



BHP Mitsubishi Alliance

Progressive Rehabilitation and Closure Plan

Saraji Mine

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EA holder name

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INVESTMENT PTY. LTD.; Umal
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Version Management

Version	Details	Date
1.0	Initial submission of the transitional PRCP for Saraji Mine	01 April 2023
2.0	Revised PRCP submitted with the Information Request response - Information Request Notice was issued to BMA by the administering authority on 31 May 2023	22 January 2024
3.0	Revised PRCP submitted after BMA received the Notice of Decision to approve with conditions or amendments the proposed PRCP schedule - Notice of Decision was issued to BMA by the administering authority on 4 September 2024	03 October 2024
4.0	Administrative correction of PRCP content page only	5 November 2024
5.0	Revised PRCP submitted with a PRCP amendment application - Proposed to amend milestone criteria and PMLUs to be consistent with the more recently approved BMA PRCP schedules, where relevant	26 February 2026

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 grasses
Administering authority	Department of Environment, Tourism, Science and Innovation (Queensland)
AD	Acid/acidic drainage
AEP	Annual exceedance probability
AHD	Australian height datum
AMD	Acid and metalliferous drainage
AQP	Appropriately qualified person
ASC	Australian Soil Classification
BBAC	Barada Barna Aboriginal Corporation
bcm	Bank cubic meter
BMA	BHP Mitsubishi Alliance
BMC	BHP Billiton Mitsui Coal Pty Ltd
BOM	Bureau of Meteorology
CCP	Community consultation plan
CEC	Cation exchange capacity
CHPP	Coal handling and preparation plant
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSM	Conceptual site model
DEM	Digital elevation model
DES	Department of Environment and Science (Queensland)
DESI	Department of Environment, Science and Innovation (Queensland) (the administering authority)
DETSI	Department of Environment, Tourism, Science and Innovation (Queensland) (the administering authority) (previously referred to as the Department of Environment, Science and Innovation)
DL	Dysart Lower coal seam
DM	Dry matter (with reference to vegetation)
DNRME	Department of Natural Resources, Mines and Energy
DNRMMRRD	Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (previously referred to as the Department of Resources)
DoR	Department of Resources (Queensland)
DSITI	Department of Science, Information Technology and Innovation (Queensland)
DU	Dysart Upper coal seam

Term / Abbreviation	Description
EA	Environmental Authority (in terms of the <i>Environmental Protection Act 1994</i> , Queensland)
EC	Electrical conductivity
EIS	Environmental Impact Statement
EP Act	<i>Environmental Protection Act 1994</i> (Queensland)
EPP (Water)	Environmental Protection (Water) Policy 2009
ERD	Effective Rooting depth
ESA	Environmentally sensitive area
ESP	Exchangeable sodium percentage
Fine rejects	More commonly known as tailings. Disposed within tailings storage facilities (TSFs)
FoS	Factor of safety
GDE	Groundwater dependant ecosystem
GED	General environmental duty
GMA	Groundwater management area
HCL	Harrow Creek Lower coal seam
HCU	Harrow Creek Upper coal seam
HVR	High-value regrowth
IA	Improvement area “...for a NUMA, means an area of land in the NUMA to which a management milestone for the NUMA relates” (DESI, 2024).
IDC	Index of diversion condition
IESC	Independent Expert Scientific Committee
Interburden	Mineral (mining) waste located between mined coal seams.
IRC	Isaac Regional Council
lcm	Loose cubic meter
LGA	Local government area
LOD	Land outcome document
LSA	Land suitability assessment
MDBC	Murray Darling Basin Commission
MERCPA	<i>Mineral and Energy Resources (Common Provisions) Act 2014</i> (Queensland)
MERFP Act	<i>Mineral and Energy Resources (Financial Provisioning) Act 2018</i> (Queensland)
MIA	Mine industrial area
MIBC	Methyl isobutyl carbinol
Milestone criteria	“...for a management milestone or a rehabilitation milestone, means a requirement that must be met to achieve the milestone” (DESI, 2024)
Mineral waste	Material comprising spoil, ± tailings, ± rejects, ± waste coal. Sometimes called ‘mine waste’ or ‘mining waste’

Term / Abbreviation	Description
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) (DESI, 2024)
MSES	Matter of state environmental significance
NAF	Non-acid forming
NC Act	<i>Nature Conservation Act 1992</i> (Queensland)
NMD	Neutral and metalliferous drainage
NPM	Norwich Park Mine (now referred to as Saraji South Mine)
NUMA	Non-use management area
OQMRC	Office of the Queensland Mine Rehabilitation Commissioner
Overburden	Mineral (mining) waste located above coal seams
PAF	Potentially acid forming
PAWC	Plant available water capacity
PDM	Peak Downs Mine
PFAS	Perfluoroalkyl and polyfluoroalkyl substances
PMF	Probable maximum flood
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 Act) (DESI, 2024)
PMP	Probably maximum precipitation
PRCP	Progressive rehabilitation and closure plan
PRCP Guideline	Progressive rehabilitation and closure plan guideline (September 2024) (DESI, 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” (DESI, 2024)
RE	Regional ecosystems
Rejects	Waste material produced during coal processing
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)” (DESI, 2024)

Term / Abbreviation	Description
RMP	Rehabilitation Management Plan
ROM	Run-of-mine
RRR	Residual risk rating (with reference to the risk assessment)
SD	Saline drainage
SMU	Soil mapping unit
Spoil	Rock material overlying and between ‘target’ coal seams, which will report as waste (i.e. overburden and interburden)
SPR	Source-pathway-receptor
SQP	Suitably qualified person (for performing a regulatory function)
SRM	Saraji Mine
SRTM	Shuttle Radar Topography Mission
SSM	Saraji South Mine (previously referred to as Norwich Park Mine)
Stable condition	“...defined in section 111A of the EP Act: Land is in a stable condition if - • 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” (DESI, 2024)
STAC	Smart Transformation Advisory Council
SWCC	Soil water characteristic curve
Tailings	Fine-sized waste material produced during coal processing
TDS	Total dissolved solids
TLO	Train load-out
Transitional PRC Plan	“...the holder of an existing EA for an ineligible mining activity relating to a mining lease that is transitioning into the new PRC Plan framework” (DESI, 2024)
TSF	Tailings Storage Facility
VM Act	<i>Vegetation Management Act 1999</i> 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

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

This Progressive Rehabilitation and Closure Plan (PRC Plan) has been prepared for SRM in accordance with the requirements of the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (MERFP Act). This PRC Plan 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) (DESI, 2024)

Environmentally relevant activities at SRM are schedule 3 13 - mining black coal, ancillary 08 - chemical storage 3, ancillary 63 - sewage treatment 1, ancillary 60 - waste disposal 2, and ancillary 31 - mineral processing 2. They are undertaken under the conditions of the site's Environment Authority (EA) EPML00862313 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: EPML00862313 (28 May 2025)

Land description: ML1775 (part), ML1782 (part), ML1784, ML2360, ML2410, ML70142 (part), ML70294, ML70298, ML70328 (part), ML700021

As detailed in the PRCP Guideline, the main purposes of the PRCP are to (subject to transitional provisions):

- Require the holder of an EA to plan for how, where and when activities will be carried out on land in a way that maximises the progressive rehabilitation of the land to a stable condition (defined in section 111A of the EP Act)
- Provide for the condition to which the holder must rehabilitate the land before the EA may be surrendered.

This PRC Plan comprises two parts:

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

This PRC Plan also includes Section C: Appendices, providing key information and specialist studies used to support development of this plan.

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* (EPML00862313) *for a mining activity relating to a mining lease authorising operations* at SRM (Section 750, EP Act).

In accordance with the transitional provisions and requirements of Section 6 of the PRCP guideline, BMA adhered to the following process to transition rehabilitation and closure outcomes from the SRM EA into the approved transitional PRCP schedule:

1. Identifying rehabilitation and closure outcomes in the land outcome document (LOD)
2. Identifying post-mining land uses (PMLUs)
3. Identifying non-use management areas (NUMAs)

4. Defining rehabilitation areas (RAs) within the PMLU, or improvement areas (IAs) within the NUMA
5. Identifying milestones
6. Identifying milestone criteria
7. Identifying when the first rehabilitation milestone (RM) and management milestone (MM) must commence and completion dates for the milestones

In accordance with transitional provisions (section 750, EP Act), the SRM EA (EPML00862313) (DES, 2023) was an approved LOD for the transitional PRCP.

Transitional timeline

The assessment process for the transitional PRCP included:

- The initial version of the transitional SRM PRCP was submitted to the administering authority on 1 April 2023.
- An Information Request Notice was issued to BMA by the administering authority, dated 31 May 2023. The response to this Information Request and revised PRCP were provided to the administering authority on 22 January 2024.
- Subsequent clarifications on the Information Request were requested by the administering authority on 22 February 2024 and provided by BMA on 12 March 2024.
- A draft SRM PRCP schedule was issued by the administering authority on 27 March 2024 and a response to that draft schedule was provided by BMA on 23 April 2024. To support the response, BMA facilitated a SRM site visit for the administering authority.
- In-person workshops were held on 3 – 4 June 2024 and 12 August 2024 between the administering authority and BMA, and meetings on 15 August 2024 and 20 August 2024, were conducted to discuss and resolve outstanding issues in relation to the draft PRCP conditions and milestone criteria. No agreement could be reached on erosion.
- On 4 September 2024, BMA received a Notice of Decision from the administering authority that the SRM PRCP schedule was approved with conditions or amendments. The PRCP schedule as decided included:
 - Rehabilitation milestones and criteria imposed by the administering authority during the assessment process which had been agreed by BMA and;
 - Erosion milestone criteria that had not been agreed by BMA.
- The associated amended EA was issued by the administering authority on 28 May 2025.

KNOWLEDGE BASE REFINEMENT

Compilation of this PRC Plan has been supported by the rehabilitation and closure-related knowledge base for SRM at the time of submission of this PRC Plan. Relevant studies contributing to this knowledge base have been referenced throughout this PRC Plan, 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 (ICMM, 2025), *“the collection, updating, use and review of the knowledge base is an ongoing and iterative process over the mine life, used to inform the closure planning process”*. ICMM also indicate *“gaps and uncertainties will be identified over the mining life cycle, with studies, research and trials undertaken as needed to close knowledge gaps”* and *“the plans to address gaps and uncertainties over the life of the mine should be incorporated into the closure execution plan and used to inform closure planning and implementation.”*

The Australian Government state in their Leading Practice Sustainable Development Program for the Mining Industry Mine Rehabilitation handbook that *“at worst, initiating closure operations when the site has not developed the skills, equipment and necessary technical knowledge to successfully carry out a large rehabilitation program can result in very poor outcomes requiring very costly remediation, and with greatly reduced probability of successful closure”* (DIIS, 2016).



Internal BHP guidance states that the knowledge base is the foundation for all other steps in the closure management process and review of the knowledge base should enable gaps and uncertainties to be identified for defining forward work plans. Without a robust, relevant and fit for purpose knowledge base, decisions may be made without the right level of detail or erroneous information, resulting in sub-optimal closure outcomes, increased closure risk and destruction of asset value through increased cost and/or time for closure implementation.

As the rehabilitation and closure knowledge base for PDM develops, 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

SRM is a metallurgical coal resource located approximately 30 kilometres (km) north of the town of Dysart in the Bowen Basin, and 167km south-west of Mackay (Queensland). BMA's Peak Downs Mine (PDM) is located to the north of SRM, with BMA's Saraji South Mine (SSM – previously referred to as Norwich Park Mine) located to the south of SRM (Figure 1).

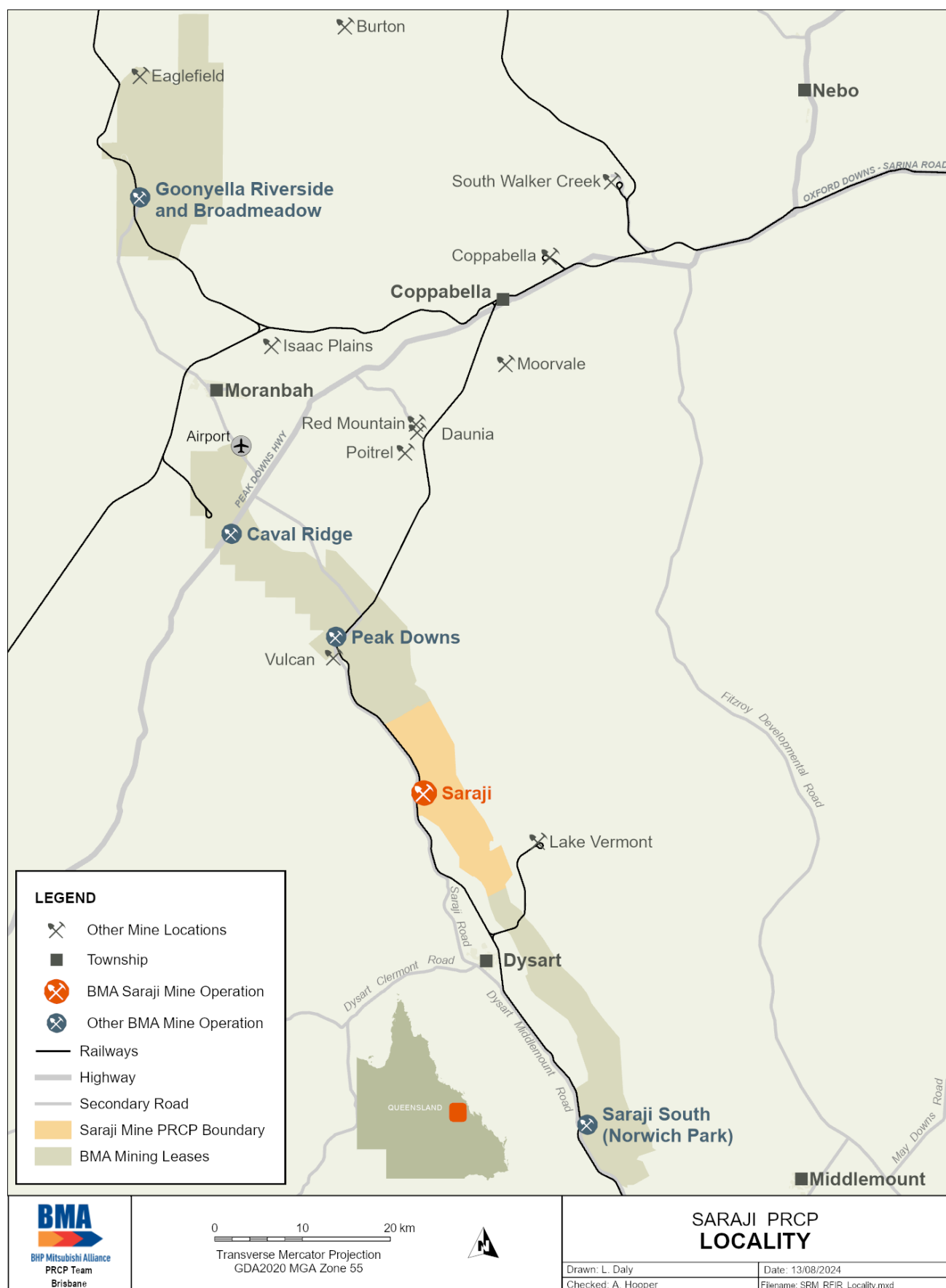


Figure 1: SRM location map

1.1.2 Mining tenements

SRM operates on the mining leases (MLs) provided in Table 1 and illustrated in Figure 2. The ML area within the SRM EA, and applicable to this PRCP covers 10,995 hectares (ha). The majority of coal mining to date has occurred on ML1775 and ML1782, with a small portion having occurred on ML2360 and ML2410.

Table 1: SRM mining tenements

Lease number	Name	Date granted
ML1782 (part)	Part Saraji And Norwich Park	22 December 1983
ML1775 (part)	Part Saraji, Peak Downs and Caval Ridge	22 December 1983
ML1784	Saraji	14 October 1976
ML2360	Fiddlewood	27 February 1992
ML2410	Phillips Creek	27 February 1992
ML70142 (part)	Boomerang Creek	23 May 2002
ML70294	Hakea West	5 December 2002
ML70298	Hakea South	4 December 2002
ML70328 (part)	Tay-Glen	09 November 2006
ML700021	Grevillea	16 October 2018

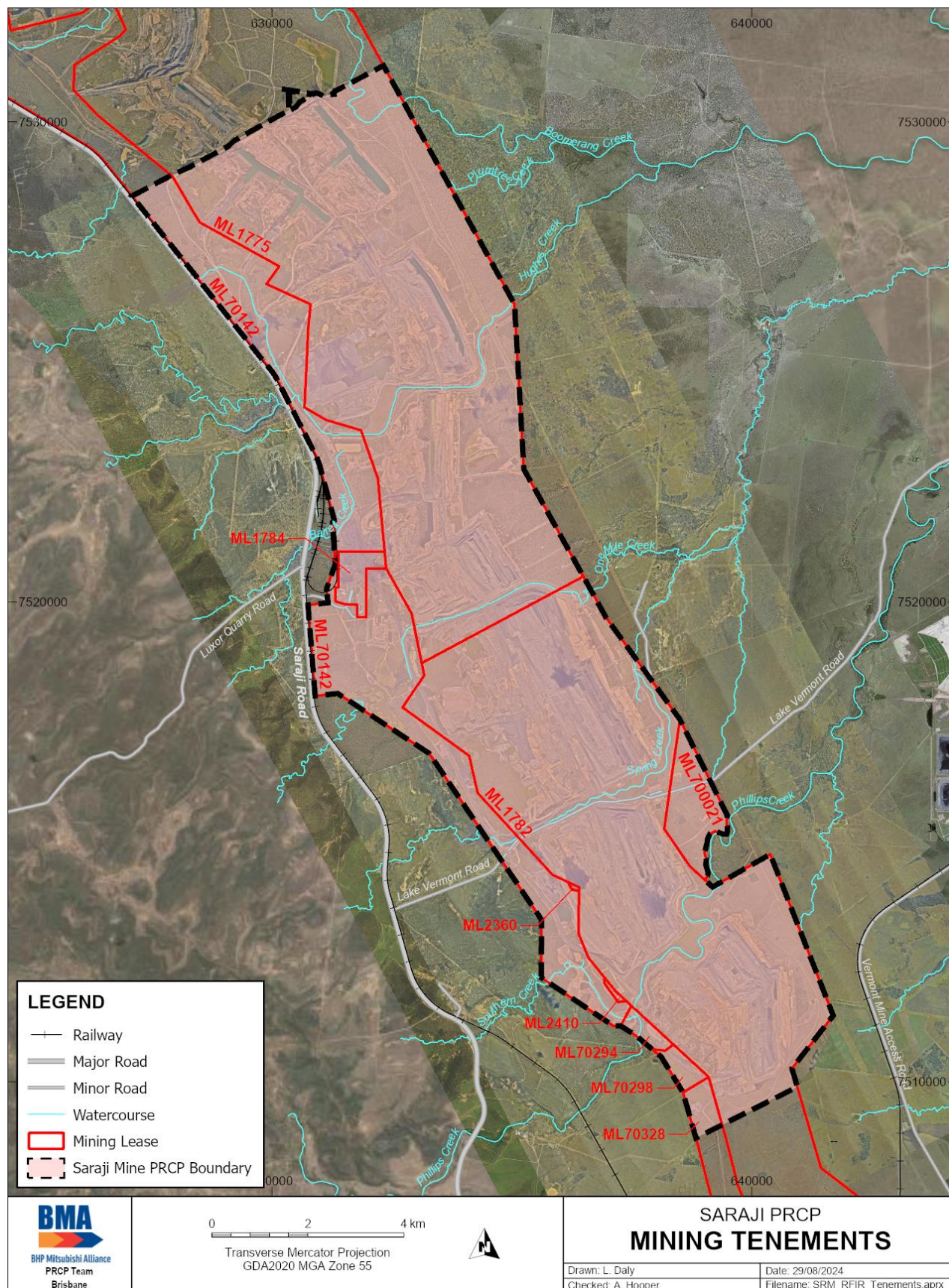


Figure 2: SRM mining tenements

1.1.3 Primary mine features and infrastructure on-site

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

Table 2: Primary mine features and infrastructure at SRM

Mine domain	Mine feature
Pits: voids and spoil dumps	- Acacia Pit¹ - Jacaranda/Bauhinia Pit - Coolibah/Dogwood Pit - Ebony/Grevillea Pit - Hakea Pit
Stockpiles	- Run-of-mine (ROM) coal stockpiles - Product coal stockpiles - Topsoil stockpiles - Rock stockpiles
Tailings storage facilities (TSFs)	- Ramp 2/3 TSF - Ramp 6 TSF - TSF no. 2 - TSF no. 3 - TSF no. 4
Dams	- Mine water dams - Raw water dams - Sediment dams
Creek diversions	- Plumtree Creek Diversion - Hughes Creek Diversion - Barrett Creek Diversion - One Mile Creek Diversion - Spring Creek Diversion - Southern Creek Diversion - Phillips Creek Diversion
Processing infrastructure	- Coal handling and preparation plant (CHPP) - Conveyors and transfer stations - Stackers and reclaimers - Surge bins and hoppers - Tunnels

¹ Acacia Pit will merge with Jacaranda and Bauhinia Pits and be progressively backfilled during operations. It will form part of the Jacaranda-Bauhinia spoil landform at closure.

