit	224	1,216	1,216	106 - 110
Heyford Pit	223	687	679	49 - 52

6.3.2.2 Groundwater modelling

The Horse and Heyford voids will act as groundwater sinks post-mining, and groundwater will continue to flow towards the residual voids. The pit lakes that form within the voids, remain below the pre-mining groundwater levels and shallow geological units due to evaporative effects on the pit lakes (Section 6.1.1), therefore, environmental harm beyond the tenure boundary is not expected.

6.3.2.3 Water quality

The void closure plan (Appendix L) includes an analysis of the void water quality (geochemical stability), and identifies the following key findings across the residual voids:

- There are no significant sources of acid generation associated with the post-mining surface water hydrology, and acidic conditions are unlikely to develop in the residual voids
- There are no significant sources of NMD or SD (oxidative) associated with the post-mining surface water hydrology
- It is unlikely that NMD and/or SD driven by sulphide oxidation will develop in the residual voids
- Evapoconcentration processes will drive water quality in the residual voids

- EC in both residual voids will continue to increase over time
- Preliminary, high-level screening base on predicted EC levels suggest that both void lakes may become stratified

As both residual voids stabilise as groundwater sinks over time, they do not present an unacceptable risk of environmental harm beyond the tenure boundary.

6.3.3 Options for minimising final void

The pits will be progressively backfilled during the operation to minimise the final void to the final operational mining strip. Multiple ramp voids are planned to also be progressively backfilled, minimising the number of ramps remaining at closure. Over 70% of the mined out pit void will be progressively backfilled by the end of mining.

Once mining is complete, the final void area and volume will be further reduced by additional backfill. Partial backfill is planned where required to prevent flood ingress (Section 6.1.2). Additional backfill will be dependent on the mining sequence of the final strips, which may change during the remaining operational period as new geological data becomes available and market factors change, and to ensure backfill does not result in an unacceptable risk of environmental harm beyond the tenure boundary. As CVM has significant mine life remaining, opportunities for further backfill of the final voids may be refined over the life of the operation and finalised as mining approaches the final strips.

6.3.4 Residual void dimensions and wall angles

Outcomes of the void geotechnical and geochemical stability analyses, void water balance modelling, site-wide hydrogeological and rehabilitation flood modelling have resulted in optimisation of the residual void dimensions towards minimising the extent and location of the NUMAs.

The residual void extents are defined by the high-wall, end-wall and low-wall crests at natural ground level. The average void dimensions and wall angles, measured from the wall toe to the wall crest at ground level, are shown in Table 40.

Table 40: Proposed residual void dimensions and overall wall angles

Void	Average depth (m)	Average length (m)	Average width	High-wall overall slope	End-wall overall slope	Low-wall overall slope
Horse Pit	150	8,700	700m (surface) 60m (floor)	40°	38°	18°
Heyford Pit	206	3,930	800m (surface) 60m (floor)	40°	40°	21°

The residual void high-wall and end-wall profiles will remain as the final excavated wall profile, with numerous mining benches of varying face angles and heights. Each mining bench is offset with a berm of varying widths, reducing the overall final walls to approximately 38 to 40°. These wall angles may vary with the final geotechnical design which will be developed as mining approaches the final pit limits, to ensure it is based on the latest material and geotechnical data.

The final low-wall profile within the NUMA area will remain as the final as-dumped profile, with dragline spoil and truck dump lifts within the NUMA area remaining at angle of repose. The truck dumps are offset from the dragline spoil by two spoil peaks and each truck dump lift is offset, reducing the overall low-wall angle to less than 21°. This wall angle may vary with the final geotechnical design which will be developed as mining approaches the final pit limits, to ensure it is based on the latest material, pit floor and geotechnical data.

The NUMA extents achieve an area that is safe and structural stability and include the additional set-backs from the void high-wall and end-wall crests to achieve a minimum FoS of 1.5 (low-walls meet the FoS without any additional set-backs), plus a safety bund (Section 6.3.1). The overall high-wall and end-wall angles from void wall toe to the NUMA extents at natural ground level are therefore lower than the angles shown in Table 40. The overall high-wall/end-wall angle to the NUMA extent is approximately 34° for Horse Pit and 37° for Heyford Pit.

6.3.5 Improvement and management strategies

The residual voids become available for improvement once mining of each pit is complete and reshaping of the spoil dump low-wall outside of the NUMA area is complete (RA1), as well as any partial backfill for flood mitigation. This is for safety reasons to eliminate the risk of any injury or damage within the NUMA area from the reshaping and rehabilitation activities. Both residual voids will be retained as NUMAs.

To support attainment of residual voids that are safe and do not present an unacceptable risk of off-tenure environmental harm, the improvement and/or management activities provided in Table 41 will be undertaken.

Table 41: Improvement and/or management strategies for the CVM residual voids

Residual void closure aspect	Closure objective			Improvement and/or management strategy
	Safety	Stability	Non-polluting	
Geotechnical stability	✓	✓	-	• As mining approaches the final limits, re-assess the void geotechnical wall designs and any required geotechnical set-backs based on the latest available data • Review and adjust the mine plan and final closure state landform, if needed, to account for any revised set-back requirements • Use a minimum FoS ≥ 1.5 as a guidance for ongoing void closure planning. (This may be refined over the mine life should industry research provide optimised guidance on observational methods and consequence assessment).
Void hydrology	-	-	✓	• Residual void catchments are minimised as far as practicable and predominantly include only the low-wall areas • At cessation of mining activities, review and update the void water balance modelling, incorporating identified changes to the final closure landform and spill point elevations, rainfall and evaporation, surface water runoff, groundwater inflows, and climate projections • Although not identified in current modelling, if future modelling identifies an unacceptable risk of environmental harm outside the tenure boundary, then management strategies will be implemented • Obtain certification from an AQP that the residual voids do not present an unacceptable risk of environmental harm outside the tenure boundary • If necessary, identify and implement mitigation measures for appropriate protections works of

Residual void closure aspect	Closure objective			Improvement and/or management strategy
	Safety	Stability	Non-polluting	
				landforms where floodwaters from watercourses interact with final closure landforms
Void hydrogeology	-	-	✓	• At cessation of mining activities, review and update the groundwater modelling, incorporating updated void WBM outputs and in-field groundwater sampling data, as required • Although not identified in current modelling, if future modelling identifies an unacceptable risk of environmental harm outside the tenure boundary, then management strategies will be implemented • Obtain certification from an AQP that, upon completion of mining, residual voids do not present an unacceptable risk of environmental harm outside the tenure boundary • Undertake groundwater and residual void lake level monitoring to confirm the voids are progressing towards acting as sinks
Void water quality	-	-	✓	• At cessation of mining activities, review and update the void geochemical assessment, including additional or refined data from in-pit surface water samples, surface- and groundwater samples, and biochemical modelling • Although not identified in current modelling, if future modelling identifies an unacceptable risk of environmental harm outside the tenure boundary, then management strategies will be identified and implemented • Obtain certification from an AQP that the residual voids will not present an unacceptable risk of environmental harm outside of the relevant tenure boundary
Void access control	✓	-	-	• On cessation of mining activities: - Construct a safety bund at the geotechnical set-back distance - Erect fencing and signage (where required) around the perimeter of the safety bund • Obtain certification from an AQP that the residual void is safe to humans and livestock
Vegetation cover	–	✓	✓	• When the NUMA becomes available for improvement activities, revegetate the NUMA low-wall down to 10m above the modelled maximum residual void lake elevation to establish vegetation cover

Relationship with PRCP schedule
Both the Horse and Heyford residual voids will be managed as NUMAs. Long-term geotechnical stability of low-walls, end-walls and high-walls is achieved within the NUMA extents. The residual voids will not overtop and will stabilise to be ongoing groundwater sinks post-mining which will not present an unacceptable risk of environmental harm outside of the tenure boundary. The geotechnical stability and safety requirements, as well as water levels and water quality will be managed by the management milestones specified in the PRCP schedule.

The information in this section is relevant to the following highlighted IAs and MMs in the PRCP schedule		
IA1		
MM1	MM2	MM3

The following Milestone Criteria will contribute to achievement of sufficient improvement:	
MM1	• The required high-wall, end-wall and low-wall set-back to achieve a FoS ≥1.5, is determined by an APQ
MM2	• Safety bund (minimum 2m height and 4m base width) is constructed, where required, at the geotechnical set-back distance • Fencing erected around perimeter of safety bund, where required • Warning signage placed along the fence line (nominally one sign every 100m)
MM3	• NUMA low-walls down to 10m above the modelled maximum residual void lake elevation; total vegetation cover ≥30% • Certification from an APQ that the residual void is safe to humans and livestock • Certification from an APQ that the residual void will not present an unacceptable risk of environmental harm outside of the tenure boundary

6.4 Underground mining

> ***PRCP Guideline (Section 3.6.4)***
>
> *For underground mining operations, the rehabilitation planning part must include:*
>
> - *a geotechnical study*
> - *an assessment of groundwater interactions and potential lowering of groundwater levels*
> - *the development of a hydrogeological conceptual model*
> - *subsidence analysis and modelling and a subsidence vegetation/habitat impact assessment*
> - *consideration of how potential entries to underground workings will be sealed (i.e. through some form of capping or back filling)*
> - *how surface ponding and cracking will be mitigated*
> - *identification of post-closure stabilisation of underground workings in order to manage the potential for unplanned surface subsidence and unplanned ground collapse such as sinkholes and pot holing.*

Not applicable, as there is no underground mining at CVM.

6.5 Built infrastructure

> ***PRCP Guideline (Section 3.6.5)***
>
> *The administering authority's expectation of rehabilitation relating to built infrastructure is that it will be decommissioned, demolished, salvaged and/or disposed of unless it is being formally retained by the landholder to achieve an appropriate PMLU.*
>
> *The rehabilitation planning part must include:*
>
> - *Identification of infrastructure that will be decommissioned and the methods for decommissioning.*
> - *A description of infrastructure that will remain post-rehabilitation and the identification of ongoing maintenance requirements.*
> - *Evidence of agreement for any infrastructure that will have ownership transferred.*

In accordance with the CVM EA condition E16: "*All infrastructure, constructed by or for the EA holder during the mining activities including water storage structures, must be removed from the site prior to surrender, except where agreed in writing by the post-mining landowner/landholder*." However, the EA further notes that "this is not applicable where the landowner/landholder is also the environmental authority holder", which is the case for the majority of CVM (Section 1.2.12).

Table 42 details the infrastructure associated with the mining activities at CVM. BMA owned surface infrastructure, not beneficial to the PMLU, will be decommissioned and removed in accordance with the EA conditions. Surface infrastructure that may be retained to support the PMLUs will have a demonstrable benefit and may include selected: fencing; access tracks; services related infrastructure; sheds and buildings; hardstand areas/transport logistics areas; and water related infrastructure.

Infrastructure not constructed for the purpose of mining, such as dams used for grazing, gates, cattle grates, stock handling/watering areas, access tracks, fire breaks etc., will not be removed as part of rehabilitation works.

Priority will be to repurpose, salvage or recycle any infrastructure to be removed. Demolition and disposal within the mining voids or spoil dumps will only be undertaken when repurpose, salvage or recycle alternatives are deemed by BMA not to be viable. This approach is in line with the waste and resource management hierarchy outlined in the Queensland Waste Management and Resource Recovery Strategy created under the *Queensland Waste Reduction and Recycling Act 2011*.

Table 42: Infrastructure associated with the approved CVM mining activities

Category		Infrastructure
Built infrastructure	Steel, concrete and brick infrastructure	• CHPP • Conveyors and transfer stations • Stackers and reclaimers • Surge bins and hoppers • Tunnels • Various buildings e.g., administration, crib rooms, warehouse, laboratory, storage, sheds • Workshops • Fuel, oil, chemical and water storage • Fuel and wash bays • Fences
	Rail and train load-out related infrastructure	• Train load-out • Conveyors

Category		Infrastructure
	Supporting services	• Pipes and pumps • Power lines • Switchyard and substations • Communication and lighting towers • Concrete pads and bitumen • Culverts
Water infrastructure		• Mine water dams • Raw water dams • Sediment dams • Drains

The timing of the decommissioning and removal of the infrastructure is based on the proposed timing of the CVM operation, processing of the final coal and rehabilitation activities.

Any public infrastructure associated with the Peak Downs Highway, Moranbah Airport, Moranbah Access Road, and power, water and communications supply to landowners or townships, or not owned by BMA, is not included in this PRCP.

Further detail on the rehabilitation stages after decommissioning of the infrastructure, such as landform reshape, surface preparation, revegetation and monitoring are covered in the relevant sections of this PRCP.

6.5.1 Built infrastructure

Decommissioning of the built infrastructure with no beneficial use to the PMLU will follow the resource management hierarchy and will include:

- Disconnecting services
- Removing surface built and service infrastructure through salvage or recycling activities, or demolishing and burying in the mining voids or spoil dumps
- Removing below-ground built and service infrastructure to a depth of 0.5m below the surface and recycling, or burying in the mine void or spoil dumps, or covering to a minimum depth of 0.5m to enable establishment of the PMLUs
- Removing concrete to a depth of 0.5m below the surface and recycling, or burying in the mine void or spoil dumps, or covering to a minimum depth of 0.5m to enable establishment of the PMLUs
- Removing bitumen and recycling, or burying in the mining voids or spoil dumps
- Disposing of demolition-related putrescible and hazardous wastes at an appropriately licenced facility

6.5.2 Water infrastructure

Decommissioning of the water-related infrastructure constructed for the mining activities with no beneficial use to the PMLU will include:

- Removing any remaining water in accordance with the EA condition F23: *"Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this environmental authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder or a third party (with consent of the third party)"* or pumped into residual voids
- Disposing of mine dam sediment according to the results of an assessment by an AQP
- Removing any mine dam liners

- Breaching mine dam walls and reshaping of the area to make it free-draining
- Removing culverts and drains constructed for mining activities and operations

6.5.3 Contaminated land investigation

In accordance with the EA conditions, contaminants must not be released in a manner that constitutes environmental harm, and spillage of any wastes, contaminants or other materials must be cleaned up as quickly as practicable, stored in accordance with relevant standards and handled in a way that prevents environmental harm.

At completion of mining operations and prior to landform reshaping, surface preparation and revegetation, a contaminated land investigation will be undertaken in accordance with the National Environment Protection (Assessment of Site Contamination) Measure. The contaminated land investigation will assess the site for the presence of contamination with the potential to adversely impact the nominated PMLUs and/or environmental values. Should land contamination be identified, the potential risks will be assessed and, where required, remediation will be undertaken and/or a Site Management Plan developed to allow the ML area to be safely utilised for the nominated PMLUs (Section 3).

Relationship with PRCP schedule
Surface infrastructure not beneficial to the PMLU will be decommissioned and removed. Below ground infrastructure will be removed if required to a depth of 0.5m or covered to enable establishment of the PMLU. A contaminated land investigation will be undertaken at the completion of operations and prior to final landform development and shaping. Remediation and/or management of any identified contamination that has the potential to present unacceptable risks to the nominated PMLU or environmental values, will be undertaken.

The information in this section is relevant to the following highlighted RAs and RMs in the PRCP schedule														
RA1				RA2				RA3			RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
RM1	• Services with no beneficial PMLU re-use disconnected • Built and service surface infrastructure with no beneficial PMLU re-use removed • No below-ground built or service infrastructure within 0.5m of the final landform surface • No concrete or bitumen within 0.5m of the final landform surface • Demolition waste removed from the final landform surface • Assessment of mine water dams is completed by an AQP and sediment and identified water management actions are completed • Mine water dams are decommissioned • Watercourse crossings and culverts removed
RM2	• Contaminated Land Investigation Document completed in accordance with the Environmental Protection Act 1994, including: - Site Suitability Statement confirming the suitability of the property for the PMLUs - Audit Certification

The following Milestone Criteria will contribute to achievement of PMLU to a stable condition:	
	• Contaminated Land Investigation Document including a Site Investigation Report and, where required, a Validation Report and/or a draft Site Management Plan
RM3	• Landforms requiring reshaping are reshaped to be free-draining with maximum 12% slopes (RA3) or maximum 15% slopes (RA4)

6.6 Summary of key rehabilitation and management practices

The key rehabilitation activities and associated rehabilitation milestones are shown in Table 43, and the key management/improvement activities and associated management milestones are shown in Table 44.