Mine domain	Mine feature
Rail infrastructure	• Rail line • Train load-out (TLO) bin and facilities • Conveyors
General infrastructure	• Administration, warehouse, crib and various buildings • Workshop • Fuel, oil and chemical storage • Fuel and wash bays • Pipes and pumps • Power lines • Switchyards and substations • Communication and lighting towers • Sewage treatment plant • Fences
General disturbance	• Laydown areas • Access roads • Haul roads • Drains • Exploration
Regional infrastructure	• One Mile Creek Dam (Section 6.1.7.5)

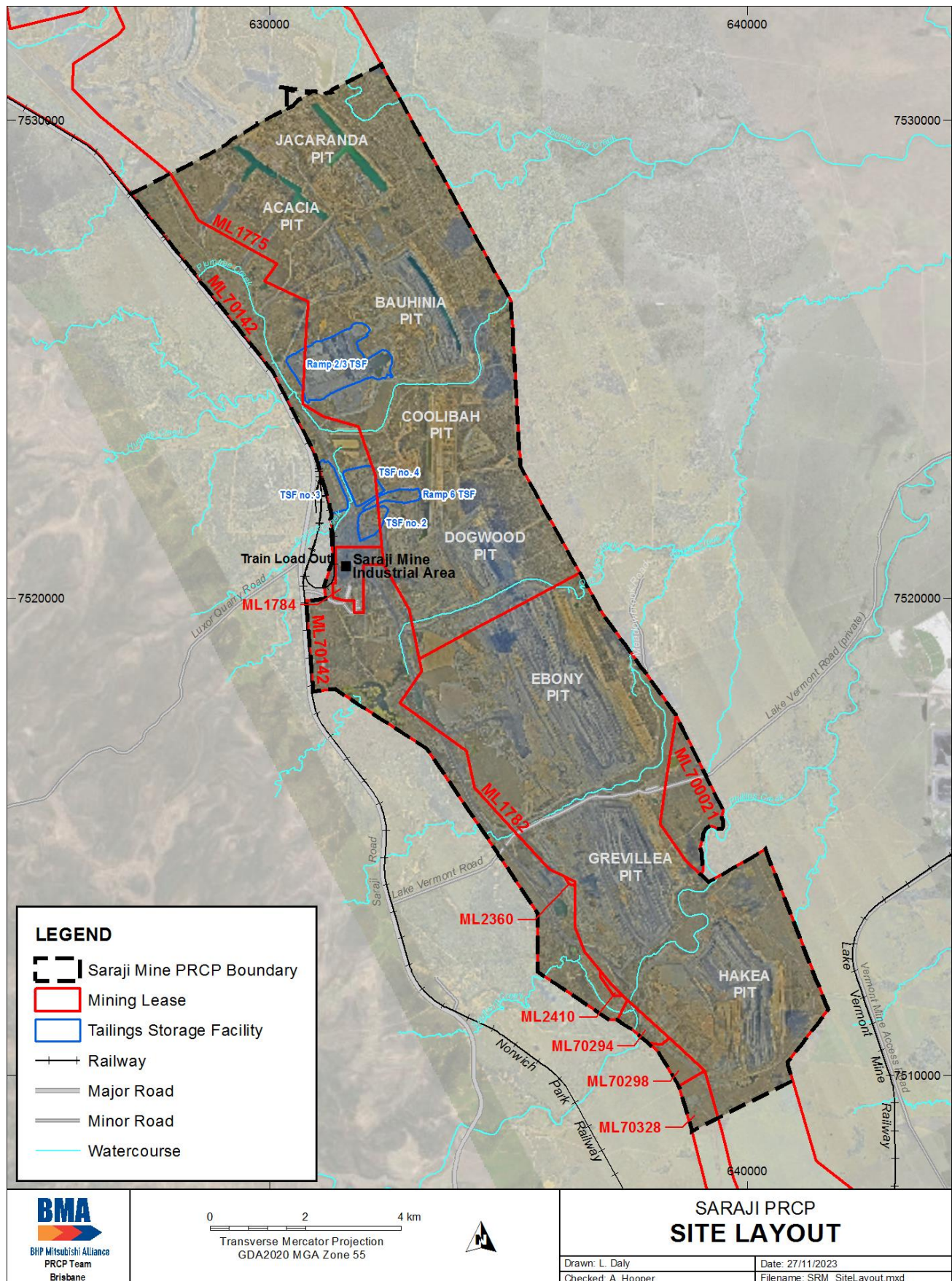


Figure 3: SRM site layout

1.1.4 Type of mining operation

SRM is a conventional open cut strip mine using both draglines and truck and shovel fleets. The strips are orientated in an approximate north-west/south-east direction, with pit development progressively working eastwards down dip.

Mining involves 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 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 stockpiles. The coal is processed at the CHPP. Coal waste fines are disposed of in dedicated TSFs, and coarse rejects are disposed of within the spoil dumps. Coal from SSM is also processed at SRM.

Product coal is transported by rail to the Hay Point Coal Terminal for export.

1.1.5 Proposed duration of the operation

Operations at SRM commenced in 1974. Current life-of-mine planning mines the state approved extent of the operation within the EA area. The approved areas are planned to be mined until 2098 at current mining rates. All pits are mined continually in the life-of-mine schedule until 2080. From 2080, mining will progressively finish in each pit. Variations to the planned mining rates due to business or market conditions, or refined resource information may change the proposed duration, and as a result, when necessary, a PRCP amendment will be submitted to the administering 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 topography of SRM consists of predominantly flat to undulating areas, with several watercourses passing through the site. Elevations across SRM range from approximately 200m Australian Height Datum (AHD) in the west to 160m AHD in the east, grading east-northeast towards the Isaac River, which is the most prominent regional drainage feature.

The regional topography of the Bowen Basin is dominated by flat to gently sloping landforms and low rolling hills. SRM is located on the western edge of the Isaac River Valley, which is a broad valley approximately 30km wide and generally oriented north to south. Cherwell Range defines the western edge of the valley, where the relatively steep slopes contrast with the extensive flat areas along the base of the valley.

1.2.2 Climate

SRM is located in a semi-arid climatic zone, which is characterised by high summer temperatures, warm dry winters and distinct wet and dry seasons. 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 (December, January and February) (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 PRC Plan and supporting technical studies have utilised the *BMA Climate Change Adaptation in Mine Water Planning and Hydrologic Assessments Guideline* (BMA, 2023). This guideline was developed specifically for the location of the BMA coal 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

SRM is located on the western limb of the northern Bowen Basin. The Bowen Basin in the area is characterised by a relatively thin accumulation of sediments, gentle easterly dips and minor to moderate deformation. The lithology at SRM is characterised by typical basin-fill sediments, comprising mudstone, claystone, siltstone, sandstone (typically fine to medium-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 are the Permian-age Moranbah Coal Measures, comprising the following seam groups in stratigraphic order, from youngest to oldest:

- Q/R/S [minor upper seams; mostly in the weathered zone; currently only encountered just below base of weathering in Grevillea and Hakea pits]
- P seam [mined in all pits, but within the weathered zone in Acacia, Bauhinia, Coolibah and Dogwood pits]
- Harrow Creek Upper (HCU) and Harrow Creek Lower (HCL) [mined in all pits]
- Dysart Upper (DU) and Dysart Lower (DL) [mined in all pits except Hakea]

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

Non-mined seams below the DL include the DLL and DLLL groups. Seam splitting is prevalent along the length (north-south) of all pits and continuing north and south into neighbouring PDM and SSM. Overlying the Moranbah Coal Measures 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 sand, clay and gravel.

To date, most of the coal mined at SRM has been from the HCU/HCL and DU/DL seam groups, with a small amount of P seam being mined from Jacaranda, Ebony, Grevillea and Hakea pits. As mining progresses eastwards (down-dip) the upper seams such as the HCU seam group, followed by the P seam group (and potentially Q-R-S seam group), will become more prevalent.

Due to the eastward dip of the seams and the nature of the seams splitting and coalescing, the location of the weathered zone varies from pit to pit (north to south) and from west (start of mining) to east (current and future mining). Geological cross-sections (indicatively west-east) through the pits, including current topography, are provided in Figure 4 to Figure 6.

Underlying the Moranbah Coal Measures is the Permian Back Creek Group, which has geological similarities with the host rock of the Moranbah Coal Measures (i.e., quartzose to lithic sandstone, siltstone, carbonaceous shale and minor coal).

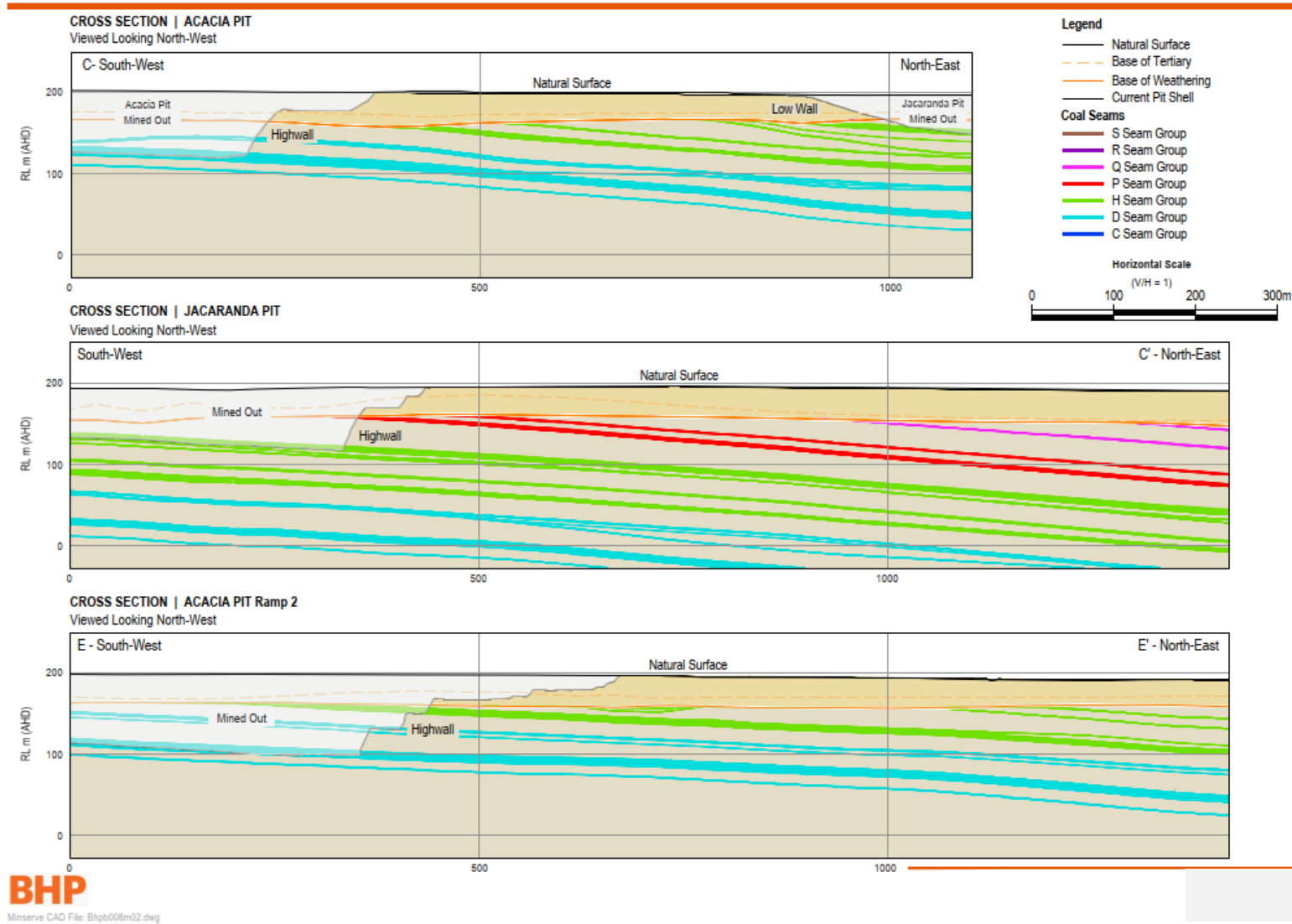


Figure 4: Pit cross-sections – Acacia and Jacaranda Pits

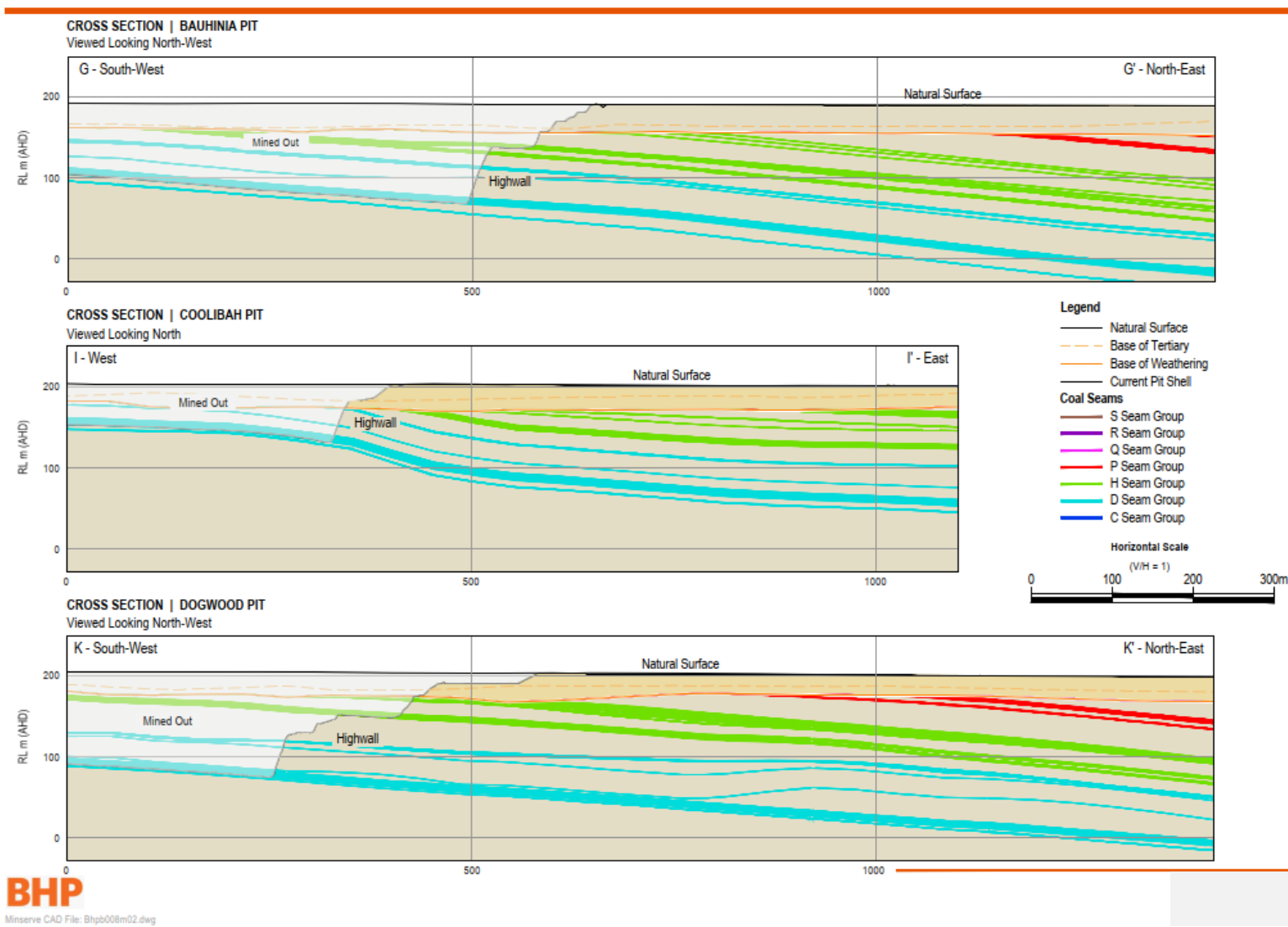


Figure 5: Pit cross-sections – Bauhinia, Coolibah and Dogwood Pits

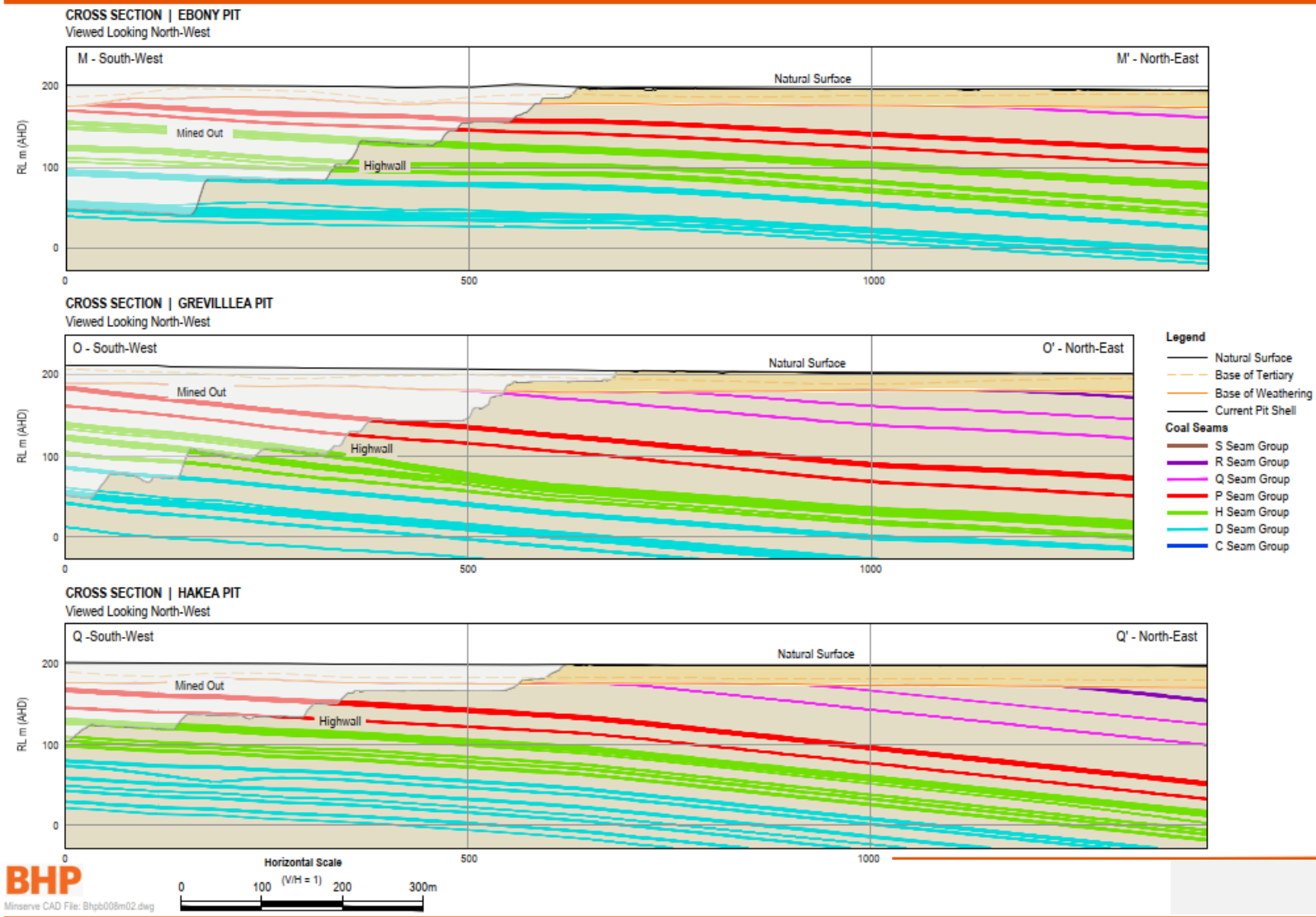


Figure 6: Pit cross-sections - Ebony, Grevillea and Hakea Pits

1.2.4 Site hydrology and fluvial networks

SRM is located within the Isaac River Sub-basin within the Fitzroy Basin and the Isaac Western Upland Tributaries sub-catchment of the Isaac River catchment. The Isaac River is located approximately 20km to the east of the SRM operations. The Isaac River flows southwards through the catchment for approximately 130km to join the Mackenzie River, which flows onwards for approximately 150km to join the Fitzroy River, which enters the Coral Sea at Rockhampton adjacent to Casuarina Island.

The Isaac River Sub-basin has a total area of approximately 22,327km² and the total Fitzroy Basin has an area of approximately 142,482km². From a broad regional context, the area covered by the SRM ML area (110km²) represents less than 0.5% of the Isaac River Sub-basin.

The Isaac Western Upland Tributaries sub-catchment is covered under the *Environmental Protection (Water and Wetland Biodiversity) Policy* (2019), Department of Environment and Heritage Protection (2011) Isaac River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including water of the Isaac River Sub-basin (including Connors River) (DEHP, 2011). The nominated environmental values of the sub-catchment are summarised in Table 4.

Table 4: SRM 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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Watercourses that traverse SRM have headwaters originating in the Denham and Cherwell Ranges to the west of SRM and flow in an easterly direction toward the Isaac River. The watercourses and drainage lines within and surrounding SRM are ephemeral with flows occurring for short periods during and immediately after rainfall events. Ponded water within the natural watercourses is relatively shallow and temporal. The watercourses that intersect SRM are summarised in Table 5 and are shown in Figure 7.

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

Watercourse	Perenniality	Hierarchy	Strahler stream order	Comment
Boomerang Creek	Intermittent	Minor	4	Runs through a diversion from west to east within PDM and enters SRM in the north-eastern corner in the natural watercourse alignment. The pre-diversion natural creek alignment was located further north within PDM.
Plumtree Creek	Intermittent	Minor	1 – 2	The original alignment of the creek has been mined through with the creek diverted south on the western side of the operations and into Hughes Creek.
Hughes Creek	Intermittent	Minor	3 - 4	Runs through a diversion and receives water from the diverted Plumtree Creek and Barrett Creek.
Barrett Creek	Perennial [#]	Minor	3	Current creek alignment enters SRM to the north-west of the mine industrial area (MIA) and drains through a diversion into Dudley's Dam, which is an authorised release point to Hughes Creek. When the planned and approved alignment is constructed to the west, Barrett Creek will flow directly into Hughes Creek.
One Mile Creek	Intermittent	Minor	1 - 2	Drains into One Mile Creek Dam followed by Campbells Dam before running through diversions.
Spring Creek	Intermittent	Minor	2	Current creek alignment runs through a diversion from the west to the eastern side of the operations. The diverted alignment will change when the approved Spring Creek and Southern Creek diversion is constructed to divert Spring Creek to Phillips Creek.

Watercourse	Perenniality	Hierarchy	Strahler stream order	Comment
Southern Creek	Intermittent	Minor	1 - 2	Southern Creek is diverted south on the western side of the operations and into Phillips Creek. The diverted alignment will change when the approved Spring Creek and Southern Creek diversion is constructed.
Phillips Creek	Intermittent	Minor	3 - 4	Drains through a diversion and receives drainage from Southern Creek, and Spring Creek upon construction of the approved Spring Creek and Southern Creek diversion.
Southern drainage line (unnamed)	Intermittent	Minor	1	<i>Water Act 2000</i> unmapped and unnamed drainage line, on the southern extent of SRM. Does not support riparian vegetation in the proximity of the site. Tributary of Phillips Creek.

- Within the Queensland Government GIS data (Queensland Globe) Barrett Creek is listed as perennial. However, flows within Barrett Creek are not perennial in nature and are consistent with other watercourses listed as intermittent.

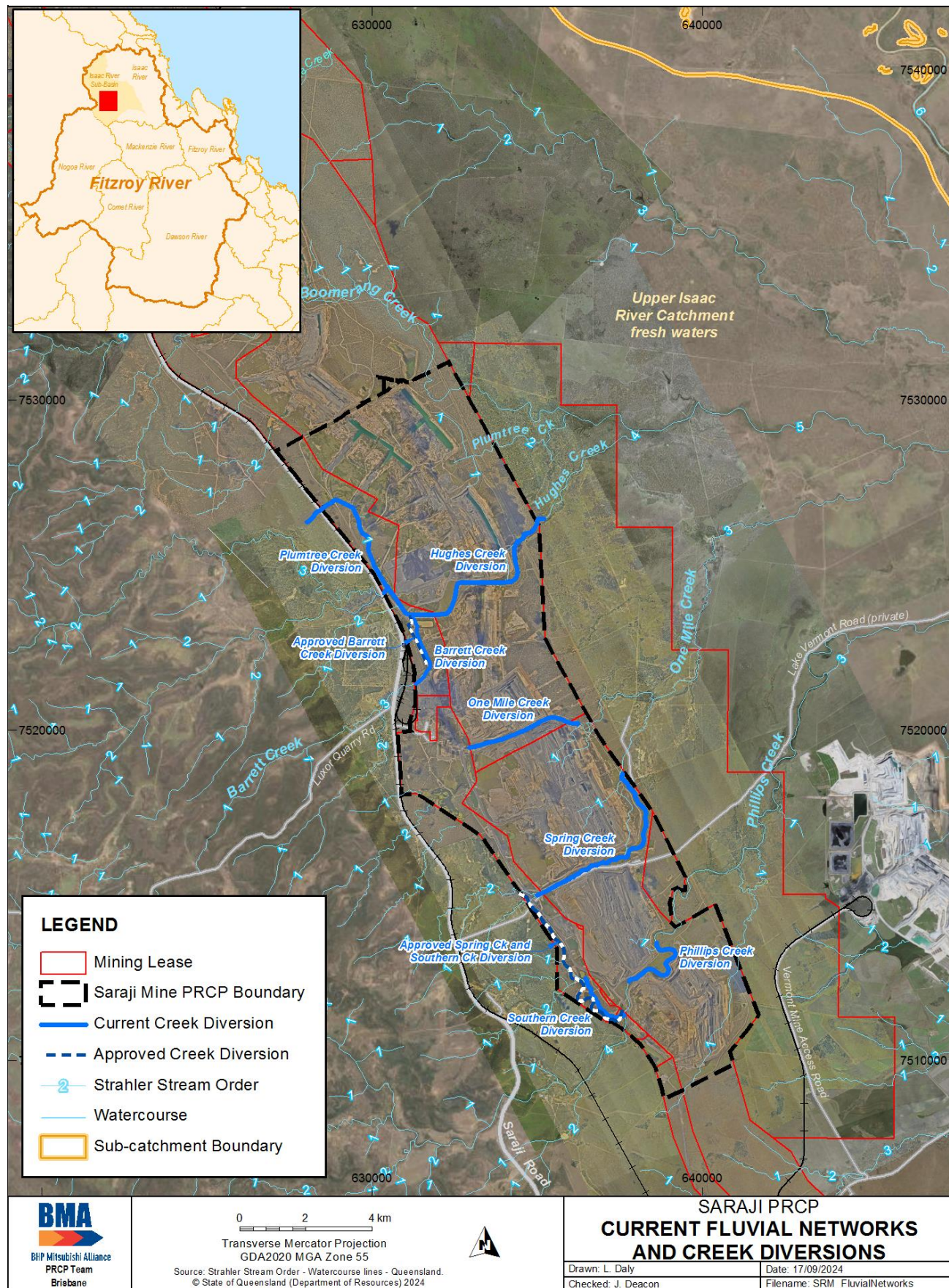


Figure 7: SRM current fluvial network and creek diversions

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

- Diversion of watercourses (creek diversions shown in Figure 7)
- Interfering with the flow of water by impounding
- Taking of water

Water licences applicable to SRM are summarised in Table 6.

Table 6: Water licences applicable to SRM

Authorisation number	Authorisation activity	Authorised purpose	Approval date (most recent update)	Expiry date
34346F	Licence to interfere by diversion - Plumtree Creek Diversion	Divert the course of flow	23/10/2014	30/06/2111
34358F	Licence to interfere by diversion - Hughes Creek Diversion Upstream	Divert the course of flow	31/10/2014	30/06/2111
52666F	Licence to interfere by diversion - Hughes Creek Diversion Middle	Divert the course of flow	31/10/2014	30/06/2111
0426546F	Licence to interfere by diversion - Hughes Creek Diversion Downstream	Divert the course of flow	31/10/2014	30/06/2111
30970F	Licence to interfere by diversion - Barrett Creek	Divert the course of flow	10/09/2020	30/06/2111
30971F	Licence to interfere by impounding - embankment or wall – Campbell's Dam (One Mile Creek)	Impound water	16/12/2009	30/06/2111
30972F	Licence to interfere by diversion - One Mile Creek Diversion	Divert the course of flow	16/12/2014	30/06/2111
27661F	Licence to interfere by impounding - embankment or wall - One Mile Creek Dam	Impound water	03/08/2016	30/06/2111
46127F	Licence to interfere by diversion - Spring Creek Diversion*	Divert the course of flow	16/12/2014	30/06/2111
623114	Licence to interfere by diversion - Spring Creek and Southern Creek	Divert the course of flow	24/09/2020	30/06/2111
172682	Licence to interfere by diversion - Phillips Creek - Haul Road Diversion	Divert the course of flow	16/12/2014	30/06/2111
178206	Licence to interfere by diversion - Phillips Creek Diversion (Downstream)	Divert the course of flow	16/12/2014	30/06/2111
46301F	Licence to take water - Unnamed Tributary of Phillips Creek	Industrial	17/12/2009	30/06/2111
46302F	Licence to interfere by impounding - embankment or wall - Unnamed Tributary of Phillips Creek (Southern Creek Diversion)	Impound water	15/12/2009	30/06/2111
46303F	Licence to interfere by diversion - Unnamed Tributary of Phillips Creek (Southern Creek Diversion)*	Divert the course of flow	16/12/2014	30/06/2111

*Will no longer be applicable once the Spring Creek and Southern Creek diversion (water licence 623114) is constructed

In accordance with Section 334ZP of the *Mineral Resources Act 1989* and Section 1283 of the *Water Act 2000*, a water licence for the taking of, or interfering with, underground water is considered granted where the taking of underground water, required for the safe extraction of the resource or due to evaporative losses on an approved mining project, began prior to commencement of the *Water Act 2000*. As SRM commenced operations in 1974, a water licence in addition to those listed in the above table is considered to be granted for the taking and interfering of underground water.

1.2.4.1 Fluvial Water Quality

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

The REMP reports have included the assessment of background surface water quality through sample points within Hughes, One Mile, Phillips, and Spring creeks located upstream and to the west of SRM. Sampling methodologies employed for the program were 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 2010. Upstream results reflective of background surface water quality at SRM, reproduced from the Gauge (2023) REMP report, are summarised in Table 7.

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

Analyte	Unit	Average Upstream			
		80 th percentile	+ One standard error	20 th percentile	- One standard error
EC	µS/cm	408.23	417.06	154.58	145.75
Turbidity	NTU	528.55	656.8	81.68	-46.57
DO	%	82.29	87.03	49.63	44.89
Temp	°C	28.28	28.58	24.58	24.28
TSS	mg/L	533.16	572.36	306.52	267.32
Hardness	mg/L	74.88	83.59	33.16	24.45
SO4	mg/L	26	27.23	5.3	4.07
Fluoride	µg/L	171.6	177.1	112	106.5
Ammonia	µg/L	84	93.02	23.4	14.38
Nitrate	µg/L	142.36	168.28	43	17.08
TN	µg/L	3656	4000.63	1636.4	1291.77
TP	µg/L	738.5	901.8	22.5	-140.8
C6-C9	µg/L	10	10.32	10	9.68
C10-C36	µg/L	35	45.03	25	14.97

Analyte	Unit	Average Upstream			
		80 th percentile	+ One standard error	20 th percentile	- One standard error
Al (dissolved)	µg/L	678	745.76	20.44	-47.32
As (dissolved)	µg/L	0.76	0.81	0.60	0.55
B (dissolved)	µg/L	41.6	43.67	25	22.93
Cd (dissolved)	µg/L	0.05	0.05	0.04	0.03
Cr (dissolved)	µg/L	0.62	0.65	0.35	0.32
Co (dissolved)	µg/L	0.56	0.91	0.50	0.15
Cu (dissolved)	µg/L	1.7	1.8	0.70	0.60
Fe (dissolved)	µg/L	664.8	711.83	111.6	64.57
Pb (dissolved)	µg/L	0.50	0.64	0.50	0.36
Mn (dissolved)	µg/L	18.62	49.07	1.04	-29.41
Hg (dissolved)	µg/L	0.05	0.06	0.05	0.04
Mo (dissolved)	µg/L	0.60	0.62	0.50	0.48
Ni (dissolved)	µg/L	3.04	3.33	1.7	1.41
Se (dissolved)	µg/L	5	5.16	2.12	1.96
Ag (dissolved)	µg/L	0.50	0.52	0.23	0.21
U (dissolved)	µg/L	0.52	0.54	0.28	0.27
V (dissolved)	µg/L	5.4	5.57	2.79	2.62
Zn (dissolved)	µg/L	2.5	2.87	2.5	2.13
Al (total)	µg/L	19,767	21,162	6,647	5,254
As (total)	µg/L	3.68	60.45	1.62	-55.15
B (total)	µg/L	56.44	60.25	25	21.19
Cd (total)	µg/L	0.06	0.06	0.04	0.03
Cr (total)	µg/L	23.76	26.27	5.03	2.51
Co (total)	µg/L	14.76	16.13	4.16	2.79
Cu (total)	µg/L	19.8	25.52	6.5	0.78

Analyte	Unit	Average Upstream			
		80 th percentile	+ One standard error	20 th percentile	- One standard error
Fe (total)	µg/L	25,126	26,762	8,012	6,377
Pb (total)	µg/L	24.76	29.07	10.18	5.87
Mn (total)	µg/L	364.08	414.48	100.8	50.4
Hg (total)	µg/L	0.05	0.07	0.05	0.03
Mo (total)	µg/L	0.58	0.73	0.50	0.35
Ni (total)	µg/L	30.56	178.18	7.7	-139.92
Se (total)	µg/L	5	5.17	2.14	1.97
Ag (total)	µg/L	0.50	0.62	0.23	0.11
U (total)	µg/L	0.95	0.99	0.49	0.44
V (total)	µg/L	25.71	27.48	9.24	7.47
Zn (total)	µg/L	52.88	55.61	21.38	18.65

Notes:

Data collection and interpretation methodology detailed within Gauge (2023) 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 8.73 and 5.95.

The background surface water quality results are reflective of the upstream catchment and land uses to the west of SRM, which primarily consist of grazing and woodland habitat. The 80th/20th percentile concentrations within the upstream sample locations outside of the adopted published investigation levels for pH, dissolved oxygen, total suspended solids, sulphate, ammonia, nitrate, total nitrogen, aluminium, iron, manganese, chromium, lead and petroleum hydrocarbons (Gauge, 2023).

The on-going data collection will continue to provide surface water quality data throughout the operational life of SRM and increase the statistical relevance of the data set. The on-going assessment of background surface water quality will provide information on trends over time and allow for any off-lease catchment changes to be accounted for.

Future surface water monitoring 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 basin to monitoring undertaken by coal mines.

1.2.5 Hydrogeology

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

SRM lies within the Isaac Connors groundwater management area (GMA – Zone 34) of the Fitzroy Basin under the State of Queensland *Water Act 2000 Water Plan (Fitzroy Basin) 2011*. Within the GMA, alluvial groundwater is managed as Groundwater Unit 1, and water within the hard rock aquifers as Groundwater Unit 2 (sub-artesian aquifers). Volumetric limits apply to extraction of groundwater within the GMA. The objectives for groundwaters

within the GMA – Zone 34 management area of the *Water Plan (Fitzroy Basin) 2011* are for sustainable management to maintain ecological values and enable maintenance and ongoing use of the resources through water allocations and licensing.

1.2.5.1 Groundwater environmental values

SRM is located within the Isaac Groundwaters environmental values area and the groundwater chemistry zone of 'sodic sequence', which is saline, sodium (Na) and chloride dominated (DEHP, 2011). Table 8 summarises the Isaac Groundwater environmental values.

Table 8: SRM 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 SRM comprises the following key hydrogeological units:

- Cainozoic sediments:
 - Quaternary alluvium – unconfined aquifer (sporadically water-bearing strata of permeable unconsolidated sand or gravel) localised at and near to SRM along Phillips Creek, and regionally along the Isaac River
 - Tertiary alluvium and weathered units – unconfined and largely unsaturated unit at SRM and in surrounding area
- Permian - (Fort Cooper Coal Measures and Moranbah Coal Measures):
 - Low permeability interburden units with aquitard properties
 - Coal seams that exhibit water bearing properties associated with both primary porosity and secondary porosity
- Permian Back Creek Group

The coal seams within the Moranbah Coal Measures are the primary aquifer at SRM. The coal seams can be characterised as confined sedimentary aquifers, with the Q Seam, P Seam, H Seam and D Seam forming the main aquifer units locally. The Moranbah Coal Measures overburden and interburden act as aquitards and are typically low yielding.

The Back Creek Group underlies the Blackwater Group at SRM and outcrops immediately to the west. The Back Creek Group (a regional-scale aquitard) are a semi-pervious confining lower boundary for groundwater flow in the overlying Blackwater Group units. As such, the unit can be regarded as a hydrogeological basement and has not been considered further within the hydrogeological assessments supporting this PRC Plan.

Quaternary alluvium

Mapped Quaternary alluvium at SRM is localised along Phillips Creek, crossing SRM and extending north-eastwards. Quaternary alluvium is also mapped along the Isaac River to the east. The mapped Quaternary alluvium associated with Phillips Creek extends continuously to join with the Isaac River alluvium. Although groundwater monitoring data from the Philips Creek indicates that saturation of the alluvium is highly sporadic and groundwater resources are likely hydraulically disconnected to the Isaac River alluvium.

SRM monitoring records for the alluvium have also identified the following:

- To the west and upgradient near Phillips Creek, alluvium groundwater elevations have been recorded ranging between 196.4 and 201mAH
- The Phillips Creek downstream alluvial monitoring bore has consistently been reported as dry since installation in July 2019
- Hughes Creek alluvium monitoring bore has identified groundwater elevations ranging between 196.5 and 203mAH (noting that this is a landholder supply bore without installation records and may be taking water Tertiary sediments in addition to or rather than Quaternary alluvium)
- Groundwater elevations within the alluvial monitoring bores have shown a correlation to climatic conditions with periods of increased rainfall corresponding to higher alluvial groundwater elevations

The hydraulic conductivity of alluvium in the region is variable, ranging from 1×10^{-2} to almost 10 metres per day (m/day), which reflects the heterogeneous discontinuous nature of the alluvial sediments. Hydraulic testing of the alluvium within SRM found the hydraulic conductivity of the intersected alluvium to range from 0.16m/d to 8.64m/d.

Groundwater flow direction within the alluvium in the vicinity of SRM, where the sediments are saturated, has been qualitatively assessed to be topographically controlled, flowing from higher to lower elevations, consistent with surface drainage patterns.

Recharge of the alluvium would mostly be from stream flow or flooding (losing streams), with direct infiltration of rainfall also occurring where there are no substantial clay barriers in the shallow subsurface. Using chloride mass balance calculations and regional bores, recharge rates of the alluvium ranged between 1.3mm/yr and 3mm/yr (SLR, 2023).

Discharge of the alluvial groundwaters is through downstream throughflow where continuous, evapotranspiration from deeper rooted riparian vegetation and baseflow contributions after significant rainfall and flood events. Alluvial groundwater is also extracted through bores in the region, particularly along the Isaac River. Geological logs in the region indicate the alluvium is underlain by low hydraulic conductivity stratigraphy (i.e., claystone, siltstone and sandstone), which restricts the rate of downward groundwater migration to underlying formations.

The identified water types in the unconsolidated alluvium are generally Na-Mg-Cl and Na-Mg-Cl-HCO₃ dominant with the alluvium in the vicinity of Hughes Creek having a greater proportion of sulphate ions. The water within the alluvium is considered fresh to moderately saline with an average total dissolved solids (TDS) of 556mg/L and ranging between 10mg/L and 5,620mg/L.

Monitoring results indicate that water within the Phillips Creek alluvium upstream of SRM is generally suitable for all relevant Isaac River environmental values, with only occasional iron (Fe) concentrations exceeding long-term-term irrigation and aquatic ecosystem protection. Hughes Creek alluvial groundwater generally exceeds guideline levels for stock watering (sulfate and TDS), aquatic ecosystem (95%) protection (Al, Cu, Ni, Mn, Zn), drinking water (TDS, chloride and Na), and long-term irrigation (boron (Bo) and Fe). The Hughes Creek alluvial groundwater also records concentrations of electrical conductivity (EC), dissolved major ions and dissolved manganese (Mn) above the water quality objectives for Zone 34 (Shallow) aquatic ecosystems.

Tertiary and weathered units

Tertiary alluvium, colluvium and weathered undifferentiated sediments, consist of poorly consolidated or unconsolidated alluvial deposits and are indicative of flood plain material associated with watercourses traversing the area. The Tertiary alluvium is distributed across and surrounding SRM and is present to the east of SRM towards the Isaac River. Previous SRM site investigations have identified the Tertiary alluvium on site as comprising of primarily Tertiary clay units with 'tight' clays overlying an irregular discontinuous basal sand unit, which can be significant locally with up to 3m thickness identified at SRM.

SRM monitoring records for the Tertiary have identified the following:

- Groundwater elevations in the Tertiary sediments where saturated at SRM are approximately 169mAH to 190mAH and 17m below ground level (mBGL) to 24mBGL
- Previous monitoring of Tertiary bores at SRM found they generally became dry as a result of drawdown caused by sampling, indicating limited potential for sustainable yields

- Groundwater elevations within the monitoring bores have shown limited correlation to climatic conditions due to the low hydraulic conductivity of the clay and claystone strata with only subdued responses in groundwater levels noted in select locations

Regional groundwater flow directions within the Tertiary, where saturated, has been qualitatively assessed to be topographically controlled, flowing from higher to lower elevations consistent with surface drainage patterns. Therefore, groundwater within the Tertiary at SRM is expected to flow towards the Isaac River in a south easterly direction.

Also present at SRM and the surrounding area are weathered units, comprising of unconsolidated sediments, including colluvium and residual deposits derived from weathering of the underlying Permian strata. Surficial deposits are located to the west of the SRM area and associated with the weathering of the Permian Back Creek Group by watercourses. The weathered units in the SRM area comprise a heterogeneous distribution of fine to coarse grained sand, clay, sandstone and claystone. They are generally 15m to 45m thick extending to a maximum of 50mBGL.

The weathered units are not expected to form a significant aquifer at SRM and available data for both SRM and the surrounding area indicates it has only sporadic saturation and limited potential for sustainable yields. The presence of groundwater within the weathered units is generally restricted to lower elevation areas along the Isaac River and the lower reaches of its tributaries (e.g., Hughes Creek near its confluence with the Isaac River).

Recharge of the Tertiary and weathered units is considered to be mostly from flooding and direct infiltration of rainfall where there are no substantial clay barriers in the shallow subsurface. Estimates of recharge based on the chloride mass balance method are 0.1mm/yr.

Groundwater discharge from the Tertiary material regionally occurs primarily via evapotranspiration, with some baseflow to streams under wet climatic conditions. Vertical seepage is limited by the underlying low hydraulic conductivity material. The Tertiary and weathered unit hosted groundwaters are effectively a perched groundwater system above the Permian strata.

Water within the Tertiary is fresh to moderately saline with an average TDS of 556 mg/L (marginal) and ranging between 10mg/L and 5,620mg/L. Where water is present within the weathered units, it is generally saline to highly saline, with an average TDS of 7,101mg/L and ranging between 1,110mg/L and 18,600mg/L.