Table 43: Key rehabilitation activities and rehabilitation milestones for CVM

Rehabilitation area	Relevant activities	Rehabilitation activities	Commencement of rehabilitation timing	Rehabilitation milestones
RA1	• Spoil dumps	• Reshape the landform with maximum 30% slopes • Slopes >20% to be covered in 0.5m of rock • Spread topsoil to a thickness of 100mm to 150mm • Assess growth media characteristics to determine ameliorant and other treatment requirements • Apply ameliorants and other treatments (if required) • Deep rip along contour • Seed as per recommended seed mix and rates • Undertake monitoring and maintenance to demonstrate achievement of a woodland habitat PMLU	• Progressive rehabilitation has commenced • Progressive rehabilitation of spoil dump areas as soon as practicable • Rehabilitation of spoil dump low-wall area will commence once mining in each pit is complete	• RM3 • RM5 • RM8 • RM11 • RM14
RA2	• Creek diversions • Watercourse crossings	• Remove watercourse crossings and culverts • Reshape the disturbed areas within natural watercourse bed and banks to a profile similar to the pre-disturbance condition • Spread topsoil a minimum thickness of 150mm • Assess growth media material characteristics to determine ameliorant and other treatment requirements • Apply ameliorants and other treatments (if required) • Rip along contour as required • Seed as per recommended seed mix and rates • Undertake monitoring and maintenance to demonstrate achievement of a watercourse PMLU	• Dependent on the location in relation to mining and closure activities, areas are available either at the end of mining or at the end of the major rehabilitation activities, including low-wall reshape	• RM1 • RM3 • RM6 • RM9 • RM12 • RM15

Rehabilitation area	Relevant activities	Rehabilitation activities	Commencement of rehabilitation timing	Rehabilitation milestones
RA3	• CHPP and associated infrastructure • Administration, crib and general buildings • Workshop, fuel, oil and chemical storage • Coal stockpiles • Mine dams • Roads • TLO and rail infrastructure • Laydown areas • General infrastructure and disturbance	• Disconnect services • Remove BMA owned surface built and service infrastructure where there is no beneficial use to the PMLU • Remove below ground built and service infrastructure within 0.5m of the surface or cover to a minimum depth of 0.5m where there is no beneficial use to the PMLU • Remove concrete and bitumen within 0.5m of the surface or cover to a minimum depth of 0.5m where there is no beneficial use to the PMLU • Remove demolition waste • Assess mine dam water and sediment and dispose appropriately • Undertake assessment for contaminated land and, where appropriate, remediate impacted areas, and/or implement management controls and/or develop a SMP • Reshape the landform to be free-draining with maximum 12% slopes • Spread topsoil a minimum thickness of 150mm • Assess growth media characteristics to determine ameliorant and other treatment requirements • Apply ameliorants and other treatments (if required) • Rip along contour • Seed with recommended seed mix and rates	• Dependent on the use and location in relation to mining and closure activities: stockpiles, coal processing infrastructure, rail infrastructure and laydown areas are available at the end of mining and coal processing; with all other infrastructure, such as administration, crib rooms, workshops, available at the end of the major rehabilitation activities, including low-wall reshape	• RM1 • RM2 • RM3 • RM4 • RM7 • RM10 • RM13

Rehabilitation area	Relevant activities	Rehabilitation activities	Commencement of rehabilitation timing	Rehabilitation milestones
		• Undertake monitoring and maintenance to demonstrate achievement of a cattle grazing PMLU		
RA4	• Roads • Laydown areas • Conveyors • Exploration • General infrastructure and disturbance	Where required, dependent on the extent of the disturbance: • Disconnect services • Remove surface built and service infrastructure • Remove below ground built and service infrastructure within 0.5m of the surface or cover to a minimum depth of 0.5m • Remove concrete and bitumen within 0.5m of the surface or cover to a minimum depth of 0.5m • Remove demolition waste • Reshape the landform to be free-draining with maximum 15% slopes • Spread topsoil to a thickness of 100mm to 150mm (only in topsoil stripped areas) • Assess growth media characteristics to determine ameliorant and other treatment requirements • Apply ameliorants and other treatments • Rip along contour • Seed with recommended seed mix and rate • Undertake monitoring and maintenance to demonstrate achievement of a woodland habitat PMLU	• Exploration rehabilitation is commenced within six months after exploration activities are complete (as per Eligibility criteria and standard conditions for exploration and mineral development projects) • The remaining areas are dependent on the use and location in relation to mining and closure activities: the majority is available at the end of mining; with the remaining available at the end of the major rehabilitation activities, including low-wall reshape	• RM1 • RM3 • RM5 • RM8 • RM11 • RM14

Table 44: Key management/improvement activities and management milestones for CVM

Improvement area	Relevant activities	Management/improvement activities	Improvement timing	Management milestones
IA1	• Residual voids	• Re-assess geotechnical wall designs and set-backs, as required • Review and update groundwater and void-related modelling, as required • Construct safety bunds at FoS ≥ 1.5, where required to restrict access • Erect fencing and signage around the perimeter of the bund • Revegetation of the NUMA low-walls down to 10m above the modelled maximum residual void lake elevation • Undertake monitoring to demonstrate achievement of sufficient improvement	• Available for improvement once the PMLU low-wall spoil reshaping is complete for each residual void and any partial backfill for flood mitigation is complete	• MM1 • MM2 • MM3

7 RISK ASSESSMENT

Legislative Requirement

In accordance with section 126C(1)(f) of the EP Act, the rehabilitation planning part of the PRC Plan must identify the risks of a stable condition for land described as a post-mining land use not being achieved, and how the applicant intends to manage or minimise the risks.

PRCP Guideline (Section 3.7)

As per section 126C(1)(j) of the EP Act, the administering authority considers it necessary for the proposed PRC Plan to contain a risk assessment of all proposed NUMAs. The risk assessment must be carried out to identify the risks of the NUMA causing environmental harm and not being safe and structurally stable and detail how the applicant intends to manage and minimise the identified risks.

The AS ISO 31000:2018 Risk Management – Guidelines (Standards Australia, 2018) describes risk assessment as the overall process of risk identification, risk analysis, risk evaluation and risk treatment. Each of these aspects must be included in the risk assessment in the rehabilitation planning part.

Information requirements in this section apply to all applicants whether or not they are an existing EA holder. Existing holders may have the required information available from previously submitted plans/reports/applications that, if still valid, can be used in the PRC Plan.

7.1 Identifying, assessing and treating risks

7.1.1 Risk methodology

A risk-based approach to the CVM PRCP has been undertaken in term of the method described in Figure 17.

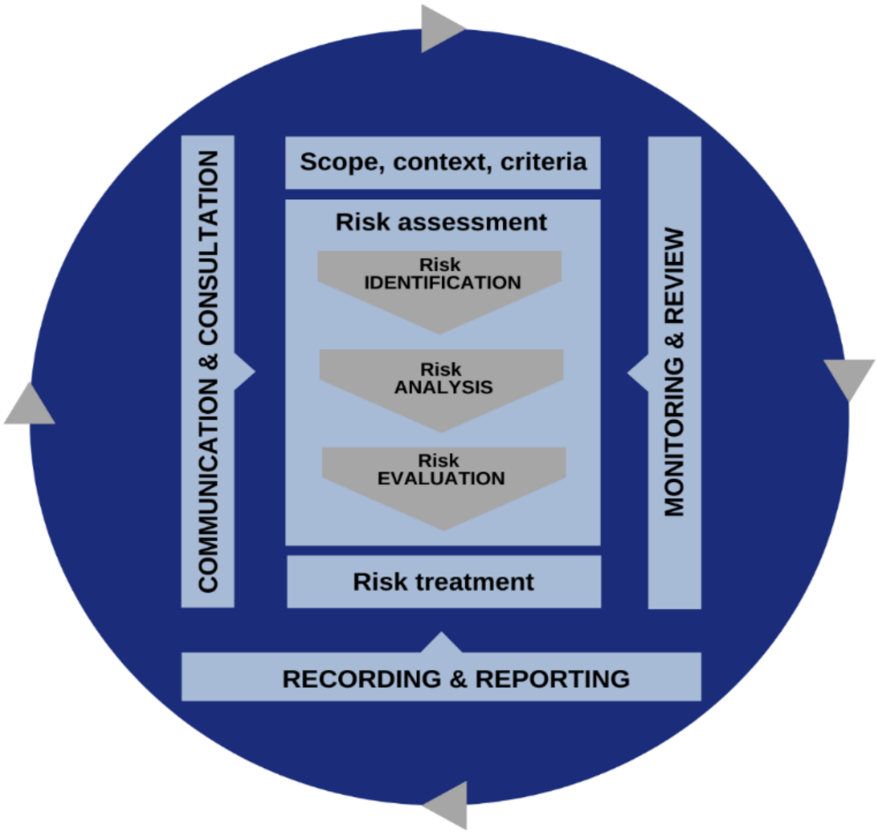

Figure 17: ISO 31000-compliant risk-based approach followed for the CVM PRCP

7.1.2 Risk identification

The risk event - a stable condition for land described as a PMLU not being achieved - was assessed per ISO 31000 methodology described in Figure 17 above, where stable condition is defined as per section 111A of the EP Act:

- The land is safe and structurally stable, and
- There is no environmental harm being caused by anything on or in the land, and
- The land can sustain a PMLU

For CVM, the PMLUs being assessed are cattle grazing, woodland habitat, and watercourse (Section 3).

In addition, the risk event - NUMA does not achieve safe, structurally stable condition or causes environmental harm - was also assessed.

7.1.3 Risk analysis, evaluation and relevant treatments

The full risk assessment – *Caval Ridge Mine PRCP Risk Assessment* is included in Appendix M and provides the risk analysis, risk evaluation and risk treatments for each risk scenario.

Worst case outcomes were assessed for each scenario, preventative and mitigating controls identified and then a residual risk rating (RRR) was calculated. The BHP likelihood and severity tables, as well as the outcomes of the RRR heat map ratings matrix are provided in Table 45, Table 46 and Table 47 respectively.

Table 45: BHP risk likelihood table

Likelihood table			
Uncertainty	**Frequency**	**Likelihood factor**	**Guidance**
Highly Likely	Likely to occur within a 1-year period	3	Event is expected to occur >80% of the time during a 5-year planning cycle
Likely	Likely to occur within a 1 – 5-year period	1	Event is expected to occur 60% to 80% of the time during a 5-year planning cycle
Probable	Likely to occur within a 5 – 20-year period	0.3	Event is expected to occur 30% to 60% of the time during a 5-year planning cycle
Unlikely	Likely to occur within a 20 – 50-year period	0.1	Event is expected to occur 10% to 30% of the time during a 5-year planning cycle
Highly Unlikely	Not likely to occur within a 50-year period	0.03	Event is expected to occur <10% of the time during a 5-year planning cycle

Table 46: BHP risk severity table

Severity table		
Severity level	**Descriptor**	**Severity factor**
5	Severe impact to the environment and where recovery of ecosystem function takes 10 years or more	1000

Severity table		
Severity level	**Descriptor**	**Severity factor**
4	Serious impact to the environment, where recovery of ecosystem function takes between 3 and up to 10 years	300
3	Substantial impact to the environment, where recovery of ecosystem function takes between 1 and up to 3 years	100
2	Measurable but limited impact to the environment, where recovery of ecosystem function takes less than 1 year	30
1	Minor, temporary impact to the environment, where the ecosystem recovers with little intervention	10

Table 47: BHP RRR heat map

			Severity level	S1	S2	S3	S4	S5
			Severity factor	10	30	100	300	1000
	Likelihood	**Likelihood factor**	**Timeframe**	**Residual risk calculation (with controls in place and effective)**				
Likelihood	Highly Likely	3	Within 1 year	30	90	300	900	3000
	Likely	1	Within 1-5 years	10	30	100	300	1000
	Probable	0.3	Within 5-20 years	3	10	30	90	300
	Unlikely	0.1	Within 20-50 years	1	3	10	30	100
	Highly Unlikely	0.03	Not within 50 years	0.3	1	3	10	30

With controls in place and implemented effectively, the RRR for the identified risk scenarios of the risk event – a stable condition for land described as a PMLU not being achieved, is deemed to be low (RRR of 3).

The risk treatments for each scenario that are necessary for achieving a stable condition for the land described as the PMLUs are shown below in Table 48.

Table 48: Necessary risk treatments identified to achieve a stable condition for the PMLUs

Aspect	Risk treatment
Risk event: Stable condition for land described as a post-mining land (reference CVM EA Table E1 - cattle grazing, woodland habitat and watercourse) is not achieved	
PMLU scenario 1: Landform failure	
Reasons for selecting treatment option	• Material testing and modelling indicate these treatments achieve a stable condition for the proposed final landform

Aspect	Risk treatment
Responsibility for plan: • Approval • Implementation	• Technical Services • Site Operations
Proposed actions	• Materials characterisation • Growth media assessment by an AQP to determine ameliorant and physical treatment requirements • Landform designed for materials available onsite and what can be achieved based on their properties • PMLU selected based on what is most appropriate for landform and materials • Groundcover of vegetation and rock to provide erosion resistance • Rehabilitation monitoring and maintenance
Resource requirements	• Available material inventory • Erosion modelling • Equipment capabilities • Survey • Rehabilitation monitoring • AQP to undertake growth media assessment
Performance measures and constraints	• Comparison against design • Tracking against milestone criteria
Reporting and monitoring	• Rehabilitation monitoring
Risk timing and scheduling	• From commencement of rehabilitation activities to final achievement of PMLU
PMLU scenario 2: Alteration of hydrogeological conditions	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a stable condition for the proposed final landform
Responsibility for plan: • Approval • Implementation	• Site Operations • Environment Team
Proposed actions	• Environmental monitoring and reporting as per the EP Act (1994) and existing EA requirements. Contaminated land investigation at time of closure MAW dams to be decommissioned & desilted (including investigation for potential contamination and groundwater impacts). • Groundwater monitoring to be undertaken in accordance with EA conditions • Appropriate management, placement, and monitoring of waste (spoil, rejects) during operations

Aspect	Risk treatment
	• Landforms constructed to minimise the potential for flooding of the residual voids
Resource requirements	• Monitoring bores maintained and monitoring undertaken
Performance measures and constraints	• Operational EA condition for groundwater contaminant trigger levels
Reporting and monitoring	• Monitoring at defined frequency • Reporting under existing EA requirements
Risk timing and scheduling	• From establishment of landforms with sampling as per PRCP monitoring program
PMLU scenario 3: Alteration of surface water systems	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a stable condition for the proposed final landform
Responsibility for plan: • Approval • Implementation	• Site Operations • Environment Team
Proposed actions	• All imported hazardous materials to be stored and used in accordance with relevant standards and removed from site on completion of operations • MAW dams to be decommissioned and areas rehabilitated • Surface water monitoring to be undertaken in accordance with EA conditions • A contaminated land investigation will be undertaken at the completion of operations and remediation works undertaken as appropriate • Rehabilitation of disturbed areas will be undertaken as soon as practicable after land become available • Rehabilitation and monitoring of disturbed reaches of watercourses • Appropriate management, placement, and monitoring of waste (spoil, rejects) during operations • Landforms constructed to minimise the potential for flooding of the residual voids
Resource requirements	• Undertake surface water sampling • Sampling equipment and infrastructure to allow collection of samples during runoff events • Surface water (rainfall runoff) milestone criteria and water quality objectives (WQO)
Performance measures and constraints	• Surface water milestone criteria and WQO

Aspect	Risk treatment
Reporting and monitoring	• Monitoring when surface water flows are available • Reporting under existing EA requirements
Risk timing and scheduling	• During water runoff events
PMLU Scenario 4. Failure of creek diversions to meet closure objectives	
Reasons for selecting treatment option	• Studies and analysis performed show that these treatments will achieve a stable condition for the proposed watercourse PMLU
Responsibility for plan: • Approval • Implementation	• Site Operations • Environment Team
Proposed actions	• Removal and rehabilitation of any mine infrastructure that presents an unacceptable risk to the diversion attaining a relinquishable state (i.e. culverts and dams) • Rehabilitation of surrounding landforms • Surface water monitoring to be undertaken • Diversion monitoring to relevant IDC standard and maintenance to be undertaken
Resource requirements	• Diversion monitoring and maintenance • Collection and analysis of water samples
Performance measures and constraints	• Watercourse geomorphic index and riparian vegetation index milestone criteria • Surface water (rainfall runoff) milestone criteria and WQO
Reporting and monitoring	• Diversion monitoring • Surface water quality data
PMLU scenario 5: Contaminated land impacting on environmental receptors, rehabilitation, and attainment of PMLUs	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a stable condition for the proposed final landform
Responsibility for plan: • Approval • Implementation	• Environment Team • Site Operations
Proposed actions	• Environmental monitoring and reporting as per the EP Act (1994) and existing EA requirements. Contaminated land investigation at time of closure.
Resource requirements	• Suitably Qualified Persons (SQP) to undertake contaminated land investigations and oversee on-going monitoring requirements. • Sample collection, laboratory analyses and engineering controls.