The water within the Tertiary is not considered a suitable groundwater resource and exceeds the stock watering (sulfate), aquatic ecosystem protection (95%) (copper (Cu), nickel (Ni) and zinc (Zn)), long-term irrigation (Bo, cobalt (Co) and molybdenum (Mo)) and drinking water (TDS, Na and chlorine (Cl)) water quality objectives. The water within the weathered units was also found to exceed the Fitzroy Plan water quality objectives for aquatic ecosystem protection (95%) (EC, bicarbonate, Cl, calcium (Ca), Na, hardness, magnesium (Mg), sulfate, Cu and Mn).

Permian - coal seams

The coal seams of the Moranbah Coal Measures subcrop throughout the western portions of the SRM area. Throughout the remainder of SRM the coal seams underlie and subcrop beneath the surficial cover. The Permian coal seams are the primary groundwater bearing unit at SRM. The coal seams have dual porosity provided by primary matrix porosity and a second (dominant) porosity through fractures (joints and cleats).

Pre-mining groundwater flow within the coal seams is thought to be to the east/southeast. Differences in piezometric heads within the confined coal seam aquifers drive groundwater flow eastwards across the Bowen Basin, from the more elevated subcrop areas on the western flank. However, mining activities throughout the region have modified groundwater flows surrounding the mines through dewatering and in pit water storage.

Mining at SRM began in 1974, prior to consistent monitoring of groundwater being undertaken. Therefore, pre-mining potentiometric surface maps for the coal measures cannot be generated, however it is expected that groundwater within the coal seams would have flowed from the sub-crops in the west to the east/southeast. Available SRM groundwater monitoring data collected during active mining within the coal seams has identified the following groundwater depth ranges for the coal seams (see Appendix B, Figures 4-9 to 4-13):

- Q Seam - 173.25mAHD to 178.52mAHD
- P Seam - 167.78mAHD to 184.39mAHD
- H Seam - 135.84mAHD and 190.45mAHD
- D Seam - 132.68mAHD and 170.78mAHD

Monitoring data has identified groundwater elevations within the D and H seams are more elevated in the northwest of the SRM Area and lower in the southeast, which is indicative of a general south easterly groundwater flow direction. Localised groundwater sinks are evident at monitoring locations located in the proximity of voids, which are being mined and actively dewatered.

Horizontal hydraulic conductivity (Kh) testing from both SRM and Caval Ridge Mine have reported the following ranges:

- 0.26 – 0.33m/d for the Q Seam
- 0.024 – 0.16m/d for the P Seam
- 0.007 – 0.39m/d for the H Seam
- 0.01 – 0.023m/d for the D Seams

Recharge of the coal seams, where they remain unmined, occurs where the seams were present at outcrop and subcrop. Using the chloride mass balance method, a recharge rate for the weathered Permian units was calculated as 0.1mm/yr. Monitoring records indicate the coal seam hosted groundwaters are not influenced by climatic conditions. Higher rates of recharge may occur where fresh Permian strata has been exposed by current mining activities and particularly where voids are used for water storage. 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 themselves. Groundwater discharge predominantly occurs via inflow into active mine areas and evaporation.

Groundwater within the Moranbah Coal Measures coal seam bores is a Na-Cl dominated water type. Water types of the Q Seam, H Seam and D Seam is more variable with the distribution of the major ions varying with depth, with shallower groundwaters supporting higher proportions of calcium or magnesium ions. This is likely to be due to greater recharge from overlying surficial deposits.

Groundwater salinity within the Permian coal seams was found to be variable. The Permian coal seam groundwater recorded an average TDS of 7,598mg/L with a range between 720mg/L and 24,704mg/L.

Comparison of groundwater results to the guideline levels indicates the Moranbah Coal Measures are not considered a suitable groundwater resource for irrigation, drinking water or aquatic ecosystems. Groundwater within the Permian meets the water quality objectives for stock water supply in selected bores, with guideline exceedances most common for TDS and SO₄.

Groundwater within the Permian coal seams recorded concentrations of:

- Sulfate (H Seam), dissolved aluminium (Al) (H Seam and D Seam), dissolved chromium (Cr) (D Seam), dissolved Cu (P Seam), dissolved Ni (P Seam) and dissolved Zn (P Seam and D Seam) above aquatic ecosystem (95%) protection guidelines
- Bicarbonate (D Seam) and Na (D Seam) above the Fitzroy Basin Zone 34 water quality objectives
- EC levels (H Seam and D Seam), concentrations of magnesium (H Seam and D Seam), Na (H Seam and D Seam), chloride (H Seam and D Seam), sulphate (H and D seams), dissolved Fe (H Seam and D Seam) and pH (D Seam) above the Fitzroy Basin Zone 34 water quality objectives

Permian - interburden

Groundwater occurrence within the Permian interburden is largely restricted to weathered horizons or to secondary porosity through fractures where present. The interburden functions dominantly as an aquitard that restricts groundwater movement.

Interburden/overburden testing shows a hydraulic conductivity of at least an order of magnitude less than that of coal seams at similar depths, typically less than 10⁻⁴m/day.

Recharge occurs at subcrop, however, due to the low hydraulic conductivity of the interburden material, recharge rates to the interburden are significantly less than for the coal seams. Groundwater discharge from the interburden occurs via evaporation from active mine areas.

The interburden units record an average TDS of 5,349mg/L, ranging between 1,520mg/L and 9,126mg/L.

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 B). On-going monitoring of the groundwater undertaken throughout the operational life of the mine will continue to develop the SRM data set and aid future assessments of deep drainage from the rehabilitated landform. The following provides a summary of the currently known groundwater quality characteristics within each of the aquifers.

Interpretation of salinity levels provided below are based on the Food and Agriculture Organization of the United Nations (FAO), 2013. Chapter 2 – Saline waters as resources (FAO, 2013).

Quaternary alluvium

Salinity within the monitored alluvium at SRM was fresh to moderately saline, with an average total dissolved solids (TDS) of 556mg/L and ranging between 10mg/L and 5,620mg/L.

SRM monitoring results from the Quaternary alluvium have indicated that water within the Phillips Creek alluvium upstream of SRM was generally suitable for all relevant Isaac River environmental values, with only occasional iron (Fe) concentrations exceeding long-term-term irrigation and aquatic ecosystem protection. Hughes Creek alluvial groundwater has generally exceeded guideline levels for stock watering (sulfate and TDS), aquatic ecosystem (95%) protection (Al, Cu, Ni, Mn, Zn), drinking water (TDS, chloride and Na), and long-term irrigation (boron (Bo) and Fe). The Hughes Creek alluvial groundwater has also recorded concentrations of electrical conductivity (EC), dissolved major ions and dissolved manganese (Mn) above the water quality objectives for Zone 34 (Shallow) aquatic ecosystems.

Tertiary and weathered units

Salinity within the monitored Tertiary at SRM was fresh to moderately saline, with an average TDS of 556 mg/L (marginal) and ranging between 10mg/L and 5,620mg/L. Where water has been present within the weathered units, it has been generally saline to highly saline, with an average TDS of 7,101mg/L and ranging between 1,110mg/L and 18,600mg/L.

The water within the Tertiary is not considered a suitable groundwater resource and exceeds the stock watering (sulfate), aquatic ecosystem protection (95%) (copper (Cu), nickel (Ni) and zinc (Zn)), long-term irrigation (Bo, cobalt (Co) and molybdenum (Mo)) and drinking water (TDS, Na and chlorine (Cl)) water quality objectives. The water within the weathered units was also found to exceed the Fitzroy Plan water quality objectives for aquatic ecosystem protection (95%) (EC, bicarbonate, Cl, calcium (Ca), Na, hardness, magnesium (Mg), sulfate, Cu and Mn).

Permian

Groundwater salinity within the Permian coal seams was found to be variable. The Permian coal seam groundwater recorded an average TDS of 7,598mg/L with a range between 720mg/L and 24,704mg/L. Where present, the interburden units have record an average TDS of 5,349mg/L, ranging between 1,520mg/L and 9,126mg/L.

Comparison of groundwater results to the guideline levels indicates the Moranbah Coal Measures are not considered a suitable groundwater resource for irrigation, drinking water or aquatic ecosystems. Groundwater within the Permian meets the water quality objectives for stock water supply in selected bores, with guideline exceedances most common for TDS and SO₄.

Groundwater within the Permian coal seams recorded concentrations of:

- Sulfate (H Seam), dissolved aluminium (Al) (H Seam and D Seam), dissolved chromium (Cr) (D Seam), dissolved Cu (P Seam), dissolved Ni (P Seam) and dissolved Zn (P Seam and D Seam) above aquatic ecosystem (95%) protection guidelines
- Bicarbonate (D Seam) and Na (D Seam) above the Fitzroy Basin Zone 34 water quality objectives
- EC levels (H Seam and D Seam), concentrations of magnesium (H Seam and D Seam), Na (H Seam and D Seam), chloride (H Seam and D Seam), sulphate (H and D seams), dissolved Fe (H Seam and D Seam) and pH (D Seam) above the Fitzroy Basin Zone 34 water quality objectives

1.2.5.4 Groundwater use

The Queensland Government's Groundwater Bore Database indicates there are 62 registered bores within 5km of SRM. For the identified registered bores:

- 39 bores (63%) are used for groundwater monitoring and investigations
- 3 bores (5%) are likely to have a water supply purpose
- 20 bores (32%) do not have a registered use within the Groundwater Bore Database

A bore census undertaken (2007) in support of the Saraji Open Cut Extension Project (AECOM, 2016a) identified 12 bores within 11km of SRM on four separate landholder properties. All 12 bores were found to be unregistered bores, although four of the bores were in proximity to registered bore locations. For the 12 surveyed bores:

- 5 bores (42%) were equipped supply bores
- 1 bore (8%) was an equipped supply bore that was non-operational
- 1 bore (8%) was a supply bore undergoing maintenance (pump removed)
- 5 bores (42%) were not equipped

Source aquifer information is not available for the 12 bores found in the bore census; however, six of the bores were reported to have known depth information. Five of the six bores with known depth information access groundwater from depths of less than 80m with geological information indicating two of the bores likely access Tertiary whilst the remainder likely access the Fort Cooper Coal Measures.

Groundwater inflows from the Permian to SRM's active pits do not typically need to be actively dewatered in advance of mining, with evaporation from the pit walls and floors accounting for the removal of a majority of the groundwater seepage.

Site-specific assessments of groundwater dependent ecosystems (GDEs) (summarised in Appendix B) have identified the following:

- Remote sensing terrestrial GDEs identified a single area of potential terrestrial GDE was present within approximately 6km of SRM. The identified area is associated with the One Mile Creek Dam and is located on the western boundary of SRM, south of the MIA.
- Terrestrial ecology studies for the Saraji East Project (located immediately to the east of SRM) found the majority of floral assemblages within the area were characterised by drought tolerant species with low physiological sensitivity to water availability.
- Aquatic ecology field surveys for the Saraji East Project found no high ecological value waters or surface expression GDEs in, or surrounding, the SRM area. The surveys also found that aquatic habitats in SRM and the surrounding areas were characterised by typically isolated, small and shallow pools in natural watercourses with artificial waterbodies (dams) found to hold more permanent, extensive and deeper bodies of water.
- Stygofauna sampling undertaken in seven groundwater monitoring bores screened across Tertiary and Permian units during 2011 did not detect stygofauna species during the sampling events.

1.2.5.5 Conceptual site model

A hydrogeological conceptual site model (CSM) representing the last day of mining at SRM, is illustrated in Figure 8. The key hydrogeological features present at the end of mining that are relevant to the discussion of potential groundwater impacts post-mining are:

- Groundwater drawdown within the Moranbah Coal Measures, associated with passive dewatering into the SRM voids, resulting in inward hydraulic flow gradients in the coal measures
- Drawdown in the Moranbah Coal Measures at the end of mining is at, or close to, the maximum expected to occur as a result of the SRM operations
- Voids capture any seepage from spoil emplacements
- Voids capture seepage from TSFs
- Little to no impact on surficial aquifers including the Isaac River Alluvium
- Little to no additional impact on environmental receptors
- No impact on anthropogenic receptors

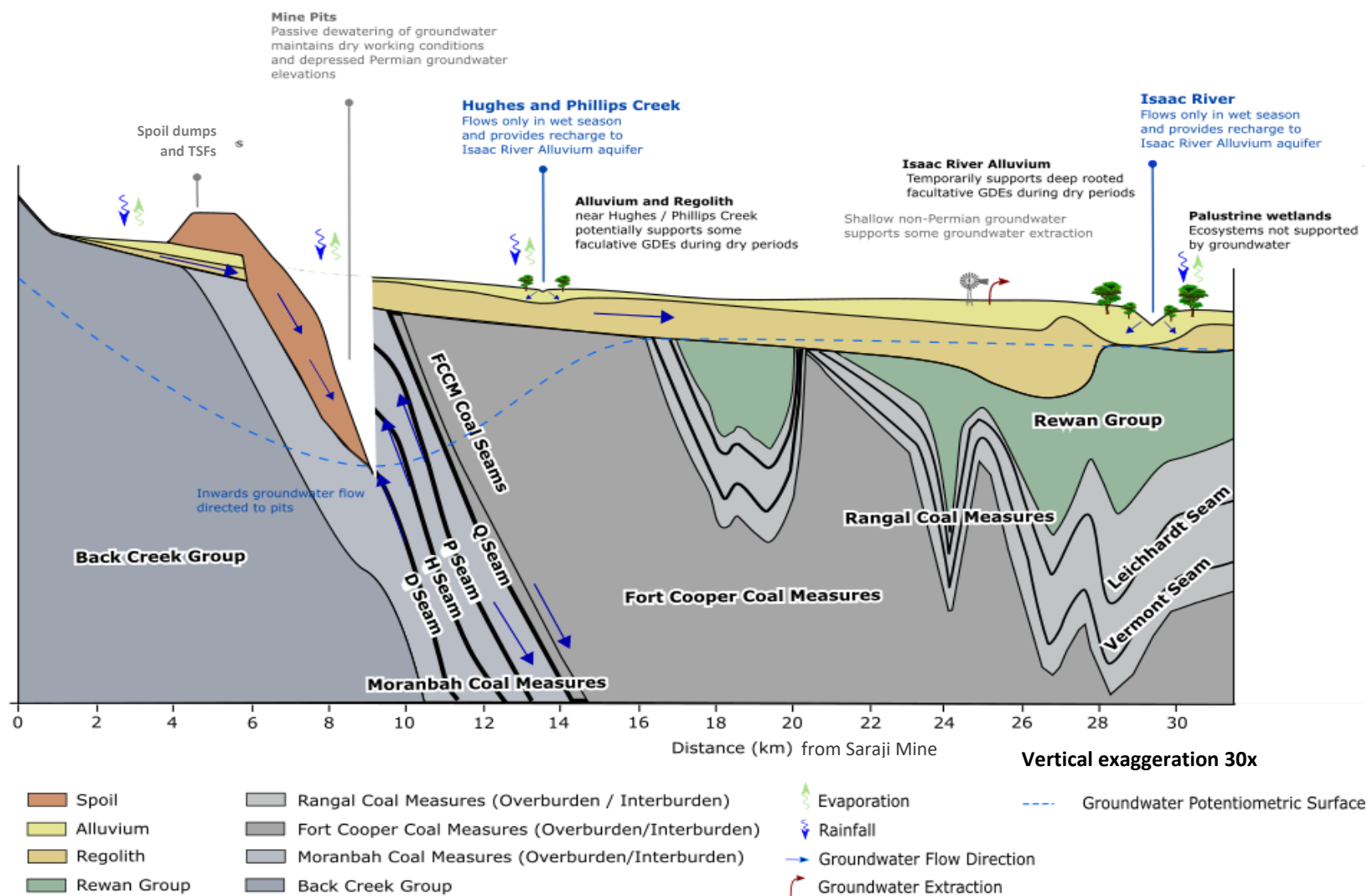


Figure 8: Conceptual site model of SRM at last day of mining (extent of mining) (SLR, 2023)

1.2.6 Soil types, properties and productivity

1.2.6.1 Soil context

A number of baseline soil surveys have been undertaken during the life of SRM. A total of 23 soil mapping units (SMUs) have been identified based on previous soil assessments (Emmerton B. R., 1999; Emmerton B. R., 2002b; Emmerton B. R., 2002a; GT Environmental, 2020; State of Queensland (Department of Resources), 2021). A summary of the Australian Soil Classification corresponding to the SMUs and a description of soil types at SRM are provided in Table 9. Soil mapping according to the Australian Soil Classification is shown in Figure 9. Further detail is provided in *Saraji Mine Material Characterisation Study* (Landloch, 2022a) Appendix C.

The pre-mining land suitability class was assessed by GT Environmental (2020) for the remaining undisturbed areas on the eastern side of SRM. The assessment was in accordance with the *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI & DNRM, 2015) classification system. This system allows for land to be allocated into five possible classes (with land suitability decreasing progressively from Class 1 to Class 5) which are derived from limitations that include soil type. The SRM pre-mining land suitability classes for grazing were predominately Class 2 to 4, as provided in Table 9.

Based on the topsoil characteristics, three soil management groups have been identified for rehabilitation: light textured loams and sands, heavy textured loams and sands and cracking clays. Table 10 summarises the chemical properties of representative undisturbed soil management groups at SRM.

Table 9: SRM baseline soil types

SMU code	Australian soil classification	Land suitability class	Soil management group	Description
2/20	Chromosol, Sodosol, Dermosol	3	Light loams/sands	Light sandy clay loam duplex soils to non-cracking clays on unconsolidated Cainozoic sediments
3	Chromosol, Sodosol	4 – 5	Light loams/sands	Sandy loam surfaced duplex soils on unconsolidated Cainozoic sediments
4	Vertosol	3	Cracking clays	Cracking clays with minor gilgai supporting brigalow and Dawson gum
5	Vertosol, Dermosol	3	Cracking clays	Cracking and non-cracking clays supporting Dawson gum and brigalow on deep tertiary clays
8	Chromosol, Sodosol	5	Heavy loams/clays	Clay loam duplex soils on sediments supporting Dawson gum and brigalow (Breakaway areas)
12	Chromosol, Sodosol	4 – 5	Light loams/sands	Sandy loam surfaced duplex soils on reworked Cainozoic sediments supporting poplar box
13	Chromosol, Sodosol	3	Heavy loams/clays	Hard-set silty duplex supporting mixed species (heavy shrub layer)
16/23	Chromosol, Sodosol	4 – 5	Light loams/sands	Fine sandy loam to silt loam surfaced duplex and gradational soil (older alluvial duplex soils)
17	Vertosol	4	Cracking clays	Minor clay soils in anabranches
18	Kandosol, Dermosol	3 – 5	Light loams/sands	Loamy sands, loams and gradational soils on stream banks and near stream levees
19	Kandosol, Dermosol	3	Light loams/sands	Loamy sand gradational soils present as relict alluvial levees

SMU code	Australian soil classification	Land suitability class	Soil management group	Description
A1 & A1V	Chromosol, Sodosol	3	Heavy loams/clays	Poplar box on deep duplex loams
A2	Vertosol	3	Cracking clays	Alluvial brigalow clay drainage lines
A3	Kandosol, Tenosol	3	Heavy loams/clays	Alluvial loamy creek channels
B1	Vertosol	1	Cracking clays	Undulating clay plains under brigalow or belah
B2 & B2V	Vertosol	2	Cracking clays	Mixed brigalow scrub on brown cracking clays
B3	Vertosol	2	Cracking clays	Cracking bark brigalow clays with gilgai
B4	Vertosol	3 – 4	Cracking clays	Melonhole brigalow clay plains
E1	Tenosol	3	Light loams/sands	Eucalypt woodlands on deep sandy loams
E2 & E2V	Vertosol, Dermosol	2	Cracking clays	Mountain Coolibah on dark basalt soils
E3	Chromosol, Sodosol	4	Heavy loams/clays	Poplar box on shallower loams
T1	Chromosol, Sodosol	4	Light loams/sands	Sandy hard duplex poplar box
T2	Chromosol, Sodosol	3	Light loams/sands	Deep sandy duplex plains with poplar box and ironbark

Table 10: Chemical properties of soil management groups (0-10cm) of SRM (Emmertton B. R., 2005)

Analysis (unit)	Soil management groups and sample ID					
	Light textured loams and sands		Heavy textured loams and sands		Cracking clays	
	S40 (north of Phillips Creek)	S12 (north of Phillips Creek)	S35 (between Phillips and Spring creeks)	S22 (north of Phillips Creek)	S41 (south of Hughes Creek)	J27 (south of Hughes Creek)
Soil pH (H ₂ O)	6.2	7.4	7.2	6.9	6.9	7.0
Soil EC (dS/m)	0.02	0.02	0.02	0.12	0.07	0.10
Total organic carbon (%)	0.80	0.60	1.45	1.06	1.95	1.75
Cation exchange capacity (CEC) (meq/100g)	7	3	9	9	29	20
Exchangeable sodium percentage (ESP) (%Na/CEC)	<3	4	<1	3	3	1
Ca/Mg (ratio)	2.2	3.3	2.6	3.1	1.8	2.8
Clay content %	15	9	20	25	36	31