Aspect	Risk treatment
Performance measures and constraints	• Attainment of surface water and groundwater closure criteria and a site suitability statement
Reporting and monitoring	• Contaminated land investigation report and reporting of water quality as per EA.
Risk timing and scheduling	• Contaminated land Investigation at closure and water sampling as per PRCP monitoring program
PMLU scenario 6: Flooding influences on rehabilitation and final landforms	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a stable condition for the proposed final landform
Responsibility for plan: • Approval • Implementation	• Technical Services • Site Operations
Proposed actions	• Removal of infrastructure from watercourses • Decommissioning of dams • Remediation/management of contaminated material where required • Design of landforms within flood extents that are safe and stable • Establishment of vegetation suitable for the environment and reduces erosion risks • Undertake rehabilitation landform monitoring and maintenance
Resource requirements	• Flood modelling • Rehabilitation monitoring of final landforms post flood events
Performance measures and constraints	• No flooding damage to landforms up to a 0.1% AEP event
Reporting and monitoring	• Rehabilitation monitoring
Risk timing and scheduling	• As per PRCP monitoring program
PMLU scenario 7: Rehabilitated landforms result in alteration of flood hydrology upstream and downstream	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a stable condition for the proposed final landform. Flood modelling indicated that some reduction in flows would occur downstream due to loss of catchment to NUMA voids. Upstream flows would not be altered.
Responsibility for plan: • Approval • Implementation	• Site Operations

Aspect	Risk treatment
Proposed actions	• Removal of all infrastructure, decommissioning of dams and removal of contaminated material • Establishment of landforms that are safe and stable and minimise the potential for flooding of residual voids up to a 0.1% AEP • Undertake monitoring and maintenance works where required to maintain landforms • Removal of culverts and other infrastructure from the creeks that could regulate/restrict flows
Resource requirements	• Flood modelling
Performance measures and constraints	• No damage to infrastructure or ecosystems as a result of changes to flood regime or change to flood extent
Reporting and monitoring	• Not required
Risk timing and scheduling	• Not required
PMLU scenario 8: Insufficient or inappropriate growth media and rock resources required for rehabilitation activities	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a stable condition for the proposed final landform
Responsibility for plan: • Approval • Implementation	• Environment Team • Technical Services • Site Operations
Proposed actions	• Management of topsoil and rock stockpiling • Management of rehabilitation material application • Review of the growth media and rock resource quantities periodically during operations • Growth media assessment by AQP to determine ameliorant and surface treatment requirements • Application of ameliorants surface treatments as per assessment • Rehabilitation monitoring and maintenance
Resource requirements	• Topsoil and rock inventory • Burden model • Survey • Equipment capabilities • Rehabilitation monitoring • AQP to undertake growth media assessment
Performance measures and constraints	• Tracking against milestone criteria

Aspect	Risk treatment
Reporting and monitoring	• Rehabilitation monitoring
Risk timing and scheduling	• From planning of soil stripping to final achievement of PMLU
PLMU scenario 9: Insufficient management of mineral waste	
Reasons for selecting treatment option	• Studies and analysis performed show that these treatments achieve a stable condition for the proposed final landform
Responsibility for plan: • Approval • Implementation	• Technical Services • Environment Team • Site Operations
Proposed actions	• Waste characterisation during operations • Surface and groundwater monitoring during operation • Ongoing sampling during operations • Reject material appropriately placed in spoil dumps. • In-situ geochemical monitoring of landforms • Rehabilitation monitoring and maintenance
Resource requirements	• Data from waste characterisation • Mineral waste sampling data • In-situ geochemical monitoring data • Rehabilitation monitoring
Performance measures and constraints	• Tracking against milestone criteria
Reporting and monitoring	• Waste characterisation sampling and analysis • Surface and groundwater monitoring
Risk timing and scheduling	• Throughout operations to final achievement of PMLU
PMLU scenario 10: Inadequate and/or inappropriate revegetation	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a stable condition for the proposed final landform
Responsibility for plan: • Approval • Implementation	• Environment Team • Site Operations
Proposed actions	• Growth media assessment by AQP to determine ameliorant and fertiliser requirements • Management of seed selection, provenance, and quality • Rehabilitation monitoring and maintenance

Aspect	Risk treatment
Resource requirements	• Rehabilitation monitoring • AQP to undertake growth media assessment
Performance measures and constraints	• Tracking against milestone criteria
Reporting and monitoring	• Rehabilitation monitoring
Risk timing and scheduling	• From rehabilitation seeding to final achievement of PMLU
PMLU scenario 11: Deterioration of built infrastructure conditions	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments are what is recommended to achieve a stable condition for the proposed final landform
Responsibility for plan: • Approval • Implementation	• Environment Team • Site Operations
Proposed actions	• Undertake a preliminary contaminated land assessment prior to the completion of the approved activities, conduct a detailed site investigation and develop remediation plan if required • Rehabilitation monitoring and maintenance
Resource requirements	• Rehabilitation monitoring
Performance measures and constraints	• Tracking against milestone criteria
Reporting and monitoring	• Rehabilitation monitoring
Risk timing and scheduling	• Throughout operations to final achievement of PMLU

The risk treatments for each scenario that are necessary for achieving a safe and structurally stable NUMA that does not cause environmental harm are shown below in Table 49.

Table 49: Necessary risk treatments identified to achieve a safe and structurally stable NUMA that does not cause environmental harm

Aspect	Risk treatment
Risk event: NUMA does not achieve safe, structurally stable condition or causes environmental harm	
NUMA scenario 1: High-wall, end-walls and/or low-wall does not achieve geotechnical stability	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a safe and structurally stable condition for the NUMA
Responsibility for plan: • Approval • Implementation	• Technical Services • Site Operations

Proposed actions	• Geotechnical assessment to be completed by AQP • Wall designs based on geotechnical assessment • Pit floor treatments as required to improve low-wall stability • Geotechnical monitoring during operations • Updated geotechnical assessment to be completed as mining approaches final limits and wall design and NUMA extent adjusted if required • NUMA extents designed to include the required FoS limit • Bunding, fencing and signage placed at FoS limit
Resource requirements	• Geotechnical assessment
Performance measures and constraints	• Tracking against milestone criteria
Reporting and monitoring	• Monitoring
Risk timing and scheduling	• From final mining to relinquishment
NUMA scenario 2: Bunding, fencing and/or signage not installed or ineffective	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a safe and structurally stable condition for the NUMA
Responsibility for plan: • Approval • Implementation	• Technical Services • Site Operations
Proposed actions	• Bunding, fencing and signage placed at FoS limit
Resource requirements	• Monitoring and maintenance
Performance measures and constraints	• Tracking against milestone criteria
Reporting and monitoring	• Monitoring
Risk timing and scheduling	• From final mining to relinquishment
NUMA scenario 3: Uncontrolled flooding into residual voids	
Reasons for selecting treatment option	• Studies and analysis performed show that these treatments achieve a safe and structurally stable condition for the NUMA
Responsibility for plan: • Approval • Implementation	• Technical Services • Site Operations
Proposed actions	• Flood modelling completed by an AQP • Flood mitigation (partial backfill and/or landforms) designed to correct flood event

	• Flood mitigation installed
Resource requirements	• Flood modelling
Performance measures and constraints	• Tracking against milestone criteria
Reporting and monitoring	• Document visual inspection
Risk timing and scheduling	• From final mining to relinquishment
NUMA scenario 4: Water in the void causes environmental harm outside of the mining tenure	
Reasons for selecting treatment option	• Studies and analysis performed showed that these treatments achieve a safe and structurally stable condition for the NUMA
Responsibility for plan: • Approval • Implementation	• Technical Services • Site Operations
Proposed actions	• Modelling completed by AQP • Flood mitigation designed to provide protection for a 0.1% AEP event • Groundwater quality and level monitoring
Resource requirements	• Groundwater and void lake water balance modelling • Monitoring
Performance measures and constraints	• Tracking against milestone criteria
Reporting and monitoring	• Monitoring
Risk timing and scheduling	• From final mining to relinquishment

Relationship with PRCP schedule
A risk-based approach has been adopted to develop the milestones in the PRCP schedule. This is primarily driven by a residual risk rating. Should a risk event materialise, the additional proposed actions identified in this risk section will be implemented and, where necessary, adjusted accordingly (in line with the risk treatment identified in this section).

7.2 Rehabilitation trials

PRCP Guideline (Section 3.7.1)

In accordance with section 126C(1)(j) of the EP Act, if rehabilitation trials are planned, the rehabilitation planning part must state:

- *the objective of the trial(s)*
- *the trial design including, but not limited to, the location, underlying land characteristics and potential issues*
- *the details of how the trial(s) will be carried out*
- *when the trial(s) will commence*
- *the duration of the trial(s)*
- *how the trial(s) will be assessed for success*
- *how the results of the trial(s) will be incorporated into rehabilitation strategies and the development of milestones, and*
- *where the trials have previously been carried out by the applicant.*

The information requirements in this section will apply to all applicants, whether or not they are an existing EA holder, who have planned or commenced rehabilitation trials. Existing EA holders can provide details of any rehabilitation trials that have occurred prior to the submission of the proposed PRC Plan.

No rehabilitation trials are proposed at CVM. Current rehabilitation practices will be executed in line with the PRCP rehabilitation milestone criteria for each PMLU.

8 MONITORING AND MAINTENANCE

PRCP Guideline (Section 3.8)

Under section 126C(1)(j) of the EP Act, the administering authority considers monitoring and maintenance necessary to decide if the PRC Plan is consistent with the requirements of the legislation. The rehabilitation planning part must contain a monitoring and maintenance program that identifies and describes the monitoring systems that will be carried out in order to demonstrate a milestone and milestone criteria have been achieved. The program must include, where relevant to the milestone and milestone criteria (but is not limited to):

- *schedule of monitoring, reporting and review for each milestone*
- *description of methodologies and standards, which could include field-based assessments and the application of new remote sensing, GIS and other relevant emerging technologies*
- *monitoring that enables the repeatable collection of relevant statistically valid data*
- *monitoring using appropriate quality assurance and data management processes and systems*
- *regular analysis of site data including multi-year comparison trends and bench-marking against analogue/reference sites*
- *contingency strategies if monitoring data indicates milestone criteria are not being met*
- *post-closure monitoring to ensure milestone criteria has been demonstrated*
- *intent of monitoring reports, such as provision of results and key findings*

The information requirements in this section will apply to all applicants whether or not they are an existing EA holder. However, existing holders may already have the required information available from previously submitted plans/reports/applications that, if still valid, could be used in the PRC Plan. If there has/is any monitoring or maintenance of areas already rehabilitated, details must be included in the PRC Plan.

8.1 Rehabilitation monitoring

Rehabilitation milestone monitoring will be undertaken at CVM by an AQP (as per condition A5 of the EA) to demonstrate achievement of the PMLUs of cattle grazing, woodland habitat or watercourse.

The RMs and associated milestone criteria for CVM are detailed in Section 1.4.2 and Section 10.3. A combination of monitoring, reporting and data analysis approaches will be used to demonstrate the achievement of the RMs as detailed in Table 50.

Table 50: Rehabilitation milestones with relevant reporting requirements

Milestone reference	Rehabilitation milestone	Reporting requirements
RM1	Infrastructure decommissioning and removal	• Undertake and document visual inspections
RM2	Remediation and/or management of contaminated land	• Contaminated Land Investigation Document including a site suitability statement completed by a suitably qualified person confirming the land does not present an unacceptable risk to proposed future land uses or the environment
RM3	Landform development and reshaping	• Survey/LiDAR of landform • Analyse final landform against design
RM4	Surface preparation (cattle grazing)	• Document growth media depth • Document growth media assessment • Document ameliorants and physical treatments applied
RM5	Surface preparation (woodland habitat)	• Document growth media depth • Document growth media assessment • Document ameliorants and physical treatments applied
RM6	Surface preparation (watercourse)	• Document growth media depth • Document growth media assessment • Document ameliorants and physical treatments applied
RM7	Revegetation (cattle grazing)	• Document seed mix, purity information, planting timing, seed application rates and areas
RM8	Revegetation (woodland habitat)	• Document seed mix, purity information, planting timing, seed application rates and areas
RM9	Revegetation (watercourse)	• Document seed mix, purity information, planting timing, seed application rates and areas
RM10	Achievement of surface requirements (cattle grazing)	• Undertake rehabilitation monitoring as per Sections 8.2
RM11	Achievement of surface requirements (woodland habitat)	• Undertake rehabilitation monitoring as per Sections 8.2
RM12	Achievement of surface requirements (watercourse)	• Undertake rehabilitation monitoring as per Sections 8.3
RM13	Achievement of post-mining land use to a stable condition (cattle grazing – RA3)	• Undertake rehabilitation monitoring as per Sections 8.2 and 8.5

Milestone reference	Rehabilitation milestone	Reporting requirements
RM14	Achievement of post-mining land use to a stable condition (woodland habitat – RA1 and RA4)	• Undertake rehabilitation monitoring as per Sections 8.2 and 8.5
RM15	Achievement of post-mining land use to a stable condition (watercourse – RA2)	• Undertake rehabilitation monitoring as per Sections 8.3 and 8.5

8.1.1 Remote sensing and technology

The current rehabilitation monitoring program utilises the capture and analysis of field data. Future advances in monitoring could include developments in remote sensing, technology and/or digital data capture which may be incorporated into the program wherever practical.

8.2 Cattle grazing and woodland habitat monitoring

8.2.1 Monitoring schedule

The rehabilitation monitoring program follows a phased approach as detailed in Table 51. Initial monitoring is undertaken on an annual basis for the first three-years to primarily assess vegetation establishment and achieving initial surface requirements (RM10 and RM11). This approach allows a timely assessment of the performance of rehabilitation post initial seeding and provides critical information to determine if rehabilitation is on track towards achieving surface requirements, or if maintenance is required.

Additional rehabilitation parameters are included into the monitoring program in years three, five, 10 and five-yearly thereafter, to assess and track achievement of surface requirements (RM10 and RM11) and achievement of PMLU to a stable condition (RM13 and RM14). The phased approach of the monitoring program enables regular analysis of rehabilitation monitoring data, including multi-year comparison of trends.

Monitoring of cattle grazing and woodland habitat reference sites will be undertaken for the parameters listed in Table 51 and will be implemented as per the monitoring schedule from Year 3.

Table 51: Cattle grazing and woodland habitat PMLU monitoring schedule and measured rehabilitation parameters

Rehabilitation parameter	Monitoring schedule				
	Year 1	Year 2	Year 3	Year 5	Year 10+ (5 yearly thereafter)
Cattle grazing and woodland habitat PMLUs					
Landform and erosion	✓	✓	✓	✓	✓
Soil and spoil	✓	-	✓	✓	✓
Groundcover	✓	✓	✓	✓	✓
Invasive plants	✓	✓	✓	✓	✓

Rehabilitation parameter	Monitoring schedule				
	Year 1	Year 2	Year 3	Year 5	Year 10+ (5 yearly thereafter)
Cattle grazing PMLU					
Land suitability assessment	✓	-	✓	✓	✓
Land condition	-	-	✓	✓	✓
Woodland habitat PMLU					
Species richness	✓	✓	✓	✓	✓
Tree height	-	-	✓	✓	✓
Tree canopy and shrub cover	-	-	✓	✓	✓
Recruitment	-	-	✓	✓	✓

8.2.2 Rehabilitation monitoring sites

Permanent rehabilitation monitoring sites will be established as part of the initial rehabilitation monitoring (Year 1) and will be assessed during all phases of rehabilitation monitoring. The permanent field monitoring sites should be selected using the following criteria:

- Representative of rehabilitation slope
- Accessible (vehicle access preferred)
- Low risk of site being disturbed by mining activity in the future

8.2.3 General rehabilitation monitoring parameters

8.2.3.1 Landform and erosion

Landform and erosion will be assessed as part of all monitoring phases. Prior to commencing the field monitoring work, a desktop assessment using LiDAR data and aerial imagery will be completed to assess the rehabilitated slope against the landform design (Year 1), and the ongoing monitoring of the landform and slopes.

The desktop analysis will identify potential areas of major ponding due to dump settlement, areas of deposition (where the ground level has increased over time), as well as the progression of erosion features such as developing gullies.

Field-based erosion monitoring will be conducted at the permanent monitoring sites, as well as any new areas identified in the desktop assessment. If erosion is present, an erosion monitoring transect will be established by running a 50m tape perpendicular to the slope and across the erosional activity identified by the LiDAR analysis.

There is no consensus in Australia on a quantitative or precise definition of what constitutes minor, moderate and/or severe erosion (CSIRO, 2009). For this reason, the state and severity of erosion will be assessed by an AQP during monitoring.

8.2.3.2 Soil and spoil

The parameters detailed in Table 52 will be analysed during all monitoring events for soils and spoils. Soil profile pits or cores will be located within close proximity to the permanent rehabilitation monitoring sites. Surface sampling depth refers to top 0 – 10cm; and sub-surface sampling depth refers to layers at 10 – 30cm, 30 – 60cm and 90 – 100cm (sampling down to refusal).

Table 52: Soil and spoil analysis parameters for rehabilitation monitoring

Category	Analyte	Purpose of analyte	Depth	
			Surface	Sub-surface
Acidity / alkalinity	pH	Identify anomalies that may affect plant growth and sustainability.	✓	✓
Salinity	EC	Identify leaching profile. High salinity can lead to poor vegetation germination and establishment, reduced plant growth and vigour.	✓	✓
Exchangeable cations	CEC	Major factor in soil fertility. Controls soil stability, nutrient availability and buffers soil's chemical properties.	✓	✓
	Exchangeable Sodium Percentage (ESP)	ESP is a measure of the dominance of sodium ions on the soil's cation exchange complex. Sodicity in soils can lead to slaking and dispersion which impact soil structure and stability.	✓	✓
Organic matter	Organic carbon	An indicator of soil nutrient stores and a contributor to improvements in soil structure. Increases in organic carbon is a key indicator of rehabilitation success.	✓	-
Major elements	Total Nitrogen	Indicator of soil nutrient store and is also a major plant nutrient.	✓	-
	Extractable Phosphorous (Colwell method)	Indicator of phosphorous readily available to plants.	✓	-
	Total Phosphorous	Indicator of total store of phosphorous, some of which is readily available. Key indicator of potential for long-term success or failure of rehabilitation.	✓	-

8.2.3.3 Groundcover

Groundcover will be assessed at the permanent rehabilitation monitoring sites as part of all monitoring events. Groundcover type is recorded as either live cover (with species recorded), standing dry cover, organic litter (including leaves, hay and woody debris (i.e., logs or dead timber)), rocks, or bare ground. The percentage of total groundcover (anything in contact with the soil surface) is calculated.

8.2.3.4 Invasive plants

An invasive plant is a prohibited or restricted matter under the Queensland *Biosecurity Act 2014*, and is defined as a species that has, or is likely to have an adverse impact on a biosecurity consideration because of the introduction, spread or increase in population size of the species in an area. A complete list of invasive plant species is listed in Schedule 2, Part 2 (Restricted matter – invasive biosecurity matter) of the *Biosecurity Act 2014*.

Invasive plants will be assessed at the permanent rehabilitation monitoring sites as part of all monitoring phases. The presence and percent cover of invasive plants, calculated as a percentage of the total vegetation cover, will be recorded at each site.

8.2.4 Cattle grazing specific rehabilitation parameters

8.2.4.1 Land suitability assessment

Land suitability (Section 3.1.1) is assessed at Year 1 to determine the effectiveness of ameliorants or if further treatments are required. Ongoing land suitability assessments will be undertaken at the permanent rehabilitation monitoring sites as part of all monitoring events from Year 3. The land suitability will be rated 1 to 5 as per the limitations in Table 21.

8.2.4.2 Land condition

Rehabilitation is assessed for cattle grazing land condition, as described in the *Queensland Reef Protection Regulations Farming in Reef Catchments Grazing Guide* (DES, 2022a) at the permanent rehabilitation monitoring sites from Year 3. This allows at least two seasons after seeding for pasture species to establish.

Land condition means *"the capacity of grazing land to respond to rain and produce useful forage"* (DES, 2022a). Indicators of land condition include *"the proportion of organic ground cover, density of desirable perennial pasture species (i.e. grasses that are perennial, productive and palatable (3P) for cattle), extent of erosion and presence of weeds"* (DES, 2022a).

Land condition is classified into four broad categories under the ABCD Land Condition Framework based on indicators associated with pasture and soil condition, as detailed in Figure 3 of DES (2022a) and replicated in Table 53.

Table 53: ABCD Land Condition Framework (DES, 2022a)

Land Condition	Land Condition Features
Good – A	A condition land has all of the following features: • most land types in good condition will typically have at least 50% and often above 70% ground cover at the end of the dry season • good density of perennial grasses dominated by those species considered to be 3P grasses for that land type, little bare ground (less than 30 % in most years) • few weeds and no significant infestations • good soil condition: no erosion, good surface condition
Fair – B	B condition land has at least one or more of the following features, but otherwise is similar to A condition land: • land types will typically have at least 50% ground cover and less than 70% in most years at the end of the dry season • some decline of grasses that are 3P grasses, increase in other species (less favoured grasses, weeds) and/or bare ground (more than 30% but less than 50% in most years)

Land Condition	Land Condition Features
	• some decline in soil condition, some signs of previous erosion and current susceptibility to erosion
Poor – C	C condition land has one or more of the following features, but otherwise is similar to B condition land: • land with poor or degraded condition will typically have less than 50% ground cover at the end of the dry season • general decline of grasses that are 3P grasses, large amounts of less favoured species and/or bare ground (greater than 50% in most years) • obvious signs of past erosion and/or current susceptibility to erosion is high
Degraded – D	D condition land has one or more of the following features: • generally less than 20% ground cover • general lack of any perennial grasses or forbs • severe erosion or scalding, resulting in hostile environment for plant growth • often no long-term ability to carry stock

8.2.4.3 Pasture condition

Pasture condition will be assessed at the permanent rehabilitation monitoring sites from Year 3.

The density and coverage of 3P grasses is a key indicator of pasture condition (DES, 2022a). Pasture condition monitoring will be undertaken in accordance with the Stocktake GLM method (Department of Agriculture and Fisheries, 2021). The assessment includes an estimate of the percentage dry matter (DM) yield in kg/ha comprised of 3P pasture species versus the percentage DM yield in kg/ha of annual and undesirable grasses. Based on the monitoring data, pasture condition will be rated as per the condition indicators in Table 54.

Table 54: Pasture condition assessment table

Condition rating	Condition indicators			
	Preferred pasture species		Annual grass % DM yield	Undesirable grasses and other weeds % DM yield
	% DM yield	Crown cover		
Excellent (A) - 1	> 80 %	Dense and plants healthy	< 20 %	< 20 %
Good (B) - 2	60 – 80 %	High to moderate density and some plants unhealthy	20 – 39 %	20 – 29 %
Poor (C) - 3	10 – 59 %	Moderate to low density and some plants dead	40 – 70 %	30 – 80 %
Very poor (D) - 4	< 10 %	Sparse and many plants dead	> 70 %	> 80 %

8.2.5 Woodland habitat specific rehabilitation parameters

The woodland habitat rehabilitation monitoring parameters are consistent with the Queensland Biodiversity and Ecology Information System and tertiary level assessment, as recommended for monitoring hybrid native ecosystems in the OQMRC 'Evaluating methods for assessing native ecosystem mine rehabilitation success – Technical Paper' (Spain, Nuske, & Gagen, 2023).

8.2.5.1 Species richness

All woody species are recorded for each survey plot. Species richness will be assessed at the permanent rehabilitation monitoring sites as part of all monitoring phases. Species richness is assessed for tree, shrub, grasses (native and exotic) and other ground species by recording the number of flora species at each site.

8.2.5.2 Tree canopy height

Tree canopy height and height range will be assessed at the permanent rehabilitation monitoring sites from Year 3. Tree canopy height (measured to the top of the highest leaves) refers to the median canopy height for trees in the canopy layer (Eyre, et al., 2015).

8.2.5.3 Tree canopy and shrub cover

Tree canopy and shrub cover will be assessed at the permanent rehabilitation monitoring sites from Year 3 using the line intercept method. The crown of each tree (single-stemmed woody plant greater than 2m tall) and the crown of each shrub (woody plant that is multi-stemmed from the base (or within 200mm from ground level) or if single stemmed, less than 2m tall) (Eyre, et al., 2015) is recorded and summed as a total tree canopy or shrub distance and converted to a percent cover.

8.2.5.4 Recruitment

Recruitment will be assessed at the permanent rehabilitation monitoring sites from Year 3. Recruitment of canopy species is assessed by observing the proportion of the dominant canopy species regenerating (<5cm diameter at breast height) at each monitoring site.

8.3 Watercourse monitoring

Watercourse monitoring will be conducted at CVM to assess the performance of the diversions and rehabilitated watercourses disturbed by mining activities. The purpose of the monitoring is to assess the performance of the rehabilitated watercourses in achieving watercourse surface requirements (RM12) and achievement of post-mining land use to a stable condition (RM15).

Watercourse monitoring will be undertaken in accordance with the IDC methodology which is outlined in the Monitoring and Evaluation Program for Bowen Basin River Diversions (ID&A, 2001). The IDC is a quantitative monitoring method used to measure the geomorphic and riparian condition of diversions; however, it can be utilised for both diverted and rehabilitated reaches of watercourses. For rehabilitated watercourses, a modified IDC method, with a reduced number of monitoring points within each reach, is required due to the reduced impact area.

The CVM watercourse monitoring schedule is detailed in Table 55. The monitoring schedule indicates the IDC parameters measured over time from Year 1, Year 2, Year 5 and then 5 yearly thereafter.

The IDC methodology encompasses:

- Visual inspection of the diversion/rehabilitated watercourse and upstream and downstream reaches (i.e. reference sites)
- Assessment of geomorphic index and riparian vegetation index at nominated monitoring points within the diversion/rehabilitated watercourse, upstream and downstream reaches
- Determination of reach-averaged geomorphic index and riparian vegetation index and overall IDC scores for the diversion/rehabilitated watercourse, upstream and downstream reaches

- Comparison of the geomorphic index and riparian vegetation index and overall IDC scores for the diversion/rehabilitated watercourse reaches to the relative upstream and downstream reaches

Table 55: Watercourse PMLU monitoring schedule and measured rehabilitation parameters

Monitoring parameters		Monitoring schedule			
Parameter	**Monitoring detail**	**Year 1**	**Year 2**	**Year 5**	**Year 10+ (5-yearly thereafter)**
Groundcover					
Groundcover	Groundcover (%)	✓	✓	✓	✓
Geomorphic index parameters					
Stream width	Width of high flow channel (m) Width of active channel (m) Width of low flow channel (m)	✓	✓	✓	✓
Bank condition	Presence of erosion	✓	✓	✓	✓
Piping of banks	Presence of piping on the banks	✓	✓	✓	✓
Bed condition	Presence of aggradation or degradation within the channel bed	✓	✓	✓	✓
Spoil piles	Proximity of spoil dumps in relation to the monitoring point	✓	✓	✓	✓
Recovery	Presence or absence of benches with/ without vegetation	✓	✓	✓	✓
Instream structures	Stability of each identified instream structure	✓	✓	✓	✓
Riparian index parameters					
Riparian zone	Width of riparian zone (m)	✓	✓	✓	✓
Structural intactness	Over-storey, understorey and ground cover (% density)	✓	✓	✓	✓
Regeneration	Presence or absence of regeneration on banks	-	✓	✓	✓
Longitudinal continuity	Assess the gaps in the riparian vegetation corridor along the banks	✓	✓	✓	✓

8.4 Reference Sites

8.4.1 Cattle grazing reference sites

Cattle grazing reference sites have been established at the locations shown in Figure 18. The reference sites were monitored in 2023, and will continue to be monitored in accordance with the cattle grazing monitoring requirements outlined in Section 8.2. Existing cattle grazing reference site results have been summarised in Table 56 (BMA, 2023a). Additional or alternative cattle grazing reference sites may be established in the future. Land suitability classes for the cattle grazing reference sites were assessed against the land suitability framework (Short, 2023) Cattle grazing reference sites have been established in areas previously cleared for cattle grazing.