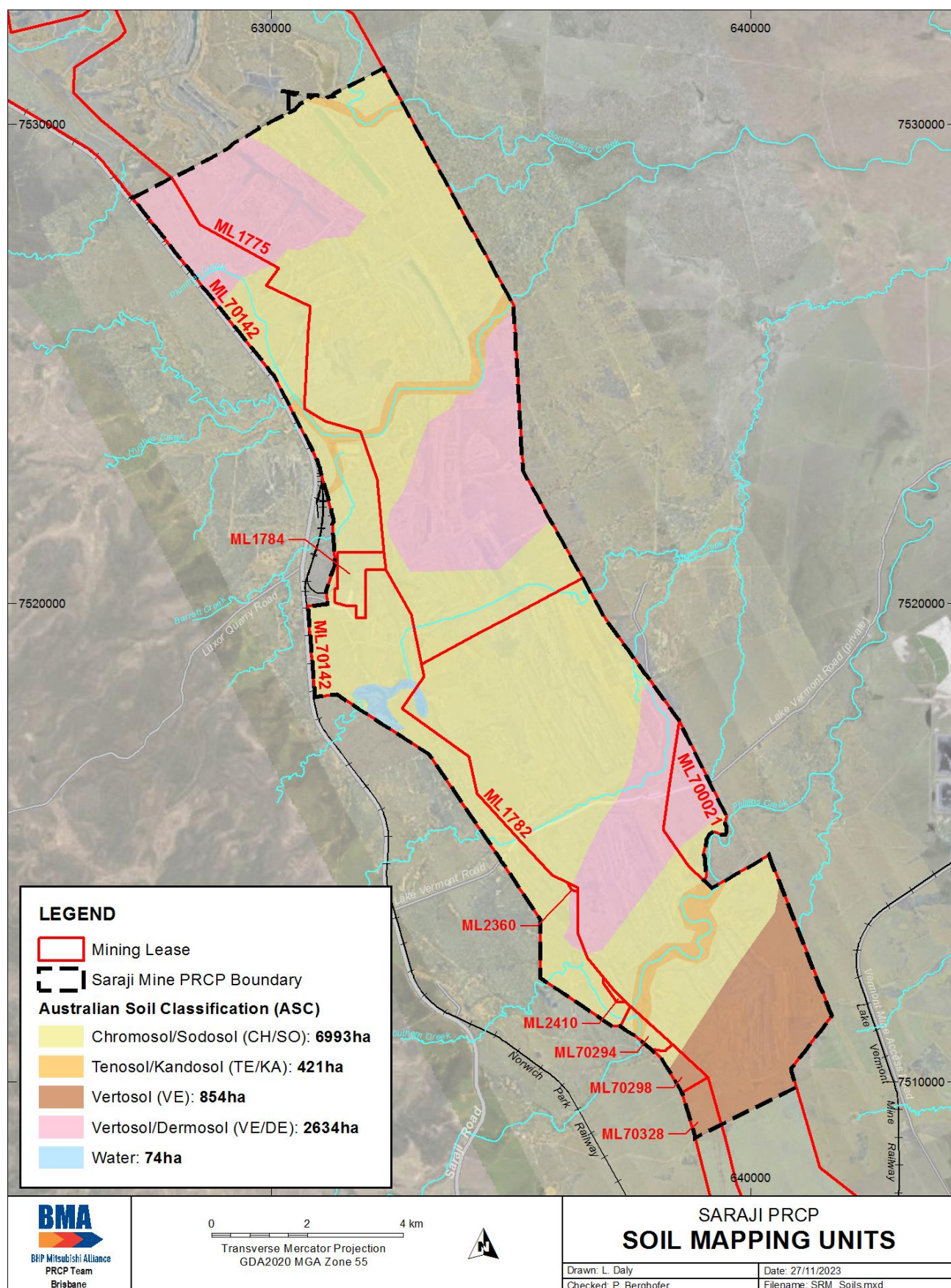


Figure 9: SRM soil mapping units (Australian Soil Classification)

1.2.7 Land stability

The pre-mining topography at SRM was generally flat to undulating and is consistent with the regional landscape. Non-mined areas adjacent to SRM and within the Bowen Basin indicate surface erosion is common upon disturbance of soils and vegetation from cattle grazing and other land uses.

1.2.8 Vegetation communities and ecological data

A number of ecological assessments of vegetation communities and ecological values have been undertaken within SRM. A review of habitat values for biodiversity and species of conservation significance was initially undertaken across SRM in 2005 (EcoServe and LAMR, 2005). A comprehensive baseline ecological assessment was undertaken by BAAM (2021). A terrestrial ecological assessment has also been undertaken along the north-eastern edge of SRM and in the adjacent mining lease area to the east (MLA70383) to support the Saraji East Mining Lease Project (AECOM, 2020). A number of additional smaller project based ecological assessments have also been undertaken within SRM (ELA, 2020; AECOM, 2016b).

The results of the BAAM (2021) ground-truthed vegetation survey have been used to map the regional ecosystems occurring on SRM. The results of the previous ecological studies and the following listed Queensland Government ecological database searches have been used to determine the other ecological values of the SRM site, as well as the fauna presence and habitats as discussed in Section 1.2.9:

- Wildlife Online Database (20km buffer surrounding the SRM site, July 2022) (DES, 2022b)
- Regional ecosystem mapping (DES, 2022c)
- Matters of State Environmental Significance mapping (MSES) (DES, 2022d)
- Maps of environmentally sensitive areas (DES, 2022f)

It is important to note that vegetation clearing and disturbance activities approved within SRM may have occurred since previous ecological assessments.

1.2.8.1 Regional ecosystems

The regional ecosystems (REs) on SRM were ground-truthed and mapped as part of the baseline ecological assessment undertaken by BAAM (2021). The remnant vegetation cover on SRM has been altered over time because of pre-mining clearing for agricultural land use purposes and clearing for approved mining activities. The areas of highest disturbance to date are contained within a broad central strip extending north to south through SRM. The remaining areas of remnant and high value regrowth (HVR) vegetation are mapped in patches on the foothills of the Cherwell Range to the west and on the undulating clay and sand plains to the east of the existing operational areas. Remnant and/or HVR vegetation also occurs in narrow strips in areas undisturbed by mining upstream and downstream of the watercourses.

The ground-truthed remnant and HVR REs mapped on SRM are listed in Table 11, along with their associated *Vegetation Management Act 1999* (VM Act) class and biodiversity status, and mapped in Figure 10.

Table 11: Ground-truthed regional ecosystems recorded during baseline assessments at SRM

RE descriptions	RE Code	Remnant/ High Value Regrowth (HVR)	RE VM Act* class	RE Biodiversity status
<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	11.3.1	Remnant	Endangered	Endangered
<i>Eucalyptus populnea</i> woodland on alluvial plains	11.3.2	Remnant	Of concern	Of concern
<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains	11.3.4	Remnant	Of concern	Of concern

RE descriptions	RE Code	Remnant/ High Value Regrowth (HVR)	RE VM Act* class	RE Biodiversity status
<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	11.3.25	Remnant	Least concern	Of concern
<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	11.4.8	Remnant HVR	Endangered	Endangered
<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains	11.4.9	Remnant HVR	Endangered	Endangered
<i>Eucalyptus populnea</i> and/or <i>E. melanophloia</i> and/or <i>Corymbia clarksoniana</i> on Cainozoic sand plains and/or remnant surfaces	11.5.3	Remnant HVR	Least concern	No concern at present
<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and/or remnant surfaces	11.5.9	Remnant HVR	Least concern	No concern at present
<i>Corymbia citriodora</i> woodland on coarse-grained sedimentary rocks	11.10.1	Remnant	Least concern	No concern at present
<i>Acacia catenulata</i> or <i>A. shirleyi</i> open forest on coarse-grained sedimentary rocks. Crests and scarps	11.10.3	Remnant HVR	Least concern	No concern at present

*VM Act = Queensland's Vegetation Management Act 1999 (VM Act)

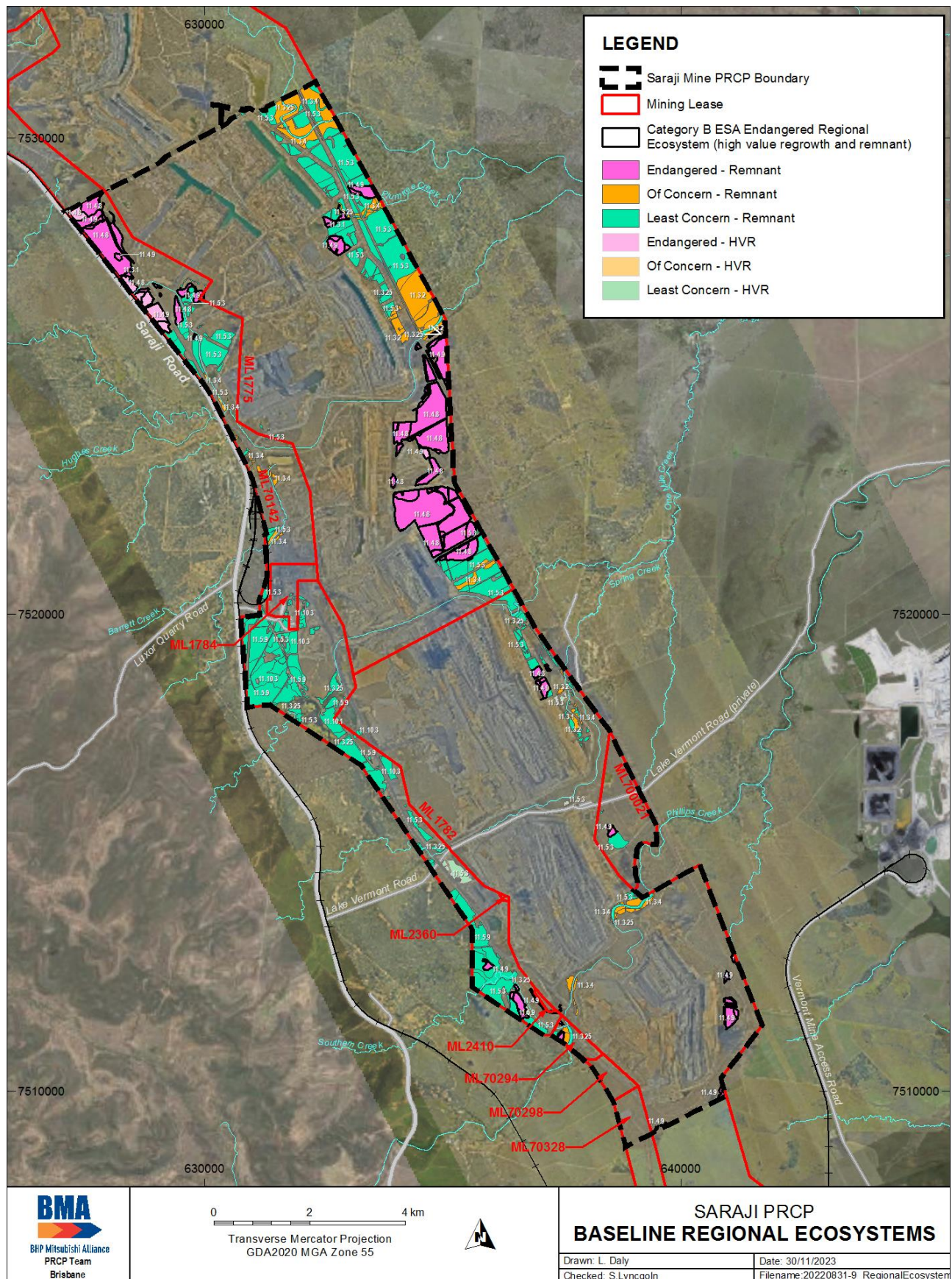


Figure 10: SRM regional ecosystems

1.2.8.2 Environmentally sensitive areas

Category B environmentally sensitive areas (ESAs) are defined under Schedule 19 of the *Environmental Protection Regulation 2019* to include Endangered REs based on the biodiversity status identified in the 'Regional ecosystem description database' (Queensland Herbarium, 2023)

The following ground-truthed REs with a current Endangered biodiversity status have been ground-truthed at SRM in associated with Category B ESAs (Figure 10):

- 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

1.2.8.3 State significant flora species

No threatened flora species under the *Nature Conservation Act 1992* (NC Act) have been recorded during previous baseline ecological surveys on the SRM site (BAAM, 2021; AECOM, 2020; EcoServe and LAMR, 2005).

1.2.9 Fauna presence and populations

1.2.9.1 State significant fauna species

The following threatened fauna species under the NC Act are known to occur on SRM based on the results of ecological surveys:

- Koala (*Phascolarctos cinereus*) (Endangered NC Act) (BAAM, 2021; ELA, 2020)
- Central greater glider (*Petauroides armillatus*) (Endangered NC Act) (BAAM, 2021; AECOM, 2016b)
- Ornamental snake (*Denisonia maculata*) (Vulnerable NC Act) (EcoServe and LAMR, 2005; AECOM, 2016b)
- Squatter pigeon (*Geophaps scripta scripta*) (Vulnerable NC Act) (BAAM, 2021; AECOM, 2016b)
- Grey falcon (*Falco hypoleucos*) (Vulnerable NC Act) (EcoServe and LAMR, 2005)
- Australian painted snipe (*Rostratula australis*) (Vulnerable NC Act) (AECOM, 2020)
- Short-beaked echidna (*Tachyglossus aculeatus*) (Special least concern NC Act) (BAAM, 2021).

The highest density of koala activity was along Boomerang Creek to the north of SRM and Phillips Creek to the south. Preferred koala habitat has been mapped on SRM in association with remnant and regrowth eucalypt woodland to open forest containing preferred food trees associated with REs 11.3.2, 11.3.4 and/or 11.3.25. Preferred koala feed tree species at SRM include *Eucalyptus camaldulensis*, *E. tereticornis*, *E. populnea*, *E. coolabah*, and *E. orgadophila* (BAAM, 2021) (Figure 11).

The greater glider has been recorded within *Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland fringing drainage lines or on alluvial plains in the northern and southern sections of SRM (BAAM, 2021). Greater glider habitat has been mapped in remnant and regrowth eucalypt woodlands with hollow bearing trees including patches of REs 11.3.2, 11.3.4, 11.5.3 and 11.10.1, as well as patches of brigalow woodland with emergent eucalypts that is representative of RE 11.3.1 (BAAM, 2021) (Figure 11).

Preferred habitat for ornamental snake includes areas currently or previously dominated by brigalow or coolibah communities with gilgai micro-relief and/or deep soil cracks. Ornamental snake habitat has been mapped in association with areas of remnant and regrowth brigalow associated with REs 11.4.8 and 11.4.9 (BAAM, 2021) (Figure 12).

Squatter pigeon has been detected at several dams adjacent to patches of remnant floodplain vegetation (BAAM, 2021). Squatter pigeon habitat has been mapped on SRM in association with remnant and regrowth eucalypt dominated REs within 1km of suitable water sources, including larger watercourses and waterbodies that hold pools of water for extended periods (BAAM, 2021) (Figure 12).

The areas where the grey falcon is most likely to breed and/or hunt within SRM have been mapped along riparian corridors and alluvial plains in association with REs 11.3.1, 11.3.2, 11.3.4 and/or 11.3.25 (BAAM, 2021) (Figure 12).

The Australian painted snipe was observed from an area of flooded brigalow woodland. Potential habitat in the form of vegetation fringed dams occurs within SRM (BAAM, 2021).

Short-beaked echidna has been recorded in remnant riparian vegetation along Phillips Creek and scats and diggings have been detected at several other locations. This species occurs in a wide range of habitats and is likely to occupy remnant and regrowth habitats within SRM site (BAAM, 2021) (Figure 10).

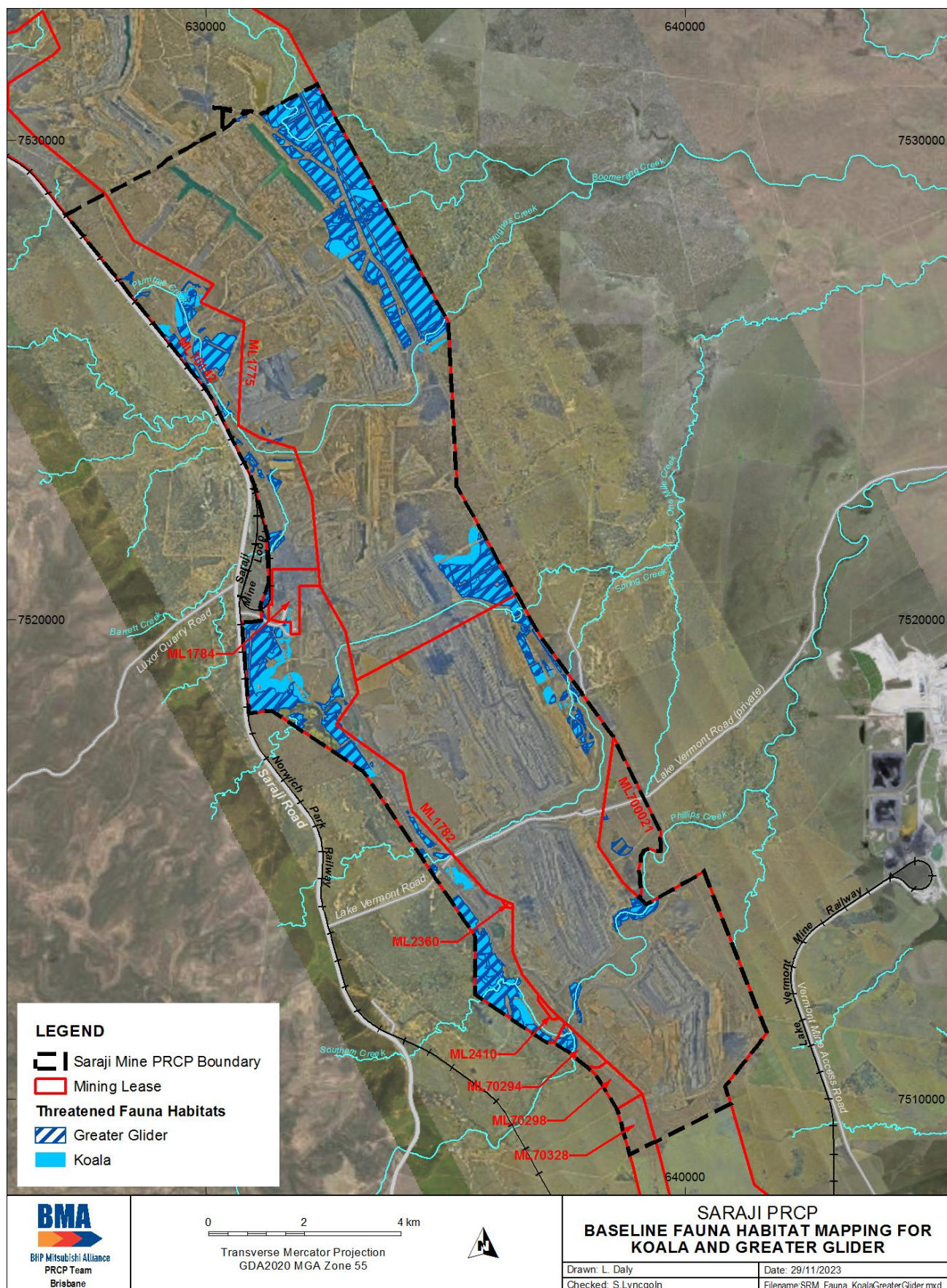


Figure 11: SRM fauna habitat mapping for koala and greater glider

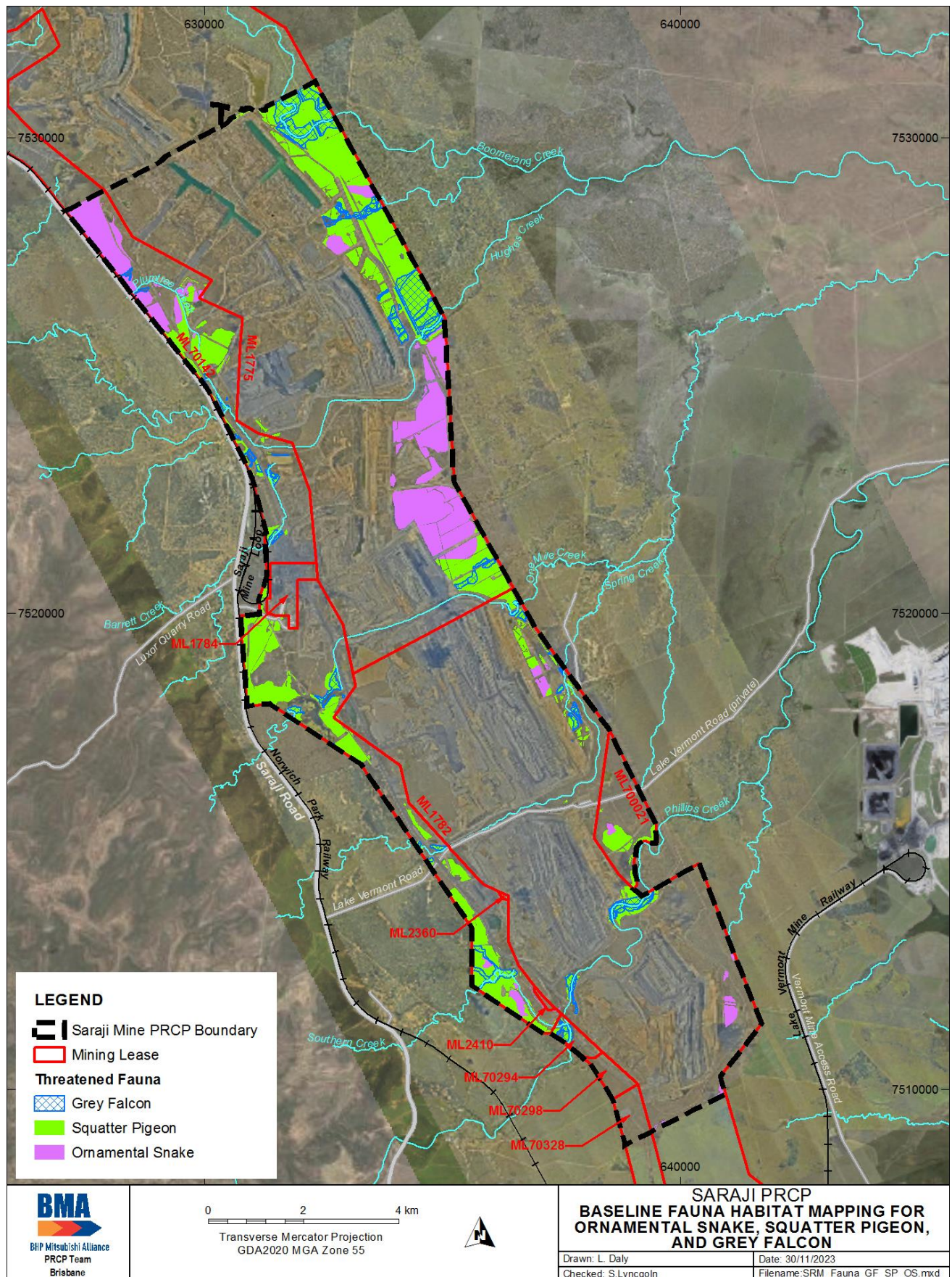


Figure 12: SRM fauna habitat mapping for ornamental snake, squatter pigeon and grey falcon

1.2.10 Pre-mining land use

Prior to mining, the SRM site was predominately used for low to moderate density grazing. A review of publicly accessible Queensland Government aerial images (State of Queensland, 1996) for the SRM area indicated that prior to disturbance from mining, the broader area also supported woodlands and open forests.