Table 56: CVM cattle grazing reference sites

Reference Sites – Cattle Grazing		
Site ID	**CVM_REF01**	**CVM_REF04**
Images		
Mean Slope	3%	5%
Total Ground Cover	95%	100%
Preferred Pasture Species (P)	*Bothriochloa bladhii* (forest bluegrass), *Cenchrus ciliaris* (buffel grass*), *Urochloa mosambicensis* (sabi grass*), *Panicum effusum* (hairy panic), *Heteropogon contortus* (black spear grass).	*Cenchrus ciliaris* (buffel grass*).
Intermediate Pasture Species (I)	*Melinis repens* (red natal grass*)	*Bothriochloa pertusa* (Indian couch*)
Undesirable Pasture Species (U)	*Aristida calycina* (dark wiregrass).	
Dry matter yield kg/ha	3000	4000
Land Condition	B - Fair	A - Good

Reference Sites – Cattle Grazing		
Site ID	**CVM_REF01**	**CVM_REF04**
Land Suitability Class (Short, 2023)	5	4
Limiting Factors	Plant Available Water Capacity (PAWC) in ERD = 24mm Available Phosphorus (P) in 0.1m = <5	Sub-soil erosion ESP at 0.5m = 27%

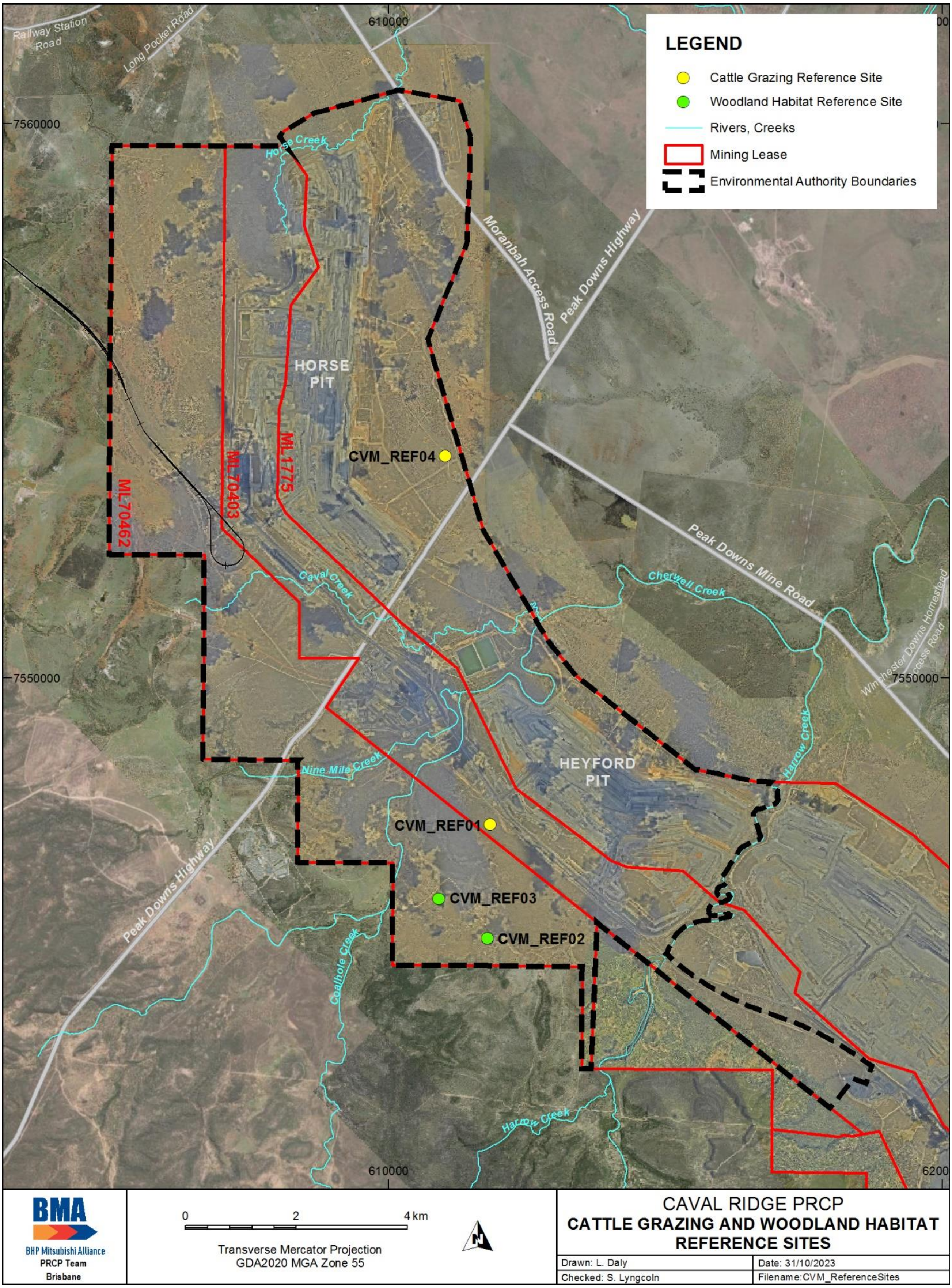

Figure 18: CVM Cattle Grazing and Woodland Habitat and Cattle Grazing Reference Sites

8.4.2 Woodland habitat reference sites

Woodland habitat reference sites have been established in areas of remnant vegetation undisturbed by mining as shown in Figure 18. The reference sites were monitored in 2023, and will continue to be monitored, in accordance with the woodland habitat monitoring requirements outlined in Section 8.2. A summary of existing woodland habitat reference site results on CVM have been provided in Table 57. Additional or alternative woodland habitat reference sites may be established in the future.

Table 57: CVM woodland habitat reference sites

Reference Sites – Woodland habitat		
Site ID	**CVM_REF02**	**CVM_REF03**
Images		
Mean Slope	4%	15%
Regional Ecosystem	11.5.9	11.10.1x
Total Groundcover	98%	100% (inc. 46% rock)
Tree Canopy Cover	47.2%	36.4%
Tree Species	*Eucalyptus crebra* (narrow leaved ironbark), *Melaleuca viridiflora* (broad leaved tea tree), *Alphitonia excelsa* (soap ash), *Corymbia clarksoniana* (long fruited bloodwood), *Eucalyptus populnea* (poplar box).	*Eucalyptus crebra* (narrow leaved ironbark), *Corymbia clarksoniana* (long fruited bloodwood), *Corymbia dallachiana* (Dallachy's gum), *Acacia bancroftiorum* (Bancroft's wattle)
Evidence of recruitment	Yes	Yes
Shrub species	*Acacia leiocalyx* (black wattle*),* *Petalostigma pubescens* (quinine bush), *Alphitonia excelsa* (soap ash), *Grevillea striata* (beefwood), *Eucalyptus crebra* (narrow leaved ironbark), *Corymbia clarksoniana* (long fruited bloodwood), *Erythroxylon australe* (cocaine tree), *Acacia excelsa* (ironwood), *Grevillea parallela, Psydrax oleifolia* (Psydrax)	*Acacia bancroftiorum* (Bancroft's wattle), *Acacia leiocalyx* (black wattle), *Erythroxylon australe* (cocaine tree), *Petalostigma pubescens* (quinine bush), *Acacia salicina* (sally wattle), *Alphitonia excelsa* (soap ash), *Croton phebalioides*

Reference Sites – Woodland habitat		
Site ID	**CVM_REF02**	**CVM_REF03**
Grasses Native	*Themeda triandra* (kangaroo grass), *Bothriochloa bladhii* (forest bluegrass), *Aristida calycina* (dark wiregrass), *Chrysopogon fallax* (golden beard grass*),* *Heteropogon contortus* (black spear grass*), Eregrostis sp.*	*Aristida calycina* (dark wiregrass), *Heteropogon contortus* (black spear grass), *Themeda triandra* (kangaroo grass).
Grasses Exotic	*Cenchrus ciliaris* (buffel grass*), *Melinis repens* (red natal grass*)	*Melinis repens* (red natal grass*)

8.4.3 Watercourse reference sites

Watercourse reference sites have been established in the existing diversions associated with Horse Creek, Caval Creek and Cherwell Creek diversions, as well as the clean water diversion located upstream of Horse Creek, as shown in Figure 19. Reference sites will be monitored in accordance with the watercourse monitoring requirements outlined in Section 8.3. Where revegetation is required, a proportional number of reference sites utilising a modified IDC method (ID&A, 2001) will be established.

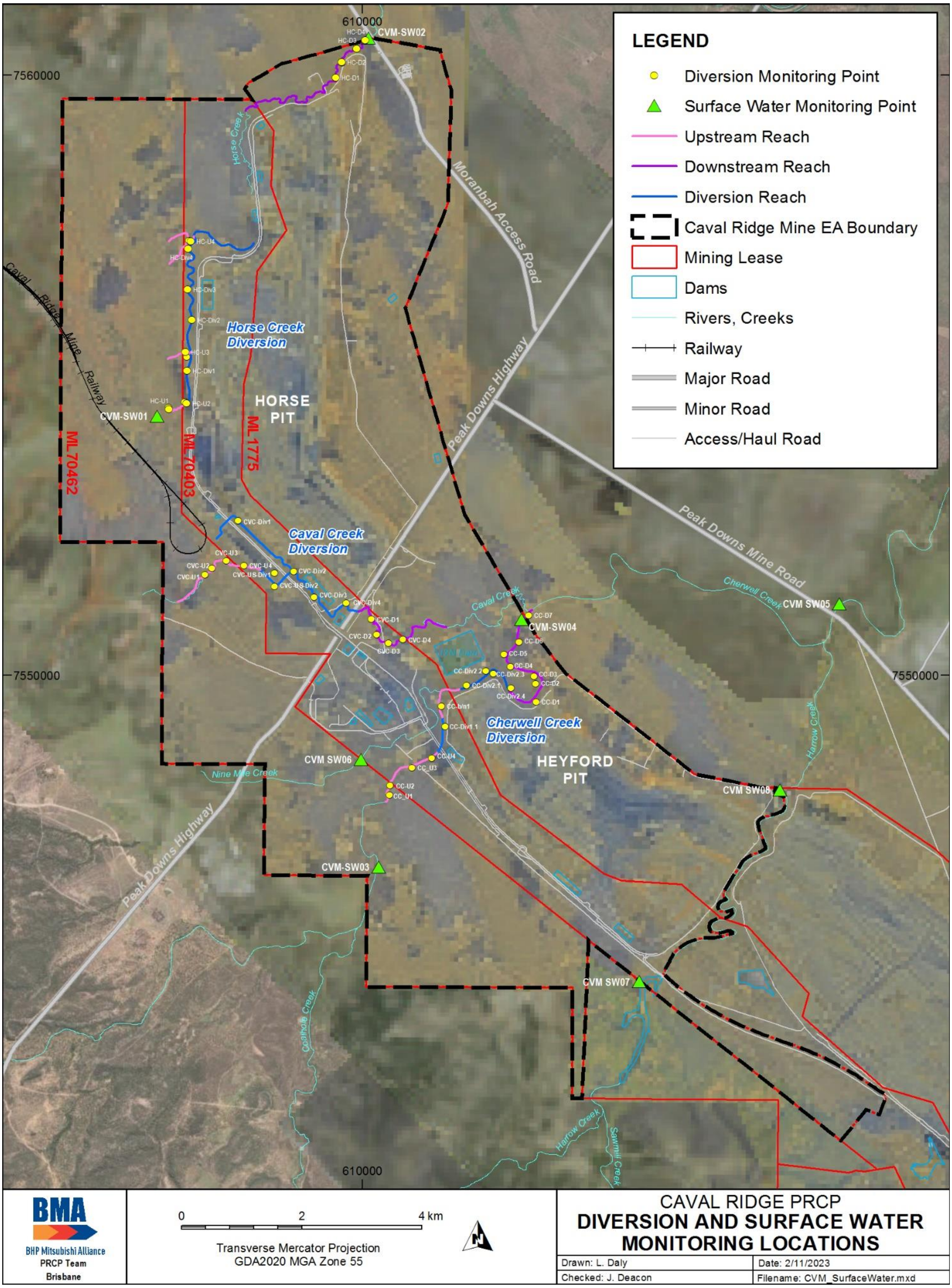

Figure 19: CVM diversion and surface water monitoring locations

8.5 Surface water monitoring

In line with the CVM EA Table E1 Rehabilitation Requirements, surface water monitoring will be undertaken for all PMLUs for pH, EC and turbidity to demonstrate achievement of PMLU to a stable condition. Appendix N provides guidance on the statistical methods and approach to be used for evaluation of the surface water results to the milestone criteria.

Water quality monitoring will be undertaken in accordance with the Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009 (DES, 2018).

8.5.1 Surface water monitoring schedule

As the creeks at CVM are ephemeral with no baseflow, the assessment of surface water quality can only be undertaken after rainfall that generates sufficient flows within the watercourses. The collection of surface water quality data with the site's ephemeral watercourses on a fixed schedule, would result in: key periods of flow not being sampled; suitable volumes of water not being present at the time of sampling; and data not being representative of discharges from the site. Therefore, in the region's semi-arid climatic conditions, which only supports temporal flows within the watercourses, an event-based sampling strategy is required.

Where rainfall events occur and generate runoff within the watercourses, a minimum of two surface water monitoring rounds per year will be undertaken for the locations listed in Table 51. For surface water rehabilitation monitoring, sufficient rainfall to generate runoff within the watercourse is at least a 5-day rainfall event of 80mm, which corresponds to a 1:1.25 AEP. This is trigger is based on a comparison of rainfall data collected at CVM and flow data at Cherwell Creek upstream gauging station (22.12635S, 148.04765E).

Additional surface water monitoring may be undertaken after lower intensity rainfall events and/or at specific rehabilitation areas where appropriate, to support the assessment of surface water runoff from rehabilitated areas.

Surface water monitoring will be undertaken and assessed against the rehabilitation acceptance criteria listed in the EA Table E1. The EA surface water acceptance criteria are transitioned to the PRCP as milestone criteria for achievement of PMLU to a stable condition (RM13, RM14 and RM15) in line with the transitional provisions applicable to this PRCP.

8.5.2 Surface water monitoring locations

Surface water sampling will be undertaken within the watercourses sample locations listed in Table 58 and shown in Figure 19, when safe to do so after suitable rainfall events. In addition to the listed watercourse sample locations, downstream surface water sampling locations may also be selected to better target individual areas of rehabilitation, while active disturbance areas remain in the wider catchment. This will enable an assessment of the individual rehabilitation areas for compliance with the milestone criteria.

Table 58: Rehabilitation surface water sample locations

Sample location identification	Approximate location (GDA_1994_MGA_Zone 55)	Description
CVM-SW01	7554316N 606587E	Clean water diversion upstream of Horse Creek and operational areas
CVM-SW02	7560616N 610107E	Horse Creek downstream at lease boundary and Moranbah Access Road.
CVM-SW03	7546805N 610276E	Cherwell Creek upstream close to lease boundary (existing monitoring point UMP1)

Sample location identification	Approximate location (GDA_1994_MGA_Zone 55)	Description
CVM-SW04	7550926N 612656E	Cherwell Creek downstream at lease boundary
CVM SW05	7551190N 617949E	Cherwell Creek downstream at Dysart- Moranbah Road (existing monitoring point MP13)
CVM SW06	7548594N 609982E	Nine Mile Creek upstream at lease boundary
CVM SW07	7544891N 614619E	Harrow Creek upstream (existing monitoring point MP3)
CVM SW08	7548089N 616957E	Harrow Creek downstream at lease boundary

The surface water monitoring locations may be amended as required to account for changes to upstream land uses/stream dynamics, or to improve the effectiveness of the monitoring program.

8.6 Groundwater monitoring

8.6.1 Groundwater quality

In line with the Guideline for Progressive certification for resource activities (DES, 2022b), deep drainage water quality will be *“addressed holistically for a site at surrender*”. The objective and acceptance criteria for groundwater is not considered relevant to progressive rehabilitation of discrete packages of rehabilitated land due to the scale and nature of groundwater aquifers. Therefore, the EA deep drainage acceptance criteria for rehabilitation will be applied only at the completion of mining operations and applied holistically for the entire CVM area. Groundwater monitoring during operations will continue as per the applicable EA conditions.

Groundwater quality monitoring will be undertaken to support the surrender of the CVM EA in accordance with EA Table E1:

- EC not significantly different to:
  - The EPP (Water and Wetland Biodiversity) schedule documents water quality objectives for relevant groundwater chemistry zones, or
  - Local water quality objectives developed in accordance with the Queensland Water Quality Guidelines

Appendix N provides guidance on the statistical methods and approach to be used for evaluation of the groundwater results applicable at surrender.

8.6.2 Groundwater levels

Monitoring of groundwater levels will focus on the relationship between the Permian groundwater level recovery and the void lake levels. Groundwater level/gradient trends over time will be assessed against the more dynamic pit lake levels to demonstrate that residual voids are progressing to a stabilised state, where they will act as on-going sinks for groundwater and thus minimising the potential for an unacceptable risk of environmental harm (MM3).

Due to the timeframes involved for the stabilisation of the void lakes and groundwater levels surrounding the mining voids, the intention of the groundwater level monitoring is to show progress towards development of long-term sinks and not to confirm the attainment of long-term sinks. Demonstrating the progress towards development of long-term sinks is to be done through assessment of trends and comparison to groundwater and void lake water balance model predictions by AQPs.

8.6.3 Groundwater monitoring schedule

During operations, groundwater monitoring will continue as per the applicable EA conditions.

Upon completion of surface preparation (RM4 to RM6) for all areas post-mining, rehabilitation groundwater monitoring will be undertaken quarterly, and will include:

- Groundwater quality monitoring, with at least one monitoring event representative of the dry season and one monitoring event representative of the wet season each year
- Groundwater level and void lake height as per groundwater quality monitoring schedule

The above will be undertaken for the first 5-years after attainment of surface preparation for all areas. Thereafter the groundwater data will be assessed to determine if there is a need to continue groundwater monitoring to demonstrate attainment of the criteria at EA surrender.

8.6.4 Groundwater monitoring locations

Groundwater monitoring will be undertaken on bores that provide a geographical distribution across CVM and coverage of the key hydrogeological units. This groundwater monitoring bore network will include selected bores existing at closure, and bores installed specifically to close data gaps and to replace bores that may have been lost due to mining disturbances or otherwise are not operational.

The groundwater monitoring bore network to be utilised for assessment at the completion of mining operations is provided in Table 59 and shown in Figure 20. For existing bore locations utilised as part of the groundwater monitoring network, details of the current bore identifications are provided in the description column in Table 59.

Table 59: CVM rehabilitation groundwater monitoring locations

Hydro-geologic unit	Sample location ID	Approximate location (GDA_1994_ MGA_Zone 55)	Description	Ground-water quality	Ground-water level
Alluvium	CVM GW01	7557468N 608169E	Horse Creek alluvium upstream extent of alluvium	✓	-
	CVM GW02	7560450N 610027E	Horse Creek alluvium at northern end of CVM at downstream lease boundary. Current monitoring bore MB20CVM01A/CVMVWP01_01	✓	-
	CVM GW03	7548264N 610442E	Cherwell Creek alluvium at upstream lease boundary. Current monitoring bore MB19CVM01A	✓	-
	CVM GW04	7549714N 611411E	Cherwell Creek alluvium at central part of CVM. Current monitoring bore location PZ08-S	✓	-
	CVM GW05	7550676N 612616E	Cherwell Creek alluvium at downstream lease boundary. Close proximity to current monitoring bore location PZ07-S and MB19CVM09A	✓	-

Hydro-geologic unit	Sample location ID	Approximate location (GDA_1994_ MGA_Zone 55)	Description	Ground-water quality	Ground-water level
	CVM GW06	7544774N 614798E	Harrow Creek alluvium at upstream lease boundary.	✓	-
	CVM GW07	7548071N 616967E	Harrow Creek alluvium at southern end of CVM at downstream lease boundary. Close proximity to former monitoring bore PZ11-S	✓	-
Basalt	CVM GW08	7559829N 608308E	Basalt at northern end of CVM. Current well location MB20CVM04T	✓	-
	CVM GW09	7551425N 611080E	Basalt central portion of CVM. Current bore location MB19CVM05T	✓	-
Permian Coal Measures	CVM GW10	7559829N 608308E	Permian coal measures at the northern end of CVM. Current monitoring bore location MB20CVM05P	✓	✓
	CVM GW11	7558680N 611376E	Permian coal measures to the east of Horse Pit	✓	✓
	CVM GW12	7549714N 611411E	Permian coal measures at the central part of CVM. Current monitoring bore location MB19CVM02P	✓	✓
	CVM GW13	7551212N 613208E	Permian coal measures east of the CVM lease. Current monitoring bore location MB20CVM03P	✓	✓
	CVM GW14	7549489N 614050E	Permian coal measures east of Heyford Pit	✓	✓
	CVM GW15	7547782N 616906E	Permian coal measures at the southern end of CVM. Current monitoring bore location PZ11-D	✓	✓

The groundwater monitoring program may be amended to include additional bores to better assess hydrogeological conditions, or to replace lost or damaged bores, as required. Bores proposed to be installed as part of the rehabilitation monitoring program will be dependent on safe access and the presence of the target hydrogeological unit (e.g., alluvium) at the selected location.

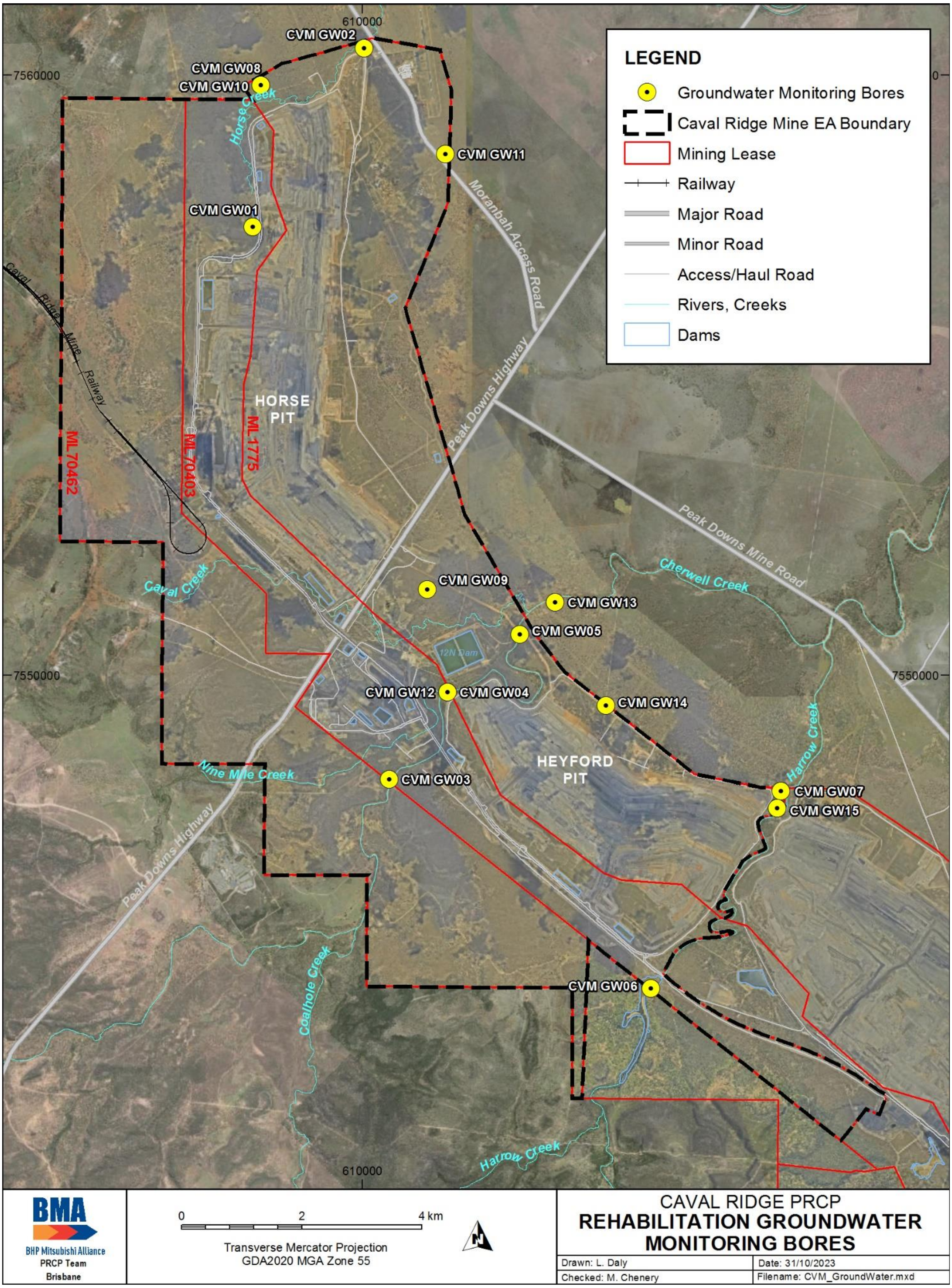

Figure 20: CVM rehabilitation groundwater monitoring bores

8.7 NUMA milestone monitoring

Management milestone monitoring will be undertaken at CVM to demonstrate achievement of the MMs, as they relate to achieving sufficient improvement of the NUMA extents. The MMs and associated milestone criteria for CVM are detailed in Section 10.4.

The following reporting requirements (Table 60) will be undertaken to demonstrate how management activities will support achievement of sufficient improvement of the NUMA extents prior to site relinquishment:

Table 60: Proposed monitoring for management of NUMAs

Management milestone	Reporting requirements	Frequency					
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 10+ (5 yearly thereafter)
MM1 Achievement of structural stability	Undertake geotechnical monitoring	✓	-	-	-	✓	✓
MM2 Achievement of surface requirements	Undertake and document visual inspections	✓	-	✓	-	✓	✓
MM3 Achievement of sufficient improvement	Undertake and document monitoring of Permian groundwater levels and void water levels*	✓	✓	✓	✓	✓	✓

*Aligned to the groundwater monitoring schedule in Section 8.6 (quarterly for 5-years followed by an assessment of additional monitoring requirements)

8.7.1 Low-wall revegetation monitoring

NUMA low-wall vegetation monitoring will likely be undertaken via remote sensing and associated aerial imagery analysis to derive the vegetation parameters. Total vegetation cover will include the combined total crown cover or projective foliage cover of the tree canopy and sub-canopy layer, shrub layer and ground layers if present, ignoring overlaps between stratum (Walker and Hopkins,1991; Neldner et al., 2022).

8.8 Achievement schedule

8.8.1 PMLUs

The timing of the rehabilitation milestones specific to achievement of surface requirements and achievement of cattle grazing, woodland habitat and watercourse PMLUs are listed in Table 61.

Achievement of surface requirements for cattle grazing (RM10) is proposed within a five-year timeframe from revegetation and a further 10-years for achievement of PMLU to a stable condition for cattle grazing (RM13). There are a number of factors which can influence the successful establishment of pastures on post-mined land including landform, soil management and amelioration, species selection, seeding rates and seeding timing, plus rainfall. This will allow for sufficient time to demonstrate the ongoing sustainability of the PMLU for cattle grazing through rehabilitation monitoring data associated with land condition and pastures.

Achievement of surface requirements for woodland habitat (RM11) and watercourse (RM12) are proposed within a five-year timeframe from revegetation. A further 15-years is allowed for initial establishment and successional processes and natural recruitment to occur, prior to achievement of the PMLUs to a stable condition (RM14 and RM15).

Table 61: Time for achievement of surface requirements and PMLUs rehabilitation milestones

Rehabilitation milestone	Rehabilitation milestone	Milestone achievement time after revegetation (in PRCP schedule)
RM10	Achievement of surface requirements (cattle grazing)	5-years
RM11	Achievement of surface requirements (woodland habitat)	5-years
RM12	Achievement of surface requirements (watercourse)	5-years
RM13	Achievement of post-mining land use to a stable condition (cattle grazing)	Up to 15-years
RM14	Achievement of post-mining land use to a stable condition (woodland habitat)	Up to 20-years
RM15	Achievement of post-mining land use to a stable condition (watercourse)	Up to 20-years

8.8.2 NUMAs

The timing of the management milestones specific to achievement of sufficient improvement (MM3) is listed in Table 62.

Table 62: Timeline for achievement of sufficient improvement for NUMA management milestones

Management milestone	Management milestone	Milestone achievement timeline (in PRCP schedule)
MM3	Achievement of sufficient improvement	Aligned with achievement of surrounding PMLUs (RM13, RM14, or RM15) to ensure maximum monitoring period

8.9 Data analysis and reporting

Rehabilitation monitoring data will be collected and analysed by an AQP and assessed against the milestone criteria. The data will be analysed to identify changes and trends, as well as map the trajectory of rehabilitation to identify whether it is on track to achieve the milestone criteria or requires corrective actions or maintenance.

The rehabilitation data will be stored and processed within internal geospatial and document management systems.

8.10 Maintenance

Maintenance will be implemented when monitoring identifies issues with the rehabilitation, or when milestone criteria are not being met. In order to select the most appropriate corrective actions, rehabilitation monitoring data will be analysed to identify the likely cause(s). Required maintenance/corrective actions will be entered into the BMA work management system for actioning and record management.

To support ongoing operations, exploration and minor ancillary activities may be required in areas not within a RA in some circumstances (Section 1.4.2). Rehabilitation of these activities will be managed as part of maintenance works and executed as soon as practicable and within at least six months of the completion of the exploration or minor disturbance. Maintenance works may include removing infrastructure, reshaping the area, re-spreading stripped topsoil, applying seed mix aligned to the PMLU, weed control or managing erosion. These rehabilitated areas will be monitored as per Section 8.

8.11 Quality assurance and quality control

The QA/QC process to be followed as part of CVM ongoing rehabilitation monitoring is illustrated in Figure 21. The process provides for initial execution of the rehabilitation in accordance with the rehabilitation plan, followed by verification of the execution against the rehabilitation plan. Based on the verification outcomes, allowance is made for implementation of corrective actions, as needed. All rehabilitated areas then undergo rehabilitation monitoring; and subsequent execution of maintenance actions identified through the monitoring (Section 8) and improvements to the rehabilitation methodology. This process allows for a repetitive execution-verification-corrective action-monitoring QA/QC approach, to ensure rehabilitation areas progress on a trajectory towards achievement of milestone criteria and eventual certification.

Figure 21: Rehabilitation monitoring quality assurance / quality control process

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B: PRCP SCHEDULE

10 PRCP SCHEDULE

Legislative Requirement

In accordance with section 126D(1) of the EP Act, the PRCP schedule in the PRC Plan must:

a) *describe the area of each resource tenure either a post-mining land use or non-use management area, and*

b) *for each post-mining land use state:*

   i. *each rehabilitation milestone required to achieve a stable condition, and*

   ii. *when each rehabilitation milestone is to be achieved, and*

c) *for each non-use management area state:*

   i. *each management milestone, and*

   ii. *when each management milestone is to be achieved, and*

d) *include maps showing the land mentioned in (a), (b) and (c).*

PRCP Guideline (Section 3.8)

Under section 126C(1)(j) of the EP Act, the administering authority considers monitoring and maintenance necessary to decide if the PRC Plan is consistent with the requirements of the legislation. The rehabilitation planning part must contain a monitoring and maintenance program that identifies and describes the monitoring systems that will be carried out in order to demonstrate a milestone and milestone criteria have been achieved. The program must include, where relevant to the milestone and milestone criteria (but is not limited to):

- *schedule of monitoring, reporting and review for each milestone*
- *description of methodologies and standards, which could include field-based assessments and the application of new remote sensing, GIS and other relevant emerging technologies*
- *monitoring that enables the repeatable collection of relevant statistically valid data*
- *monitoring using appropriate quality assurance and data management processes and systems*
- *regular analysis of site data including multi-year comparison trends and bench-marking against analogue/reference sites*
- *contingency strategies if monitoring data indicates milestone criteria are not being met*
- *post-closure monitoring to ensure milestone criteria has been demonstrated*
- *intent of monitoring reports, such as provision of results and key findings*

The information requirements in this section will apply to all applicants whether or not they are an existing EA holder. However, existing holders may already have the required information available from previously submitted plans/reports/applications that, if still valid, could be used in the PRC Plan. If there has/is any monitoring or maintenance of areas already rehabilitated, details must be included in the PRC Plan.

10.1 Final site design

The final site design in provided in Figure 22.