1.2.11 Contaminated land

Mining operations at SRM commenced in 1974, prior to the inclusion of modern environmental legislative requirements and standards. Therefore, pre-mining baseline contaminated land data and records pertaining to historical environmental incidents/management from the earlier SRM operations are not available.

Operations at SRM since the commencement of mining/exploration have included heavy industrial type activities and supporting infrastructure including the following:

- Drilling/exploration
- Extraction and processing of coal
- Chemical storage and formulation
- Waste storage and disposal
- Sewage treatment
- Operation of a variety of plant/equipment workshops and scrap yards
- Petroleum product storage and dispensing
- Explosive production, storage and use
- Operation of regulated structures such as TSFs and other dams

The nature of these types of operations, which include the storage, handling, use and disposal of hazardous materials, particularly over SRM's historical and planned operations, have the potential to result in the contamination of land. Properties (Lot 7 on CNS144, Lot 9 SP235297, Lot 10 on SP208611, Lot 11 on CNS394 and Lot 140 on SP321207) on which the SRM EA is located, are listed on the Queensland Environmental Management Register for a range of notifiable activities including:

- Asbestos manufacture or disposal
- Landfill
- Mine wastes
- Scrap yards
- Waste storage, treatment or disposal
- Petroleum product or oil storage
- Chemical manufacture or formulation
- Chemical storage
- Explosive production or storage

At the time of the contaminated land searches (August 2021), the searched properties were not listed on the Queensland Contaminated Land Register and did not have Site Management Plans attached to the register listings.

The current SRM EA provides for the conditional on-site disposal of various wastes including:

- Rejects and tailings
- Bulk rubber
- Inert waste
- Poly-pipe and other plastic

- Fibreglass
- Treated and untreated timber
- Asphalt
- Asbestos
- Treated sewage effluent
- Co-mingled hydrocarbons

The current EA also allows for the receipt of the above listed wastes from BHP Mitsui Coal (BMC)² or BMA sites in Queensland.

Current management of contaminated land is undertaken in accordance with the EP Act (1994) and the EA conditions that require the reporting of releases of hazardous contaminants and monitoring of surface water, sediment and groundwater on a regular basis. However, due to the age of operations, historical practices are not well documented. Based on historical practices and the nature of site operations, it is anticipated that waste disposal and other activities have occurred at the site that potentially have resulted in land contamination that will require on-going management.

1.2.12 Underlying landholders

The SRM site comprises a mix of BMA freehold land and leasehold land.

The TLO and rail loop located to the west of the SRM MIA are owned by Queensland Rail (QR) and operated by Aurizon.

Saraji Road, which is an Isaac Regional Council (IRC) asset, runs in a north-south direction adjacent to SRM's western boundary. Due to the agreed closure of the Lake Vermont Road, BMA has written agreement to allow Arrow Energy access to their eastern petroleum tenements via SRM.

An easement held by Sunwater accommodating the Eungella Water Pipeline (which is also owned by Sunwater) is located on leasehold land within ML1775 to the north. An easement held by Q.E.C. Ltd is located on BMA-owned land within ML7182 to the south.

The underlying landholders for SRM are shown in Figure 13.

1.2.13 Sensitive receptors

The EP Act and PRCP Guidelines do not define 'sensitive receptor'. In the context of the PRCP, BMA define a sensitive receptor post-mining as any of the following (within the EA boundary):

- Residential building, for example dwelling, residential premise, or homestead
- Sensitive place for humans: educational institution, childcare, medical centre/health care or hospital
- Conservation or protected area
- QLD Aboriginal and Torres Strait Islander Cultural Heritage Register location/area
- Groundwater bore with supply/stock water use
- Waterway ecosystem
- GDE

Sensitive receptor locations within the SRM EA boundary include waterway ecosystems, including Boomerang, Plumtree, Hughes, Barrett, One Mile, Spring, Southern and Phillips creeks. Sensitive receptors were considered when planning the PMLUs, as well as the water management and revegetation rehabilitation methodologies.

² BHP divested its 80 per cent interest in BMC to Stanmore Resources Limited on 3 May 2022

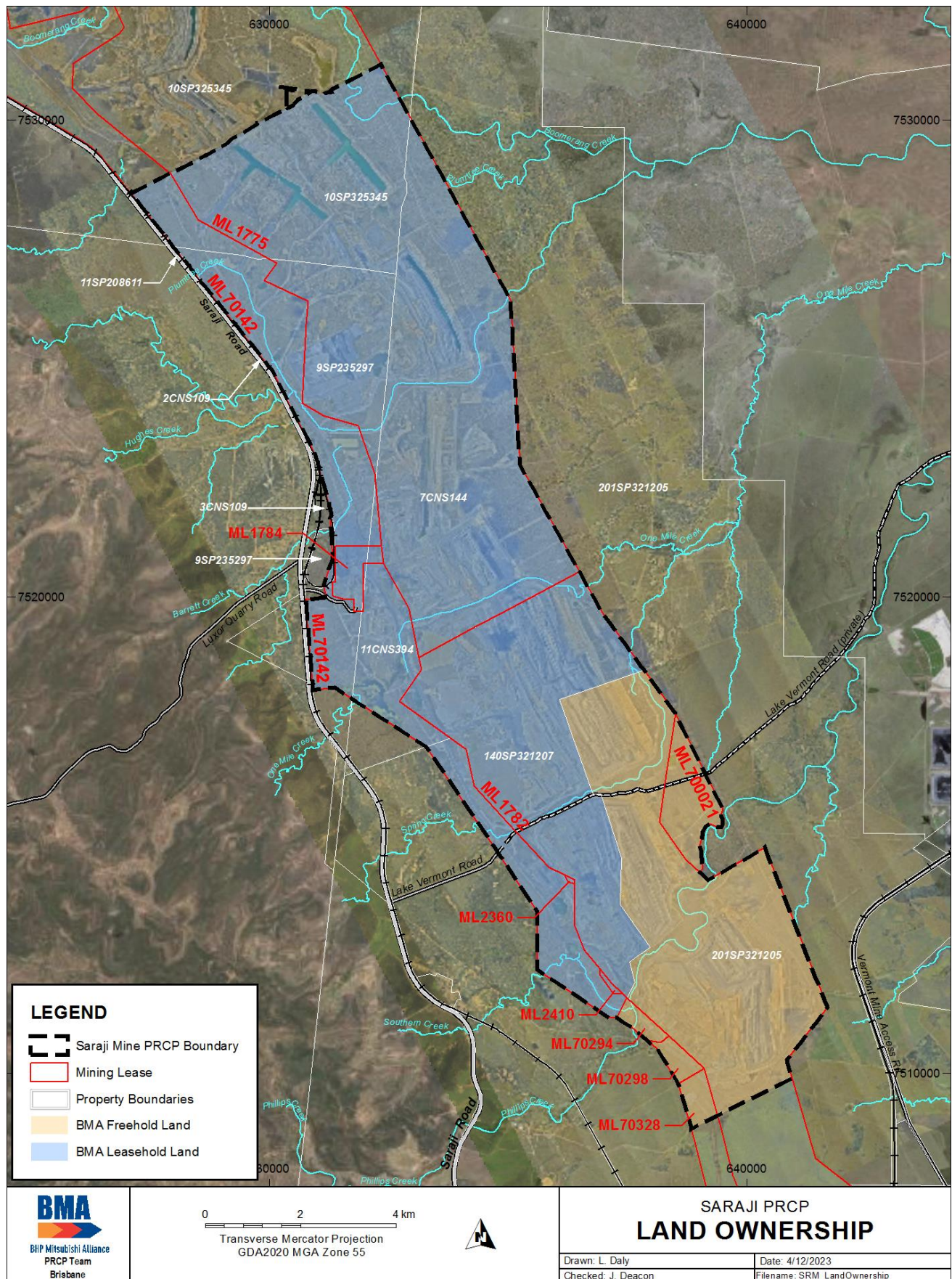


Figure 13: SRM land ownership

1.3 Design for closure

This PRC Plan has been developed to manage progressive rehabilitation of the SRM 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 SRM that will require rehabilitation, the predicted duration and availability for progressive rehabilitation, are provided in Table 12. Any infrastructure that is beneficial to the PMLU may be retained and will not be available for rehabilitation.

Table 12: Relevant activities requiring rehabilitation at SRM

Relevant activity	Predicted duration	Availability for progressive rehabilitation
Spoil dumps	Active dumping of spoil and rejects to spoil dumps will continue until the end of mining in 2098	• Progressive rehabilitation has commenced • Available for progressive rehabilitation as dump areas reach final position and are no longer required for associated infrastructure or access requirements • Due to the depth of the mining operation and the size of the spoil dumps, areas become available as per the indicative dump progression shown in Figure 14 • Progressive rehabilitation is maximised by scheduling rehabilitation as soon as practicable after land becomes available

Relevant activity	Predicted duration	Availability for progressive rehabilitation
		- Low-wall areas become available once mining in each pit is complete - Figure 15 provides indicative areas and years the spoil dump areas are available for rehabilitation 76% 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
TLO and rail infrastructure (BMA owned)	Utilised until the end of coal loading	Land is available for rehabilitation once coal loading is complete and infrastructure is removed by third party owners
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 and minor ancillary activities	Exploration: western areas are planned until 2025; other areas likely in the future Minor ancillary activities: throughout the operational life	- Available for rehabilitation within six months after exploration activities are complete (as per <i>Eligibility criteria and standard conditions for exploration and mineral development project</i>) - Available for rehabilitation once minor ancillary activities are complete
Creek 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: Spring Southern Creek diversions are available for rehabilitation after construction; Phillips, Hughes and One Mile creeks are available for rehabilitation as the spoil dumping progresses past the area; other areas are available for rehabilitation at the end of mining or after

Relevant activity	Predicted duration	Availability for progressive rehabilitation
		major rehabilitation activities are complete
TSFs	Varying, depending on design capacity	• TSF no. 3 is partially available for rehabilitation • Other areas are available for rehabilitation once planned dumping of spoil above each TSF reaches the final spoil dump position and the area is no longer required for associated infrastructure or access requirements
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

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 (as per EA condition E4).

Management milestones for residual voids are scheduled to commence as soon as each void becomes available for improvement, after final mining and backfill in each void.

Further details on the availability of areas for progressive rehabilitation are included in Section 1.4.5.

1.4.1.1 EA progressive rehabilitation conditions

The SRM EA (at the time of the development of the transitional PRCP) included the below key condition regarding the commencement of progressive rehabilitation:

- E4: “*Progressive rehabilitation for all areas except for Grevillea Pit must commence within two (2) years of when areas become available within the mining leases.*”

1.4.2 Rehabilitation areas and milestones

The RAs and RMs included in the PRCP schedule for SRM are referred to throughout this PRC Plan.

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 SRM RAs, as well as the relevant activities associated with each RA, are detailed in Table 13 and shown in Figure 29, and the RMs are detailed in Table 14. As required by the PRCP Guideline, only PMLU areas where disturbance has occurred or will occur, are mapped as a RA. Areas of ML70142 and undisturbed creek areas 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 (authorised by PRCP schedule condition PRCP9). 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 13: Rehabilitation areas, associated PMLUs and relevant activities for SRM

RA*	PMLU	Relevant activity
RA1	Woodland habitat	Spoil dumps
RA2	Watercourse	- Creek diversions - Watercourse crossings
RA3	Cattle grazing	- CHPP and associated infrastructure - Administration, warehouse, crib and various buildings - Workshop, fuel, oil and chemical storage - Coal stockpiles - TLO and rail infrastructure - Selected mine dams - Roads - Laydown areas - General infrastructure and disturbance
RA4	Woodland habitat	- Exploration - Roads - Laydown areas - Spring/Southern Creek diversion construction works - General infrastructure and disturbance
RA7	Cattle grazing	Spoil dumps – existing rehabilitation
RA9	Grassland	TSF
RA10	Woodland habitat	Spoil dumps – existing rehabilitation

* BMA uses a consistent set of RAs across their assets, and as such some RA numbers are not relevant at SRM

Table 14: Rehabilitation milestones for SRM

Rehabilitation milestones	
RM1	Infrastructure decommissioning and removal
RM2	Remediation and/or management of contaminated land
RM3	Landform development and reshaping
RM4	Surface preparation (cattle grazing, grassland)
RM5	Surface preparation (woodland habitat)
RM6	Surface preparation (watercourse)
RM7	Revegetation (cattle grazing, grassland)
RM8	Revegetation (woodland habitat)
RM9	Revegetation (watercourse)

Rehabilitation milestones	
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, RA4)
RM15	Achievement of post-mining land use to a stable condition (watercourse – RA2)
RM17	Achievement of post-mining land use to a stable condition (cattle grazing - existing rehabilitation – RA7)
RM18	Achievement of post-mining land use to a stable condition (woodland habitat - existing rehabilitation – RA10)
RM19	Achievement of surface requirements (grassland)
RM20	Achievement of post-mining land use to a stable condition (grassland – RA9)

1.4.3 Improvement areas and milestones

The IAs and MMs included in the PRCP schedule for SRM are referred to throughout this PRC Plan.

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 SRM IAs, as well as the relevant activities are detailed in Table 15 and shown in

Figure 29, and the MMs are detailed in Table 16.

Table 15: Improvement areas and relevant activities for SRM

Improvement area (IA)	NUMA	Relevant activity
IA1	NUMA	Residual voids

Table 16: Management milestones for SRM

Management milestones	
MM1	Achievement of structural stability
MM2	Achievement of surface requirements
MM3	Achievement of sufficient improvement

1.4.4 Existing rehabilitation

Progressive rehabilitation at SRM commenced in 1995, with approximately 850ha being completed since 1995. Prior to 2006, the majority of rehabilitation was planned to achieve safe, stable, non-polluting and self-sustaining revegetation able to support a cattle grazing PMLU. From 2006, rehabilitation has planned to achieve areas of cattle grazing PMLU, as well as woodland habitat PMLU, depending on the location.

A portion of the historical rehabilitation at SRM has not been included as progressed rehabilitation in the PRCP schedule due to:

- Areas located in the north at Acacia, Bauhinia and Coolibah pits are planned to be dumped over in the current life-of-mine plans for additional spoil dump capacity.
- Other areas will be re-disturbed by various mining activities, such as operating infrastructure or machinery for mining. These areas are scheduled to be rehabilitated once the areas are no longer required for mining activities or infrastructure.
- Some areas of rehabilitation undertaken between 1995 and 2005 currently have extensive leucaena (*Leucaena leucocephala*) thickets. Leucaena was included in rehabilitation seed mixes in the 1990s as it was considered suited to the soils, provided soil stabilisation and was planted for cattle fodder (leucaena stems less than 2m high can be readily eaten by grazing livestock). However, if not controlled, leucaena can form dense thickets that hinder achievement of the PMLU.
- A portion of historical rehabilitation requires rework corrective actions to achieve the nominated PMLUs. These areas are scheduled to commence rehabilitation in the PRCP schedule over the next five years.

The PRCP schedule (submitted in 2024) included 257ha of existing rehabilitation progressing towards achievement of the nominated PMLUs. The commenced rehabilitation was scheduled in the PRCP schedule for the next RM the rehabilitation was planned to achieve, as shown in Table 17.

Table 17: Progression of existing rehabilitation to the next rehabilitation milestone in the PRCP schedule (as of 2024)

RA	Cattle Grazing (ha)	Woodland Habitat (ha)		
	RM10	RM8	RM11	RM18
RA7	161	-	-	-
RA10	-	42	29	25
Total	161	42	29	25

Representative areas of commenced cattle grazing and woodland habitat rehabilitation and their associated monitoring results have been summarised in Table 18 and Table 19, respectively.

The rehabilitation methodology and RM most applicable to the implemented process for existing commenced rehabilitation at SRM has included:

- Cattle grazing:
 - RM3: Reshaped to maximum 12%, however most areas average approximately 10%
 - RM4: Applied topsoil to a minimum depth of 150mm
 - RM4: Applied ameliorants, such as gypsum and fertiliser
 - RM4: Shallow ripped
 - RM4: More recent rehabilitation has included application of surface mulch, such as straw
 - RM7: Revegetated based on seasonally available seed mixes, no records are available on specific seed species
- Woodland habitat:
 - RM3: Reshaped to maximum 25%
 - RM3: Applied rock mulch on steeper areas
 - RM5: Applied a thin veneer of topsoil (>100mm)
 - RM5: Applied ameliorants, such as gypsum
 - RM5: Deep ripped
 - RM5: More recent rehabilitation has included application of surface mulch, such as straw
 - RM8: Revegetated based on seasonally available seed mixes, no records are available on specific seed species

- RM11: Sufficient groundcover and species richness achieved as indicated by rehabilitation monitoring data

Routine rehabilitation monitoring will continue to be implemented to identify any maintenance/corrective actions required to enable the existing rehabilitated areas to progressively achieve the rehabilitation milestones.

No progressive certification applications under the EP Act have been applied for SRM rehabilitation areas.

Table 18: Representative areas of existing cattle grazing rehabilitation areas

Area	RA7 - Ramp 4	RA7 – Southern Creek
Image		
Monitoring year	2023	2023
Next RM in PRCP schedule	RM10	RM10
Coordinates (MGA2020 Zone 55)	632349 E, 7524249 N	636659 E, 7512217 N
Mean slope (%)	11	12
Age (years)	4	16 (approximately)
Total groundcover (%)	95 – 100	100
Preferred pasture species	<i>Chloris gayana</i> (cvv Callide) (rhodes grass*), <i>Cenchrus ciliaris</i> (buffel grass*), <i>Megathyrsus maximus</i> (green panic grass*)	<i>Cenchrus ciliaris</i> (buffel grass*), <i>Chloris gayana</i> (cvv Callide) (rhodes grass*)
Dry matter yield (kg/ha)	3,000 – 4,000	3,500 – 5,000
Pasture condition	1	2
Land condition	A - Good	A - Good
Land suitability class	4 - 5	4
Limiting factors	PAWC, pH in 0.1m, Slope %/ ESP, ESP at depth 0.5m	Available P, pH in 0.1m

*Exotic species

Table 19: Representative areas of existing woodland habitat rehabilitation

Area	RA10 - Ramp 4	RA10 – Southern Creek
		
Monitoring year	2023	2023
Next RM in PRCP schedule	RM18	RM18
Coordinates (MGA2020 Zone 55)	632744 E, 7524289 N	636779 E, 7512066 N
Mean slope (%)	9 – 11	10
Age (years)	15 (approximately)	15 (approximately)
Total groundcover (%)	84 – 97	99
Tree canopy cover (%)	50 – 64	52
Tree species	<i>Eucalyptus camaldulensis</i> (river red gum), <i>Eucalyptus orgadophila</i> (mountain coolibah), <i>Eucalyptus crebra</i> (narrow leaved ironbark), <i>Acacia aneura</i> (mulga), <i>Casuarina cristata</i> (belah), <i>Eucalyptus melanophloia</i> (silver leaved ironbark), <i>Acacia salicina</i> (sally wattle)	<i>Corymbia citriodora subsp. variegata</i> (spotted gum), <i>Eucalyptus orgadophila</i> (mountain coolibah), <i>Acacia salicina</i> (sally wattle), <i>Acacia aneura</i> (mulga), <i>Eucalyptus camaldulensis</i> (river red gum), <i>Eucalyptus cambageana</i> (Dawsons gum), <i>Casuarina cristata</i> (belah), <i>Corymbia tessellaris</i> (Moreton Bay ash)
Shrub species	<i>Acacia salicina</i> (sally wattle), <i>Eucalyptus melanophloia</i> (silver leaved ironbark), <i>Eucalyptus orgadophila</i> (mountain coolibah), <i>Acacia aneura</i> (mulga), <i>Eucalyptus crebra</i> (narrow leaved ironbark)	<i>Acacia salicina</i> (sally wattle), <i>Eucalyptus orgadophila</i> (mountain coolibah), <i>Eucalyptus camaldulensis</i> (river red gum), <i>Ehretia membranifolia</i> (lolly bush)
Grasses	<i>Cenchrus ciliaris</i> (buffel grass*), <i>Megathyrsus maximus var. maximus</i> (guinea grass*), <i>Chloris inflata</i> (purpletop chloris*), <i>Bothriochloa pertusa</i> (Indian couch*)	<i>Cenchrus ciliaris</i> (buffel grass*), <i>Chloris inflata</i> (purpletop chloris*), <i>Megathyrsus maximus var. pubiglumis</i> (green panic*), <i>Melinis repens</i> (red natal grass*)
Other species	<i>Sida cordifolia</i> (flannel weed*), <i>Stylosanthes hamata</i> *, <i>Enchylaena tomentosa</i> (ruby saltbush), <i>Pterocaulon serrulatum</i> (fruit salad plant)	<i>Sida cordifolia</i> (flannel weed*), <i>Malvastrum americanum</i> (spiked malvastrum*), <i>Enchylaena tomentosa</i> (ruby saltbush)

*Exotic species

1.4.5 Availability for progressive rehabilitation

As indicated in Table 12, the spoil dumps are the area predominantly available for progressive rehabilitation during mining. As mining progresses down-dip and the pits get deeper, the spoil dumps increase in height to fit the increased volume of spoil material. Increasing the dump height maximises the material dumped in-pit and reduces out-of-pit dumping. Due to the large size of the SRM spoil dumps, the outside spoil dump areas (the areas to be rehabilitated) are only a small proportion of the operational dump surface as the dumps advance, as shown in Figure 14. Areas become available for rehabilitation as spoil dumps reach the final spoil dump extents. For deep mines such as SRM, the amount of area available for rehabilitation progressively throughout the mine life is limited due to:

- Dumping occurs over multiple dump faces at various dump bench heights, with multiple dump access ramps required for access. The dump access ramps change location over time as the dumps progress. These dump access ramps, plus the coal access ramps, restrict the dump footprint available and results in the separate dump areas progressing at different rates. The access ramps also limit the area available for progressive rehabilitation until they are no longer required. Numerous coal access ramp voids are planned to be backfilled towards the end of mining. Once backfilled, these areas become available for rehabilitation.
- Dumps can only increase in height once mining has progressed sufficiently to ensure the lower dump benches have also advanced sufficient distance for geotechnical stability of the spoil. This limits progressive rehabilitation to the outside of the lower dump benches as more spoil is dumped above. Significant areas become available for rehabilitation as the final and highest dump bench is completed dumping.
- The spoil dump low-walls continually advance with the mining operation and increase in height with the spoil dumps. The low-wall PMLU area of each pit becomes available for rehabilitation once mining and final backfill of the void is complete.