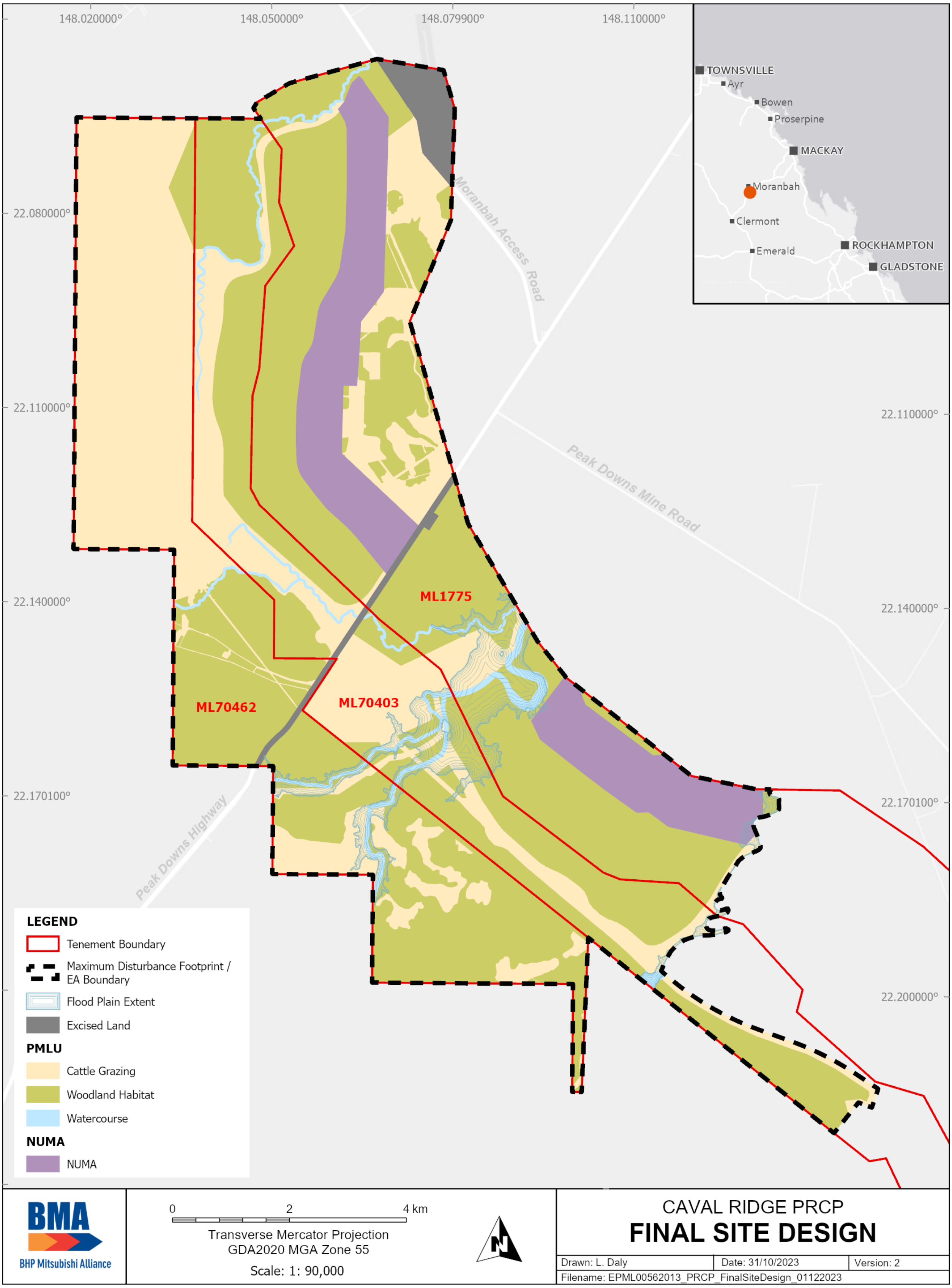

Figure 22: CVM final site design

10.2 Reference map

The reference map is provided in Figure 23.

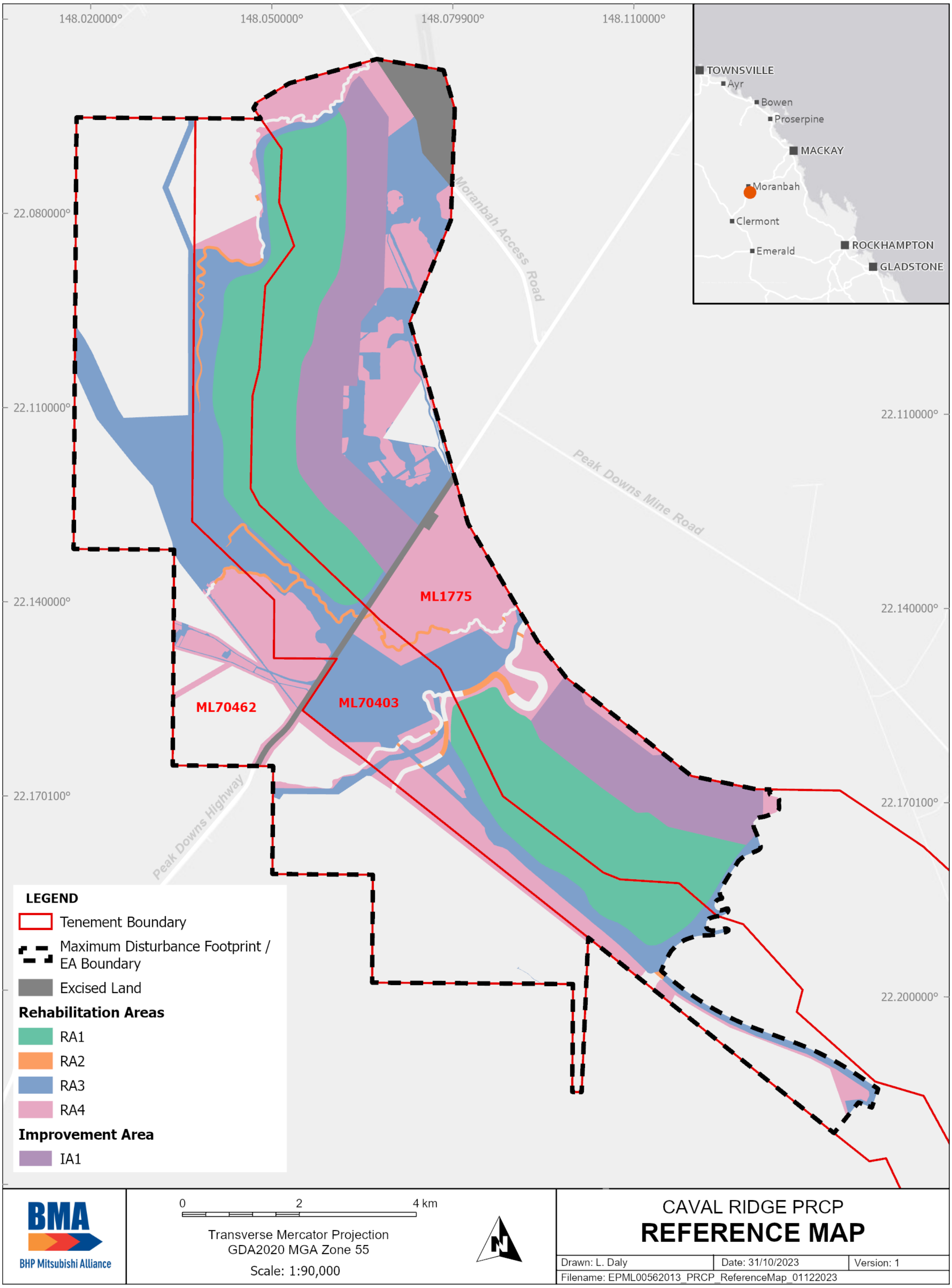

Figure 23: CVM reference map

10.3 Rehabilitation milestones

The rehabilitation milestones and milestone criteria for CVM are shown in Table 63.

Table 63: CVM rehabilitation milestones and milestone criteria

Milestone reference	Rehabilitation milestone	Milestone criteria
RM1	Infrastructure decommissioning and removal	a) Services with no beneficial PMLU re-use disconnected b) Built and service surface infrastructure with no beneficial PMLU re-use removed c) No below-ground built or service infrastructure within 0.5m of the final landform surface d) No concrete or bitumen within 0.5m of the final landform surface e) Demolition waste removed from the final landform surface f) Assessment of mine water dams is completed by an appropriately qualified person[1] and sediment and identified water management actions are completed g) Mine water dams are decommissioned h) Watercourse crossings and culverts removed *[1]**Appropriately qualified person (AQP)**: a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relating to the subject matter using the relevant protocols, standards, methods or literature*
RM2	Remediation and/or management of contaminated land	a) Contaminated Land Investigation Document completed in accordance with the *Environmental Protection Act 1994*, including: i. Site Suitability Statement confirming the suitability of the property for the PMLUs ii. Audit Certification b) Contaminated Land Investigation Document including a Site Investigation Report and, where required, a Validation Report and/or a draft Site Management Plan
RM3	Landform development and reshaping	a) Landforms reshaped with maximum 30% slopes (RA1) b) Rock placed a minimum thickness of 0.5m on >20% slopes (RA1) c) Landforms requiring reshaping are reshaped to be free-draining with maximum 12% slopes (RA3) or maximum 15% slopes (RA4) d) Disturbed natural watercourse bed and banks returned to a profile similar to the pre-disturbance condition (RA2)
RM4	Surface preparation (cattle grazing)	a) Topsoil placed at minimum depth of 150mm[2] b) Assessment of growth media characteristics is completed by an AQP[1] c) Ameliorant and physical treatments are applied as identified in RM4(b)

Milestone reference	Rehabilitation milestone	Milestone criteria
		d) Rip along contour [2] *Only applies to topsoil stripped areas*
RM5	Surface preparation (woodland habitat)	a) Topsoil placed at depth of 100mm to 150mm[2] b) Assessment of growth media characteristics is completed by an AQP[1] c) Ameliorant and physical treatments are applied as identified in RM5(b) d) Deep rip along contour
RM6	Surface preparation (watercourse)	a) Topsoil placed at minimum depth of 150mm[2] b) Assessment of growth media characteristics is completed by an AQP[1] c) Ameliorant and physical treatments are applied as identified in RM6(b) d) Rip along contour
RM7	Revegetation (cattle grazing)	a) Completed seeding in accordance with recommended species mixes and seeding rates in Table 31 of the Caval Ridge Mine PRCP, 1 December 2023, v1
RM8	Revegetation (woodland habitat)	a) Completed seeding in accordance with recommended woodland habitat species mix and seeding rates in Table 33 of the Caval Ridge Mine PRCP, 1 December 2023, v1 b) Completed seeding in accordance with woodland habitat seed mix as recommended by an AQP (RA4)
RM9	Revegetation (watercourse)	a) Completed seeding in accordance with recommended watercourse species mix and seeding rates in Table 34 and Table 35 of the Caval Ridge Mine PRCP, 1 December 2023, v1
RM10	Achievement of surface requirements (cattle grazing)	a) Groundcover[3]: >50% [3] ***Groundcover**: anything in contact with the soil surface, for example, live cover, standing dry cover, organic litter (including leaves, hay, woody debris) or rocks*
RM11	Achievement of surface requirements (woodland habitat)	a) Groundcover[3]: iii. >15% slopes ≥80% iv. ≤15% slopes ≥50%
RM12	Achievement of surface requirements (watercourse)	a) Groundcover[3]: i. >15% slopes ≥80% ii. ≤15% slopes ≥50%
RM13	Achievement of post-mining land use to a stable condition (cattle grazing)	a) Hazard assessment completed by an AQP[1] to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use b) Groundcover[3] >50%

Milestone reference	Rehabilitation milestone	Milestone criteria
		c) Rainfall runoff from rehabilitated areas is not significantly different to upstream values for the following: pH, EC and turbidity, as per Caval Ridge Mine PRCP, 1 December 2023, v1, Appendix N d) Land suitability class ≤3, or not different from pre-mining class if ≥4, or not different from reference sites if ≥4. Where assessment of rehabilitation is in accordance with Short (2023) e) Leucaena >2m high: stem density is <250 stems per hectare (1 per 40m^2) mean total area
RM14	Achievement of post-mining land use to a stable condition (woodland habitat)	a) Hazard assessment completed by an AQP[1] to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use b) Rehabilitation of RA1 is assessed as geotechnically stable by an AQP[1] with FoS≥1.5, unless an alternative is justified by an AQP[1] c) Groundcover[3]: i. >15% slopes ≥80% ii. ≤15% slopes ≥50% d) Rainfall runoff from rehabilitated areas is not significantly different to upstream values for the following: pH, EC and turbidity, as per Caval Ridge Mine PRCP, 1 December 2023, v1, Appendix N e) Species richness: trees ≥2; shrubs ≥3; grasses ≥4 f) Tree canopy cover ≥16% g) Evidence of recruitment from at least one upper storey tree species, excluding Acacia salicina (Sally wattle), regenerating as a seedling or sucker (<5 cm Diameter at Breast Height)
RM15	Achievement of post-mining land use to a stable condition (watercourse)	a) Hazard assessment completed by an AQP[1] to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use b) Rainfall runoff from rehabilitated areas is not significantly different to upstream values for the following: pH, EC and turbidity, as per Caval Ridge Mine PRCP, 1 December 2023, v1, Appendix N c) Geomorphic index score: greater than or equal to upstream or downstream values (IDC method[4]) d) Riparian vegetation index score: greater than or equal to upstream or downstream values (IDC method[4]) [4]***Rehabilitated watercourse*** *- Modified IDC method with a reduced number of monitoring points within each reach*

10.4 Management milestones

The management milestones and milestone criteria for CVM are shown in Table 64.

Table 64: CVM management milestones and milestone criteria

Milestone Reference	Management milestone	Milestone criteria
MM1	Achievement of structural stability	a) The required high-wall, end-wall and low-wall set-back to achieve a FoS ≥1.5, is determined by an AQP[1]
MM2	Achievement of surface requirements	a) Safety bund (minimum 2m height and 4m base width) is constructed, where required, at the geotechnical set-back distance b) Fencing erected around perimeter of safety bund, where required c) Warning signage placed along the fence line (nominally one sign every 100m)
MM3	Achievement of sufficient improvement	a) NUMA low-walls down to 10m above the modelled maximum residual void lake elevation: total vegetation cover ≥30% b) Certification from an AQP[1] that the residual void is safe to humans and livestock c) Certification from an AQP[1] that the residual void will not present an unacceptable risk of environmental harm outside of the tenure boundary

10.5 Schedule

The CVM PRCP schedule is provided below.

Post-mining land uses (PMLU)										
Rehabilitation area	RA1									
Relevant activities	Spoil Dumps									
Total rehabilitation area size (ha)	2036									
Commencement of first milestone: RM3	10/12/2023									
PMLU	Woodland Habitat									
Date area is available	10/12/2023	10/12/2025	10/12/2028	10/12/2030	10/12/2033	10/12/2035	10/12/2038	10/12/2040	10/12/2043	10/12/2045
(ha)	96	167	252	356	417	615	993	1393	1611	1936
Milestone completed by	10/12/2025	10/12/2028	10/12/2030	10/12/2033	10/12/2035	10/12/2038	10/12/2040	10/12/2043	10/12/2045	10/12/2048
Milestone Reference	Cumulative area achieved (ha)									
RM3	82	153	239	343	404	602	979	1380	1598	1922
RM5	96	167	252	356	417	615	993	1393	1611	1936
RM8	96	167	252	356	417	615	993	1393	1611	1936
RM11	0	0	96	167	252	356	417	615	993	1393
RM14	0	0	0	0	0	0	0	0	96	167

Date area is available	10/12/2048									
(ha)	2036									
Milestone completed by	10/12/2050	10/12/2053	10/12/2055	10/12/2058	10/12/2060	10/12/2063	10/12/2065	10/12/2068	10/12/2070	
Milestone Reference	Cumulative area achieved (ha)									
RM3	2022									
RM5	2036									
RM8	2036									
RM11	1611	1936	2036							
RM14	252	356	417	615	993	1393	1611	1936	2036	

Post-mining land uses (PMLU)										
Rehabilitation area				RA2						
Relevant activities				Creek diversions and crossings						
Total rehabilitation area size (ha)				75						
Commencement of first milestone: RM1				10/12/2040						
PMLU				Watercourse						
Date area is available	10/12/2040	10/12/2043	10/12/2048							
(ha)	17	17	75							
Milestone completed by	10/12/2043	10/12/2048	10/12/2052	10/12/2057	10/12/2063	10/12/2072				
Milestone Reference	Cumulative area achieved (ha)									
RM1	17	17	75							
RM3	17	17	75							
RM6	17	17	75							
RM9	17	17	75							
RM12	0	17	17	75						
RM15	0	0	0	0	17	75				

Post-mining land uses (PMLU)										
Rehabilitation area	RA3									
Relevant activities	Infrastructure Areas - MIA, Workshop, Dams, Coal Stockpile Areas									
Total rehabilitation area size (ha)	1840									
Commencement of first milestone: RM1	10/12/2040									
PMLU	Cattle Grazing									
Date area is available	10/12/2040	10/12/2043	10/12/2048	10/12/2051						
(ha)	467	709	709	1840						
Milestone completed by	10/12/2043	10/12/2048	10/12/2051	10/12/2054	10/12/2056	10/12/2057	10/12/2059	10/12/2060	10/12/2061	10/12/2064
Milestone Reference	**Cumulative area achieved (ha)**									
RM1	467	709	709	1840						
RM2	0	467	687	687	687	1136	1136	1136	1158	1158
RM3	0	0	467	687	687	687	687	1136	1136	1158
RM4	0	0	467	687	687	687	687	1136	1136	1158
RM7	0	0	467	687	687	687	687	1136	1136	1158
RM10	0	0	0	0	467	467	687	687	687	687
RM13	0	0	0	0	0	0	0	0	0	0

Date area is available										
(ha)										
Milestone completed by	10/12/2065	10/12/2066	10/12/2067	10/12/2069	10/12/2070	10/12/2075	10/12/2079	10/12/2085		
Milestone Reference	**Cumulative area achieved (ha)**									
RM1										
RM2	1158	1158	1840							
RM3	1158	1158	1158	1158	1840					
RM4	1158	1158	1158	1158	1840					
RM7	1158	1158	1158	1158	1840					
RM10	1136	1136	1136	1158	1158	1840				
RM13	0	467	467	687	687	1136	1158	1840		

Post-mining land uses (PMLU)											
Rehabilitation area	RA4										
Relevant activities	Surrounding mining areas										
Total rehabilitation area size (ha)	1666										
Commencement of first milestone: RM1	10/12/2040										
PMLU	Woodland Habitat										
Date area is available	10/12/2040	10/12/2042	10/12/2045	10/12/2050							
Cumulative area available (ha)	471	471	1589	1666							
Milestone completed by	10/12/2042	10/12/2045	10/12/2050	10/12/2051	10/12/2053	10/12/2054	10/12/2058	10/12/2059	10/12/2065	10/12/2073	10/12/2074
Milestone Reference	Cumulative area achieved (ha)										
RM1	471	471	1589	1666							
RM3	0	471	471	471	1589	1666					
RM5	0	471	471	471	1589	1666					
RM8	0	471	471	471	1589	1666					
RM11	0	0	471	471	471	471	1589	1666			
RM14	0	0	0	0	0	0	0	0	471	1589	1666

Post-mining land uses (PMLU)										
Rehabilitation area	IA1									
Relevant activities	Void									
Total rehabilitation area size (ha)	1091									
Commencement of first milestone: MM1	10/12/2043									
PMLU	NUMA									
Date area is available	10/12/2043	10/12/2050								
(ha)	677	1091								
Milestone completed by	10/12/2045	10/12/2052	10/12/2085							
Milestone Reference	Cumulative area achieved (ha)									
MM1	677	1091								
MM2	677	1091								
MM3	0	0	1091							

APPENDICES

Appendix A: Caval Ridge Mine Environment Authority (EPML00562013) (29 June 23)

Appendix B: DES (30 October 2020) - Progressive Rehabilitation and Closure Plan Transition Notice. Ref. EPML00562013

Appendix C: BHP (14 October 2020) - Progressive Rehabilitation and Closure Plan BMA Caval Ridge Mine - DES Pre-Notification Memo

Appendix D: DES (10 October 2022) - Approval of Extension of CVM Transitional PRCP Submission Date

Appendix E: SLR (2023) - Caval Ridge Mine Transitional PRCP Hydrogeology

Appendix F: Landloch (2023) - Caval Ridge Mine Material Characterisation Study

Appendix G: BMA (2023) - Caval Ridge Mine Community Consultation Plan and Community Consultation Register

Appendix H: SLR (2023) - Caval Ridge Mine Transitional PRCP Voids in Floodplain Assessment

Appendix I: SLR (2023) - Caval Ridge Mine PRCP Rehabilitation Flood Modelling

Appendix J: BHP (2023) – Caval Ridge Mine PRCP Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste

Appendix K: Landloch (2023) - Erosion and Landform Evolution Simulations to Support Waste Landform Design: Caval Ridge Mine

Appendix L: WSP (2023) - Caval Ridge Mine Void Closure Plan

Appendix M: BHP (2023) - Caval Ridge Mine PRCP Risk Assessment Matrix

Appendix N: Approach to Evaluating Water Milestone Criteria

Appendix N Approach to Evaluating Water Milestone Criteria

For the purpose of the PRCP schedule, the application of the nominated water milestone criteria will follow the decision tree framework approach outlined in Section 3.3 of the ANZECC/ARMCANZ 2000 Water Quality Guidelines, as shown below in Figure 24.

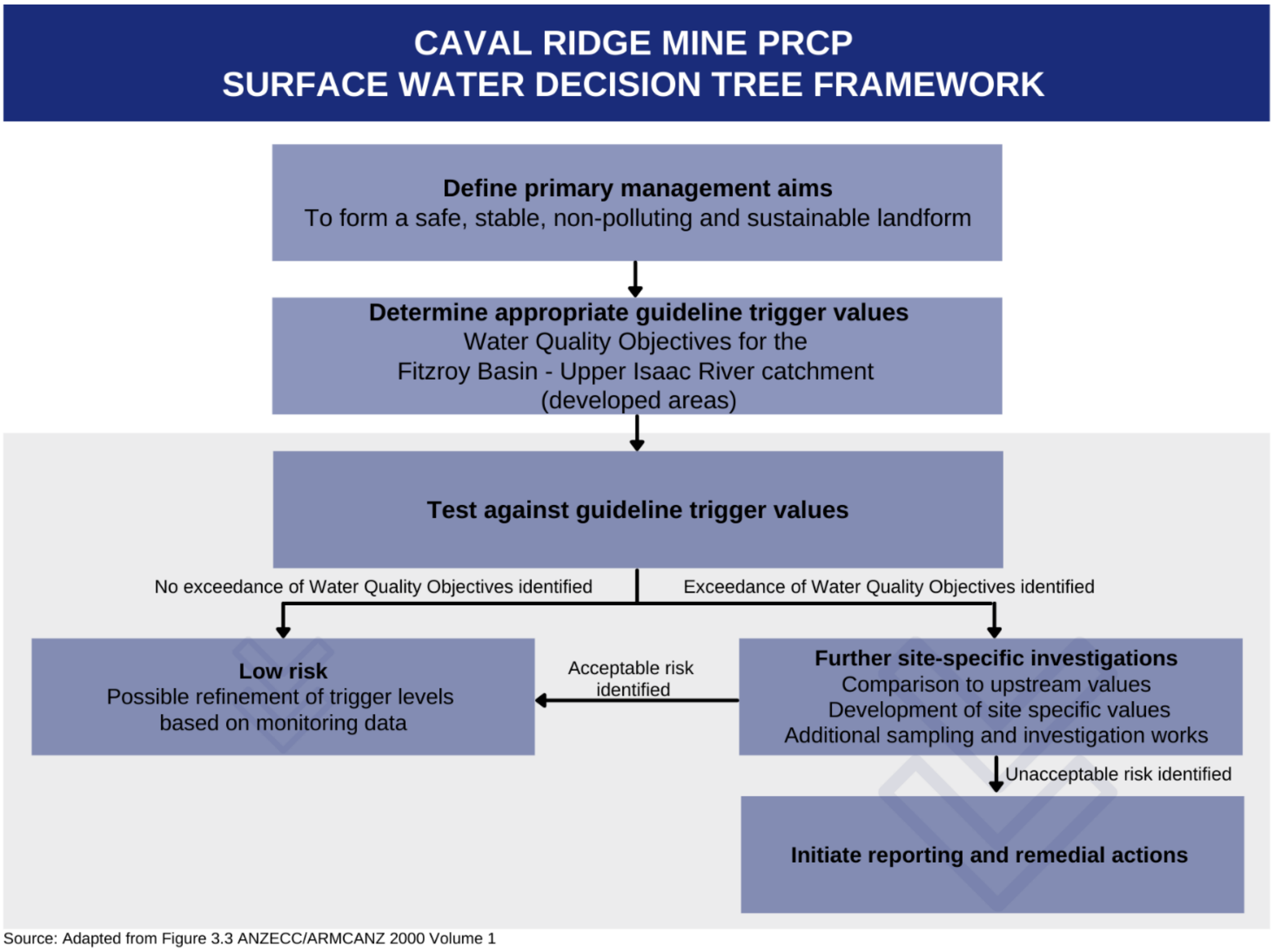

Figure 24: Water decision tree framework (Adapted from ANZECC/ARMCANZ, 2000)

To evaluate compliance with the water quality related milestone criteria and to assist with the application of SMART principles (specific, measurable, achievable, reasonable/relevant, time-specific), the following three step water data evaluation process will be undertaken.

Data Evaluation Step 1

This step will compare receiving environment/down gradient water monitoring results against the EPP WQO for the following:

- For surface water, the for the Fitzroy Basin, Isaac River Sub-Basin, Upper Isaac River Catchment; and
- For groundwater, the Fitzroy Basin, Isaac Groundwater Zone.

Sampling of surface waters will need to be undertaken on a rainfall event basis as outlined in Section 8.5. Should climatic conditions over extended periods prevent the collection of surface water samples due to insufficient flows at the nominated receiving environment sample locations, the site will not be in breach of the milestone criteria, as no significant surface water discharges would have occurred.

Surface water quality variability within the temporal waters is anticipated due to factors outside of the control of BMA, such as: weather patterns; upstream land user activities; frequency/magnitude of surface water flows;

and condition of groundcover up gradient and within the catchment. Therefore, further evaluation of collected surface water data may be required in the form of Step 2 outlined below.

Groundwater monitoring is to be undertaken at the frequency and methodologies outlined within Section 8.5 of the PRCP for the EA rehabilitation acceptance criteria of EC. Where groundwater monitoring results indicate an exceedance of the WQO, further evaluation of the collected data may be required in the form of Step 2 outlined below.

Data Evaluation Step 2

This step will compare the independent populations of the receiving and background/up gradient environments. The evaluation will be undertaken through statistical evaluation to determine if the mean results of the independent populations are significantly different. For the purpose of determining significantly different, the following statistical approach shall apply:

- Independent Populations: up gradient mean and down gradient mean (over a maximum monitoring period of five years, sample locations shown in Figure 23).
- Null Hypothesis: up gradient mean = down gradient mean.
- Alternative Hypothesis: up gradient mean ≠ down gradient mean.
- Significance level: 0.2

The statistical method to be utilised will account for the sample population size and the distribution of the data.

Where Data Evaluation Step 2 identifies a potentially significant difference between the up gradient mean and down gradient mean results, further evaluation may be deemed required in the form of Step 3 outlined below.

Data Evaluation Step 3

In accordance with the ANZECC/ARMCANZ water decision tree framework and the preferential approach to the derivation of site-specific toxicant guideline values, Step 3 includes additional investigation and development of site-specific criteria where a statistical significant difference between up gradient mean and down gradient environment sample locations is identified.

The development of surface water site-specific criteria will be undertaken using the Commonwealth of Australia guidance: Assessing and managing water quality in temporary waters. The development of groundwater site-specific criteria will be undertaken using the latest version of the Queensland Water Quality Guidelines.

The aim of Step 3 is to take into consideration the specific environment in which the site is located including a more thorough investigation of the receptors and potential risks associated with any identified exceedance. This step will require suitable data sets and to be undertaken by appropriately qualified persons.

Figure 25 provides a flow diagram of the approach to surface water data evaluation.

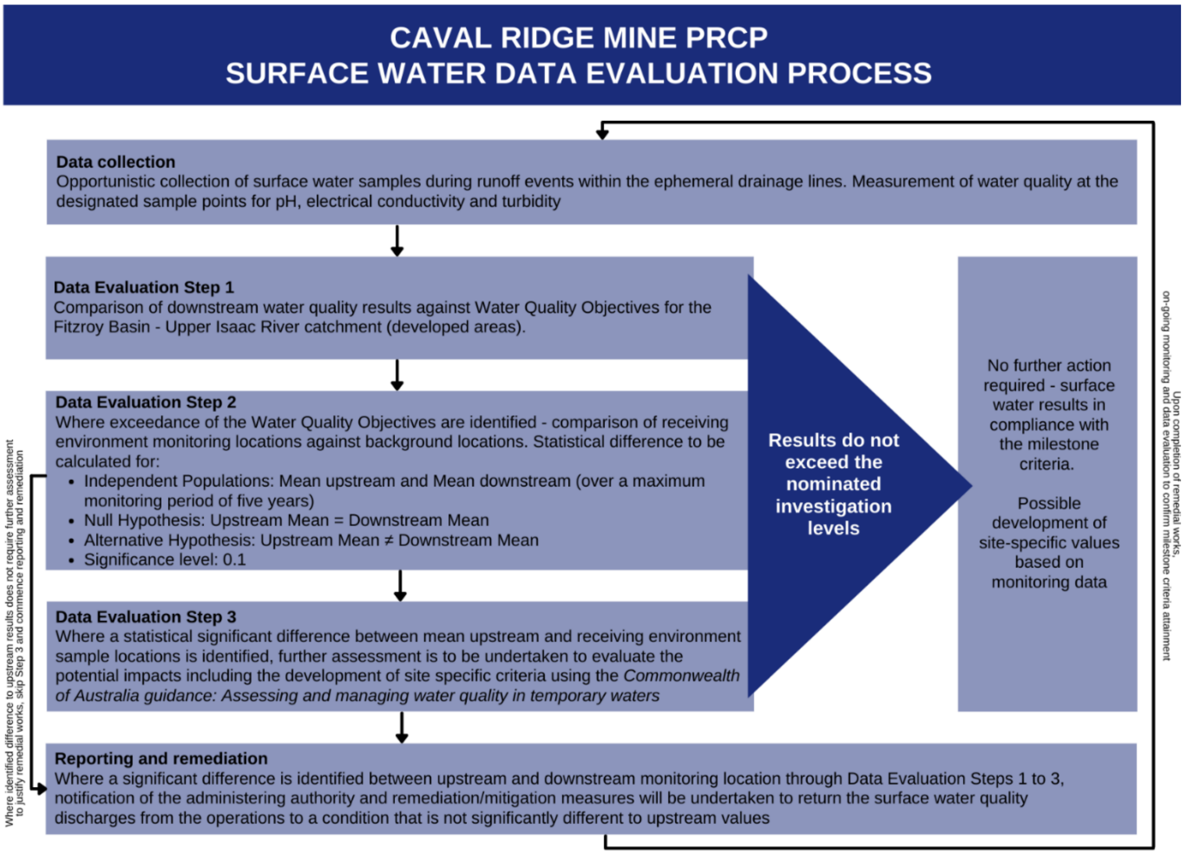

Figure 25: CVM water data evaluation flow diagram