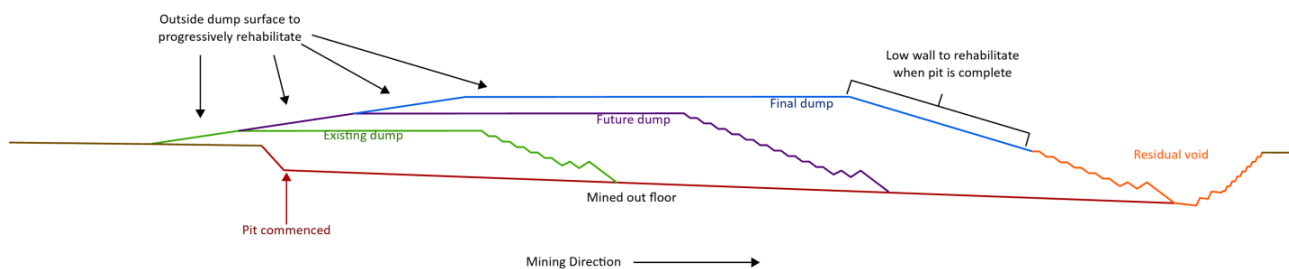


Figure 14: Indicative dump progression during life-of-mine (illustrative purposes only)

The spoil dump areas do not become available for progressive rehabilitation at a linear rate due to the mining and dumping sequence, configuration of spoil dumps and ramp access, and height and stability requirements to balance the required dump capacity. The area available for progressive rehabilitation is limited earlier in the schedule, with the majority of spoil dump areas becoming available for rehabilitation later in the schedule as dumps reach their maximum extents at a faster rate, and the low-wall areas become available once mining in each pit is complete.

Figure 15 shows the indicative progressive rehabilitation areas for the SRM spoil dumps (RA1) as mining progresses. This figure highlights the outside spoil dump areas of the lower dump benches being available for rehabilitation earlier in the life of the mine, with available areas progressing up the spoil dump slope over time, until the top dump bench and low walls become available at the end of mining in each pit. However, by the end of mining in 2098, the vast majority of the spoil dumps (76%) will have achieved the execution milestones in the PRCP schedule (Section 10.5) and have been rehabilitated to the point of revegetation (Table 20). Therefore 76% of the spoil dumps will only require monitoring and maintenance from this point to achieve the PMLU. After 2098, rehabilitation execution of the spoil dumps only remains for Jacaranda-Bauhinia low-wall and operational areas on the spoil dumps that are required until the end of mining e.g. haul roads and park-up areas.

Other areas are typically required to support mining operations, such as infrastructure areas, with limited area available for rehabilitation until mining is complete (Table 20). Areas associated with individual pits become available as mining finishes in each pit.

Table 20: PRCP schedule progressive rehabilitation summary

RA/ IA	Description	Total area (ha)	% of disturbed area	Completed RM 7-9 by 2098 (ha)	Completed RM 7-9 by 2098 (%)
RA1	Spoil Dumps	6,775	63	5,161	76
RA2	Creek diversions and crossings	211	2	176	83
RA3	Infrastructure areas - CHPP, MIA, workshop, dams, coal stockpiles, roads, general infrastructure	906	8	-	0
RA4	Roads, creek corridor areas, exploration and general infrastructure	707	7	105	15
RA7	Existing rehabilitation cattle grazing	161	2	161	100
RA9	TSF	41	0	24	58
RA10	Existing rehabilitation woodland	96	1	96	100
IA1	Residual voids	1,838	17	1,080 (MM1/MM2)	59
	Total	10,735	100	6,797	63

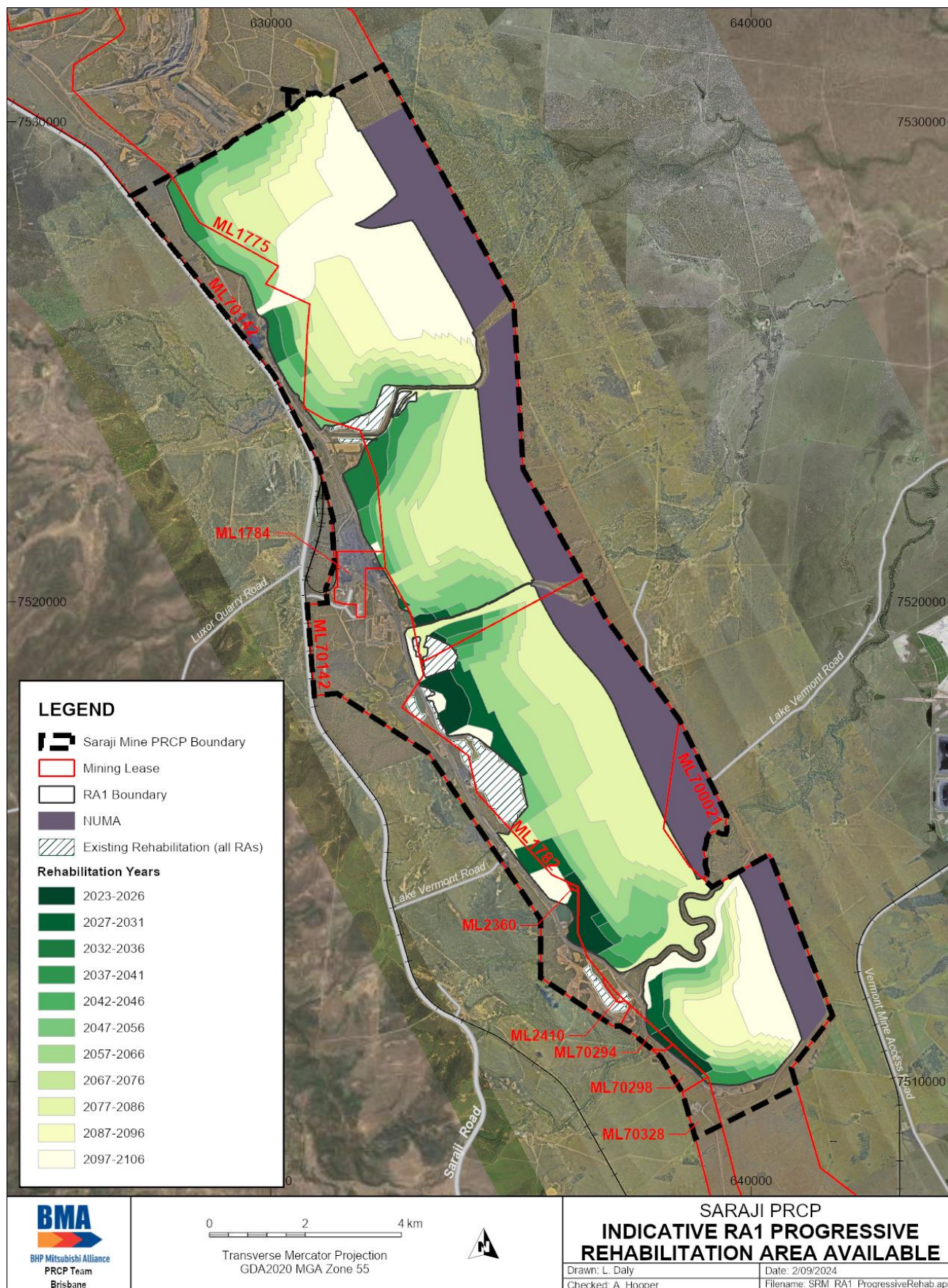


Figure 15: Indicative progressive rehabilitation plan for RA1 as mining progresses

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.

To comply with section 126C(1)(c)(iii) of the EP Act, the PRCP must include details of the consultation undertaken by the applicant in developing the proposed PRCP (Section 2.4). This includes previous consultation undertaken as part of existing EA approvals or regular engagement processes (Section 2.2.1), and consultation undertaken as part of PRCP development (Section 2.2.2).

To comply with section 126C(1)(c)(iv) of the EP Act, and the PRCP Guideline, the PRCP must include a community consultation plan which details how the applicant will undertake ongoing consultation in relation to the rehabilitation to be carried out under the plan (Section 2.3).

A Community Consultation Plan (CCP) and community consultation register have been undertaken to support the development of this PRC Plan. The complete plan and register - *Saraji Mine PRCP Community Consultation Plan and Community Consultation Register* (BHP, 2023a), is provided in Appendix D.

2.1 Consultation to date

Operations commenced at SRM in 1974. At this time, from a regulatory perspective, an Environmental Impact Statement (EIS) and associated community consultation were not required. However, the following consultation relevant to rehabilitation and closure planning has subsequently taken place:

- During 2016, BMA submitted an EA Amendment application to include an extension to the existing approved operations in the Grevillea Pit. This application included development of a Rehabilitation Management Plan (RMP) for the pit, aligned to the requirements of the existing site-wide RMP. This was approved by the administering authority.
- 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 SRM EA amendment, reflected as Table E1 (Rehabilitation Requirements).
- 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 SRM PRCP process (May and November 2022).
- Since 2021, BMA has undertaken ongoing consultation with the Barada Barna Aboriginal Corporation (BBAC), who represent the Barada Barna People as Traditional Owners. This has included various rehabilitation-related aspects. BBAC's feedback has included a request to work together with BHP to understand how they can get involved in rehabilitation execution activities over time, as guided by the PRCP schedules to be submitted for approval. Seed mix was also updated following a meeting with Barada Barna on 4th September 2023 to include Gumby Gumby (*Pittosporum angustifolium*) in the Tree/ Shrub mix for woodland habitat PMLU as it has cultural importance.
- BMA continues to engage with neighbouring landholders on land management and lease/licence conditions, and on operational matters (such as air quality monitoring), as required.

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 D.

In addition, during 2022, consultation as part of the PRC Plan preparation for SRM included distribution of letters via email to:

- IRC
- BBAC
- Adjacent property owners and agistment licensees (currently vacant)
- Owners of utilities within and adjacent to SRM
- Smart Transformation Advisory Council (STAC) members representing community members, groups and businesses in Dysart and that included the Dysart Community Support Group
- Authorised Holder Representatives of adjacent mining operations and petroleum licenses
- Department of Resources (DoR)

Information has also been provided to BMA employees, the community and groups through 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 D is compliant with section 126C(1)(c)(iii) of the EP Act and includes:

- Identification of each community member/stakeholder
- Previous engagement 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
- Decision/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 SRM. Table 21 summarises these identified stakeholders, the current BMA relationships, as well as potential areas of interest with respect to the site's PRC Plan.

Table 21: SRM 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 People, represented by BBAC	- BMA has a constructive working relationship with Barada Barna People and meets with them regularly. - Barada Barna People 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 has also undertaken negotiations with the Barada Barna People on a comprehensive Indigenous Land Use Agreement (ILUA); SRM will fall within the proposed agreement area. An ILUA is a voluntary agreement between native title parties and other people or bodies about the use and management of areas of land and/or waters. BMA has reached an in principal agreement with the Barada Barna People and will work towards finalisation in the coming year. From a PRCP perspective BMA are working with Barada Barna People specifically on provision of seed for rehabilitation and contracting opportunities across operations for rehabilitation execution, in line with ILUA commitments.	- 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
Adjacent property owners and licensees		
Owners and licensees of: Tay-Glen Station (property owner)	BMA has constructive working relationships, engaging on an as-needs	- Environmental management/stewardship - PMLU, NUMAs and closure landforms

Stakeholder	Existing BMA relationship	Potential areas of interest
- Saraji Station (property owner) - Lake Vermont Station (agistment license – currently vacant) - Meadowbrook (agistment license - currently vacant) - Anglo Coal (German Creek) Pty Ltd (EPC 747 tenement holder)	basis with nearby property owners and agistment licence holders.	- 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.) - Potential impacts on land, water, property and future business value relating to PMLUs, and timing of impacts
Utility owners		
Corporations and Government agencies: - IRC - Queensland Rail (QR) - Aurizon (rail) - Q.E.C Ltd (transmission lines) - Sunwater (water pipeline) - Energex (power supply) - Powerlink (power supply)	BMA has constructive working relationships and engages with utility owners as required (such as issue-specific or transactional engagement). This includes engagement on: - Saraji Road and Lake Vermont; both of which are IRC assets. (The portion of Lake Vermont Road within the SRM ML (and extending to the east within the BMA tenement) is owned by BMA). - The TLO and rail loop which are owned by QR and operated by Aurizon (located on land leased from BMA). - The easement within the MLs on which Energex and Powerlink powerlines, owned by Q.E.C Ltd, are located - The easement within the MLs on which Sunwater's Eungella Water Pipeline is located	- Impact on assets/asset value - Remediation of impacts on assets - Any service disruptions and mitigations - Crossing/interface agreements - Timeframe for decommissioning utilities that only service SRM (e.g. rail loop, electricity transmission, etc.) - Cost of decommissioning utilities

Stakeholder	Existing BMA relationship	Potential areas of interest
BMA operations		
SRM workforce	BMA maintains ongoing communication with its workforce through 'toolbox' talks and a bi-monthly newsletter, Coal Connect.	- Timing of closure - Rehabilitation obligations - Employment continuity
Adjoining/nearby resource interests		
Mining interests: - Whitehaven Coal WS – Winchester South - Pembroke Resources - Olive Downs - Bengal Coal - Dysart East - Bowen Basin Coal/Jellinbah Group – Lake Vermont Mine - Vitrinite P/L – Vulcan Coal Mine - Petroleum (gas) tenements: - Arrow Energy/CH4 P/L - Eureka Petroleum Pty Ltd	BMA liaises with adjoining and nearby mining and resource interests on an as-needed basis, in relation to <i>Mineral and Energy Resources (Common Provisions) Act 2014</i> (Queensland) (MERCPA) requirements for petroleum overlap activities, and as part of industry associations and research partnerships.	- Future land use and ownership - Collaboration on good industry rehabilitation and closure practices - Cumulative impacts and opportunities of mine closures
Local residents and businesses		
Dysart community members	BMA utilises a wide range of communication, consultation and social investment strategies to develop and maintain relationships with Bowen Basin communities.	- Local employment and business opportunities, and future jobs - Opportunities to participate in supply chain (e.g., environmental management, rehabilitation)
- Dysart Smart Transformation Advisory Council (STAC) members - Dysart Community Support Group	The Dysart STAC is sponsored by BMA and represents a broad cross-section of community and business interests.	With closure, loss of jobs and supply opportunities, and changes to demands for services (e.g., childcare and schools)

Stakeholder	Existing BMA relationship	Potential areas of interest
	The Dysart Community Support Group is supported by BMA and provides community services to Dysart's most vulnerable groups and members of the community.	- 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. During 2022, BMA had two briefings with Council regarding PRCP requirements (May 2022 and November 2022). These updates will continue.	- Local employment - 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 - Cumulative impacts of closure of multiple mining assets in a similar timeframe (e.g., job and population losses)

Stakeholder	Existing BMA relationship	Potential areas of interest
Government departments		
Queensland Government: - DoR - Office of the Minister, Deputy Director-General Georesources, Acting Director Native Title Services and Coal Hub, Rockhampton, Executive Director, Minerals and Coal - DESI - Office of the Minister, MERFP Act implementation team	- BMA has constructive working relationships with DoR and DESI. - BHP Corporate Affairs conducts as-needed engagement with Ministers and Members of Parliament. - DoR's Deputy Director-General Georesources has asked to be kept informed on PRC Plans. - Consultation on SRM's PRCP is not expected to be required by other State Government stakeholders, but they are briefed as necessary.	- 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 landforms - 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 SRM PRC Plan (Appendix D), documents the consultation process to enable ongoing PRCP-related engagement with the relevant stakeholders. An overview of this process is presented in Table 22.

Table 22: Process to be followed for ongoing community consultation for the SRM PRCP

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		
Consultation objective		
Stakeholders	Engagement type	Proposed consultation frequency
- Landowners and agistment licensees adjacent to SRM - BBAC - IRC - Dysart community members	Advise adjacent landowners and licensees, BBAC and IRC in writing when the PRCP is approved.	Once-off
	Communicate with agistment licensees during the terms of their licenses and seek their inputs on SRM's PRCP schedule and approved PMLUs and NUMAs.	As part of future updates and/or amendments of the SRM PRCP
	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 BHP'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 SRM 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 - build in consideration of the outcomes of Smart Transformation's projects as relevant, and the IRC's intended transformation approach	Bi-annually, or as agreed with IRC

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	
Stakeholders	Engagement type	Proposed consultation frequency
	Participate in Council, community or industry-led initiatives including research partnerships which aim to harness social value from mine closure and rehabilitation planning, and/or work towards from 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.	Ongoing engagement process
	Via the Dysart STAC, 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.	To be supported by BMA-wide consultation, as required
	Participate in Council, community or industry-led initiatives, including research partnerships, which aim to harness social value from mine closure and rehabilitation planning, and/or work towards economic transformation/transition.	As relevant

Consultation objective	2. To support transparent access to information about the SRM' PRCP and implementation, enabling opportunities for BMA personnel and communities within the Isaac LGA to provide feedback on rehabilitation and closure outcomes	
Stakeholders	Engagement type	Proposed consultation frequency
BHP employees and contractors	Keep the SRM workforce updated (via Coal Connect, a weekly email newsletter to personnel) if there are changes to the PRCP.	Ongoing engagement process

2. To support transparent access to information about the SRM' PRCP and implementation, enabling opportunities for BMA personnel and communities within the Isaac LGA to provide feedback on rehabilitation and closure outcomes		
Consultation objective		
Stakeholders	Engagement type	Proposed consultation frequency
Nearby landholders and homestead residents	Write to nearby landholders (within approximately 5 km) to advise of any substantive changes to the PRCP.	As relevant
Dysart community members and groups	Using Community Connect (BHP's bi-monthly community newsletter) and community forums such as interagency meetings, the Dysart STAC, partnership meetings and community and business networks, provide community updates on PRCPs (SRM-specific as relevant, and portfolio wide).	Ongoing engagement process
BHP licensees	Write to agistment licensees to advise of any substantive changes to the SRM PRCP.	As relevant
Local businesses and BHP suppliers	Provide information about the pending closure of SRM and potential future supply opportunities as part of closure and rehabilitation to local businesses, Traditional Owner businesses and BHP suppliers via the BHP local buying program.	5 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) - DESI 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

3. To engage with utility owners, and adjacent mining and energy tenement holders, to provide information about SRM closure planning that supports them to manage their assets and interests		
Consultation objective		
Stakeholders	Engagement type	Proposed consultation frequency
Queensland Rail and Aurizon	Maintain correspondence with QR and Aurizon regarding progressive rehabilitation activities as they affect the SRM TLO and rail loop which are owned by QR and located on land leased from BMA and undertake consultation regarding the decommissioning of the rail interface.	As requested, or as agreed with representatives
Utility owners: - Q.E.C. Ltd - Powerlink - Sunwater - Energex - IRC	Engage with relevant utility owners to inform them of closure timelines and rehabilitation activities relevant to the land either: - leased from BMA within SRM's MLs (Sunwater, QEC Pty Ltd, Energex and Powerlink); or - privately owned (QR and IRC).	Initiated 3 years prior to decommissioning
	Maintain correspondence regarding progressive rehabilitation and undertake consultation regarding crossing/interface agreements, as required, if rehabilitation will affect utilities.	During the 3 years prior to decommissioning
- Whitehaven Coal - Pembroke Resources - Bengal Coal - Bowen Basin Coal/Jellinbah Group - Vitrinite P/L - Arrow Energy/CH4 P/L - Eureka Petroleum 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 SRM PRCP. At a business level, BHP will participate in industry and research partnerships of relevance to PRCPs and rehabilitation.	As requested, or as agreed with representatives/mining operations
Department of Resources	Provide updates on PRCPs to the Director Native Title Services and Coal Hub, Rockhampton and the Deputy Director General, Department of Resources, in writing or through regular meetings.	As requested, or as agreed with Department of Resources representatives

Relationship with PRCP schedule

SRM had transitional provisions and approved land outcomes identified in the EA. Specific community engagement on the proposed PMLUs and NUMAs within the EA which were transitioned to the PRCP, and the proposed rehabilitation approach, was undertaken prior to submission of the SRM transitional PRC Plan, and consultation will continue as per the process documented in the CCP.

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 been 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 were permitted for SRM under the EA at the time of the development of the transitional PRCP (previously EA Table E1), of which the following are planned as PMLUs at SRM:

- Cattle grazing
- Woodland habitat
- Watercourse

A substantially similar PMLU to cattle grazing is also planned to provide improved rehabilitation outcomes:

- Grassland

The PMLUs are illustrated in Figure 16 and have been recommended based on the closure landform, existing vegetation, ecological values, pre-mining and current land uses and the outcomes of the rehabilitation and closure studies supporting this PRC Plan.

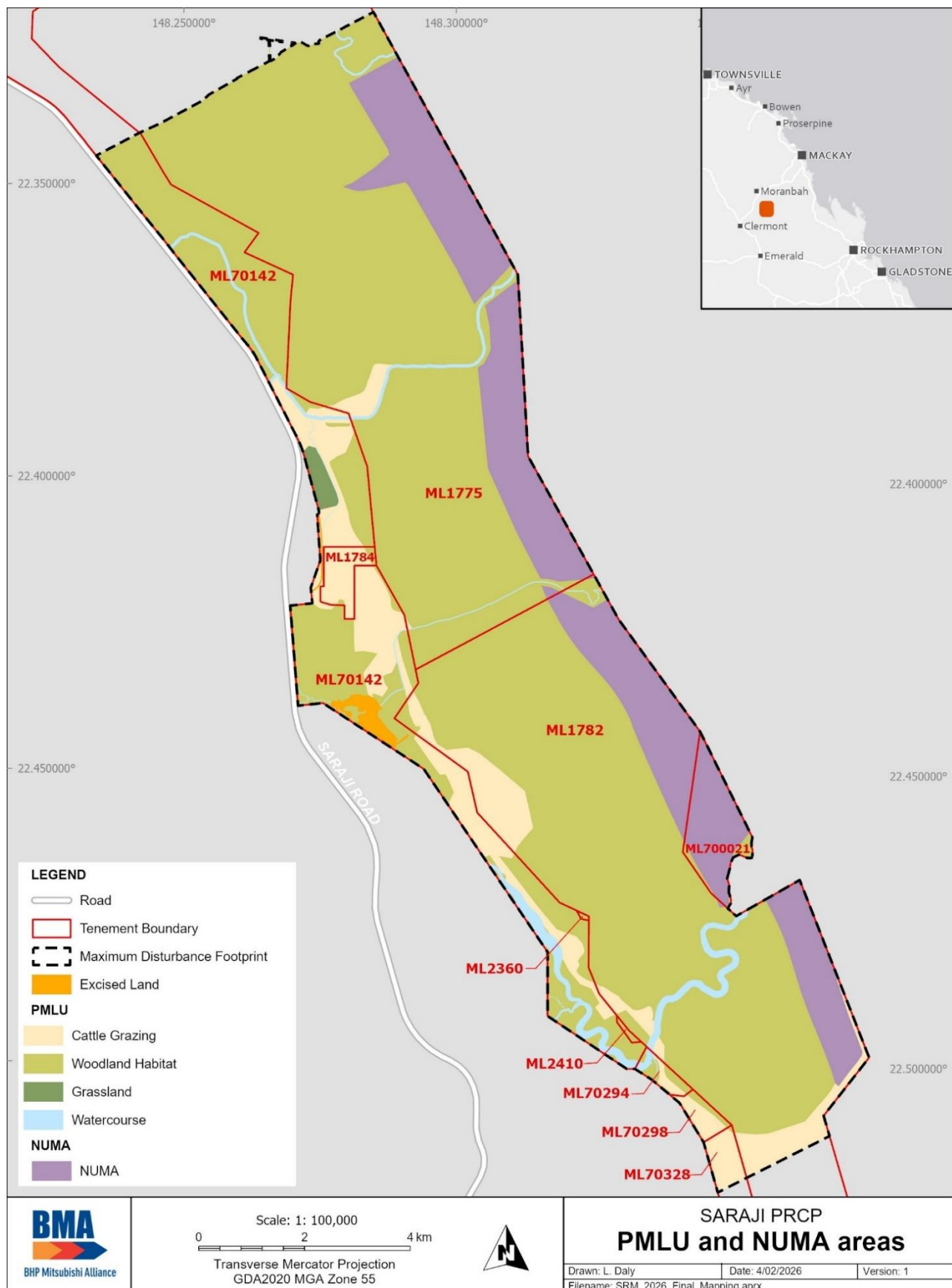


Figure 16: SRM PMLUs and NUMAs

3.1.1 Cattle grazing

3.1.1.1 Planned cattle grazing

The EA objectives, indicators and acceptance criteria (at the time of the development of the transitional PRCP) for the planned cattle grazing PMLU are listed in Table 23. As the SRM EA was an approved LOD, BMA transitioned the relevant EA acceptance criteria, as per the legislative intent of the transitional provisions, to the final milestone criteria for the achievement of the PMLU to a stable condition of cattle grazing (RM13).

At SRM, cattle grazing is predominately planned for the lower gradient areas disturbed by mining activities, areas that require shallow rooted species and/or areas where significant clearing occurred prior to mining (RA3).

Table 23: SRM EA PMLU 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%, and 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 post-mining land use	Rehabilitation is suitable for sustainable cattle grazing	Land suitability assessment for cattle grazing	Land suitability class ≤3 or not different from pre-mining class if ≥4. Assessment completed in accordance with <i>LSA Framework for Open-Cut Coal Mine Rehabilitation 2018 (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)</i> (Short, 2018) unless otherwise agreed in writing between the administering authority and the environmental authority holder.
		Leucaena stem density	<250 stems >2m height per ha (1 per 40m ²), mean total area

Pre-mining cattle grazing land suitability class

The pre-mining land suitability assessment specified in the EA acceptance criteria is based on the five land suitability classes defined under the *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI & DNRM, 2015). Land suitability decreases progressively from Class 1 (suitable land with negligible limitations) to Class 5 (unsuitable land with extreme limitations). The SRM pre-mining land suitability class desktop assessment results for cattle grazing are discussed in Section 1.2.6.1.

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, 2025) from the Office of the Queensland Mine Rehabilitation Commissioner (OQMRC) (Table 24). This land suitability framework has minor changes from the rule-set referred to in the EA (Table 23) and will be adopted for the PRCP to align with the OQMRC leading practice paper. Land suitability decreases progressively from Class 1 (suitable - land capable of attaining maximum grazing productivity) to Class 5 (unsuitable - land that is not suitable for cattle grazing).

Rehabilitation activities will aim to achieve a land suitability class of 3 or better. However, monitoring of cattle grazing reference sites has shown that land in the broader area often decreases to class 4 and class 5 due to various limitations. Therefore, cattle grazing rehabilitation at SRM can also be class ≥ 4 if not different to pre-mining (as per the EA acceptance criteria).

Reference sites (Section 8.4.1) will also be assessed according to the land suitability framework (Table 24) to enable a comparison between the performance of cattle grazing rehabilitation and the representative cattle grazing land suitability class of the broader area.

Table 24: Regional land suitability framework for beef cattle grazing PMLU rehabilitation in the Bowen Basin (Short, 2025)

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 (%)	<20	20 - 50	>50 - 70	>70 - 85	>85
	Cobble, 60 - 200mm (%)	<10	10 - 20	>20 - 50	>50 - 75	>75
	Stone, 200 - 600mm (%)	<2	2 - 10	>10 - 20	>20 - 50	>50
	Boulders, >600mm (%)	0	<2	2 - 10	>10 - 20	>20
Slope gradient	Slope gradient (%)	<5	5 - 10	<10 - 15	>15 - 20	>20
Microrelief	Vertical (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	<5	5 - 8	> 8 - 12	>12 - 18	>18
	Slope (%), ESP 6-14 (%) in 0-0.1m soil depth increment	<3	3 - 6	>6 - 10	>10 - 12	>12
	Slope (%), ESP >14 (%) in 0-0.1m soil depth increment	<1	1 - 2	>2 - 4	>4 - 6	>6
Subsoil 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

3.1.1.2 Existing cattle grazing

The majority of existing cattle grazing rehabilitation (RA7) was undertaken prior to the inclusion of the rehabilitation acceptance criteria in the EA in 2018, therefore the rehabilitation methodologies and revegetation objectives were not aligned to the EA at the time of the development of the transitional PRCP. The existing cattle grazing rehabilitation landforms were designed based on the EA and practices at the time of rehabilitation establishment.

These existing rehabilitation areas were not designed to allow for the collection of surface water quality samples representative of the specific rehabilitation area. Criteria associated with the collection of surface water samples has therefore not been transitioned for the existing rehabilitation areas.

As the existing cattle grazing rehabilitation was undertaken prior to the development of the *LSA Framework for Open-Cut Coal Mine Rehabilitation 2018* (Short, 2018), the rehabilitation methodologies do not align with this framework. Therefore, the final milestone for achievement of the PMLU to a stable condition for cattle grazing (RM17) includes a milestone criteria for the assessment of Grazing Land Management ABCD land condition as described in the *Queensland Reef Protection Regulations Farming in Reef Catchments Grazing Guide* (DES, 2022a) (Section 8.2.4.5).

Many areas of existing cattle grazing rehabilitation are highly infested with leucaena, and although leucaena will be actively managed as part of the monitoring and maintenance program (Section 8), it is likely these areas will only be suitable for marginal cattle grazing due to limitations.

3.1.2 Grassland

For areas that require a cover with shallow rooted species to manage risk, and cattle may impact the stability and integrity of the cover, a substantially similar PMLU to cattle grazing is proposed - grassland. The objective of this PMLU is stability, therefore this PMLU will not be grazed and vegetation cover is not a priority, to ensure contaminants are not released to the receiving environment. The milestone criteria for the grassland PMLU reflects the requirement for stability, with seeding with shallow rooted species, and rock may be utilised on steeper areas for erosional stability.

At SRM, grassland PMLU is planned for tailings cover areas (RA9).

3.1.3 Woodland habitat

3.1.3.1 Planned woodland habitat

The EA objectives, indicators and acceptance criteria (at the time of the development of the transitional PRCP) for PMLU of woodland habitat are listed in Table 25. As the SRM EA was an approved LOD, BMA transitioned the relevant EA acceptance criteria, as per the legislative intent of the transitional provisions, to the final milestone criteria for achievement of the PMLU to a stable condition of woodland habitat (RM14).

At SRM, woodland habitat PMLU is planned for the spoil dumps, including the low-wall to a distance 20m below ground level (RA1) and areas near existing vegetation communities (RA4).

Table 25: SRM EA PMLU objectives, 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 engineer

Goal	Objective	Indicator	Acceptance criteria
	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: - 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 an agreed post-mining land use	Native bushland habitat characteristics	Species richness: Trees Shrubs Grasses	≥2 ≥3 ≥4
		Tree canopy cover	≥16

3.1.3.2 Existing woodland habitat

For areas of existing woodland habitat rehabilitation (RA10), BMA transitioned the relevant EA acceptance criteria to the final milestone criteria of achievement of the PMLU to a stable condition (RM18). In accordance with the EA and practices at the time of rehabilitation establishment, the existing woodland habitat areas were not designed to allow for the collection of surface water quality samples representative of the specific rehabilitation area. Criteria associated with the collection of surface water samples has not been transitioned for the existing commenced rehabilitation areas.

Some spoil dump areas (RA10) have been rehabilitated to achieve a woodland habitat PMLU.

3.1.4 Watercourse

The EA objectives, indicators, and acceptance criteria (at the time of the development of the transitional PRCP) for a watercourse PMLU are listed in Table 26. These were developed specifically for creek diversions. As the SRM EA was an approved LOD, BMA transitioned the relevant EA acceptance criteria, as per the legislative intent of the transitional provisions to the final milestone criteria for the achievement of the PMLU to a stable condition of watercourse (RM15).

The watercourses that transverse through SRM, and any associated diversions, are assigned a watercourse PMLU. These include Boomerang Creek, Plumtree Creek, Hughes Creek, Barrett Creek, One Mile Creek, Spring Creek, Southern Creek and Phillips Creek (Section 1.2.4).

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

- Aerial imagery of the watercourses and associated riparian vegetation (Section 1.2.8)
- Strahler stream orders (Section 1.2.4)
- Flood modelling (Section 6.1.2)
- Creek diversion designs (Section 6.1.7)

The disturbed areas within the watercourse PMLU includes the creek diversions (Plumtree, Hughes, Barrett, One Mile, Spring/Southern and Phillips creeks) and various creek crossings in natural watercourse reaches.

Table 26: SRM 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 (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 are consistent with the outcomes of community consultation completed to date (Section 2). No concerns on these proposed PMLUs were raised during community consultation, including:

- Consultation with BBAC - the PMLUs have been discussed with the BBAC as part of ongoing consultation regarding the development of the PRCPs. This consultation included discussion on opportunity for BBAC's involvement in rehabilitation activities as it relates to the proposed PMLUs, specifically on the provision of seed and contracting opportunities for rehabilitation execution.
- Consultation with IRC – BMA has provided regular PRCP briefings to the IRC which have detailed that the proposed PMLUs as per the EA, were transitioned into the PRCP. IRC and BMA have agreed to continue to engage on future opportunities, challenges and community aspirations, relevant to mine rehabilitation and closure as they develop.

The proposed PMLU of grassland, which is substantially similar to cattle grazing, was requested by the administering authority via consultation during a visit to a BMA site in May 2025, to improve the rehabilitation outcomes for areas that require stability.

3.3 Regional planning integration

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

Under the Isaac Regional Planning Scheme (Isaac Regional Council, 2021), SRM 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 Area 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 realignments where used to align with mining or petroleum tenements’.*

Concurrently, the Queensland Government - via the Mackay, Isaac and Whitsunday Regional Plan (DLGP, 2012), maps SRM 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 of both of these plans are consistent with the PMLUs planned for SRM.

Relationship with PRCP schedule

The planned PMLUs for SRM are consistent with pre-mining and current land uses and transitioned the EA approved (at the time of the development of the transitional PRCP), or substantially similar, PMLUs. 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.

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 were authorised under Schedule E (Condition E10 and E11) of the EA as the LOD (at the time of the development of the transitional PRCP). BMA had 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, SRM is still required to meet the legislative requirements under Section 126C(1)(d) of the EP Act.

As the LOD did not state the area or the location of the proposed NUMAs, the PRCP Guideline (in terms of s754(4) of EP Act) also required the transitional PRC Plan 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 SRM NUMAs include the residual voids of Jacaranda/Bauhinia, Coolibah/Dogwood, Ebony/Grevillea and Hakea pits (Figure 17). Due to the pit progression down dip, the residual voids are located along the eastern boundary of ML1775, ML1782 and ML700021. Ramp voids below ground level are part of the residual voids.

The extent of the NUMAs is designed to achieve an area that is safe and structurally stable and includes: the residual void high-wall and end-wall below natural ground level and the associated wall set-backs at natural ground level to achieve a factor of safety (FoS) of 1.5; the residual void low-wall (and ramp walls) from 20m

below ground level and the associated wall set-backs to achieve FoS of 1.5; the residual void floor; and a safety bund and fence.

The total proposed NUMA area is 1,838ha. This NUMA area has been minimised by reducing the number of ramp voids through backfilling during the mining operations, backfilling sections of the final voids at the end of mining and extending the PMLU on the low-wall into the residual void, 20m below ground level.

The NUMAs will incorporate safety features to prevent 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

The breakdown of the NUMA area into the high-wall, low-wall and void lake components is shown in Figure 17 and Table 27.

Table 27: Breakdown of SRM NUMA area

Void	High-wall/end-wall void area (ha)	High-wall/end-wall set-back area (ha)	Low-wall void area (ha)	Low-wall set-back area (ha)	Void lake area (ha)
Jacaranda/Bauhinia Pit	97	96	223	11	76
Coolibah/Dogwood Pit	115	83	188	10	60
Ebony/Grevillea Pit	151	89	264	17	103
Hakea Pit	52	90	74	9	30

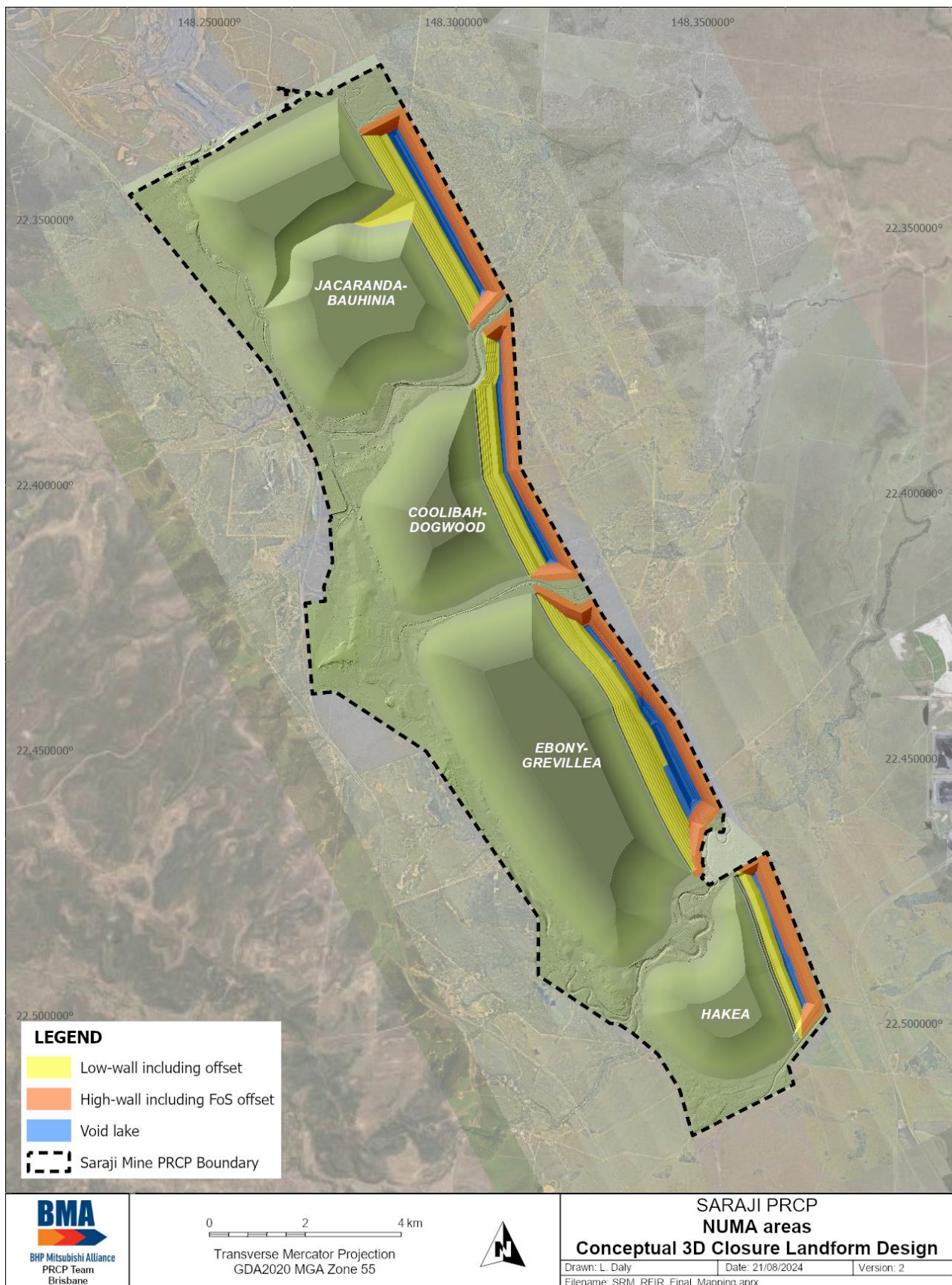


Figure 17: SRM NUMA area

4.2 Minimising environmental harm

Numerous studies have been undertaken as part of this PRC Plan to assess, refine and optimise the SRM NUMA locations and extent to minimise the potential for environmental harm. These studies have 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 and were used as the basis for the following void studies:

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

Based on the outputs of these initial PRC Plan studies, the set-back of the high-wall and end-wall from the lease boundary and watercourses was increased for all voids, to achieve structural stability of FoS ≥ 1.5 within the NUMA extents.

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:

- Jacaranda/Bauhinia: partial void backfill on both the northern and southern end-walls and a landform along sections of the high-wall 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)
- Coolibah/Dogwood: partial void backfill on both the northern and southern 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)
- Ebony/Grevillea: partial void backfill on both the northern and southern 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)
- Hakea: partial void backfill on both the northern and southern end-walls and a landform along the high-wall 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 PRC Plan support the final locations and extent of the NUMAs will not present an unacceptable risk of environmental harm outside of the tenure boundary due to:

- Flooding into the residual voids is 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 mining tenure (Sections 6.1.1.2 and 6.3.2.3)
- The potential for interconnectivity between the deeper Permian and shallower aquifers is minimised (Section 6.3.2.2)
- Long-term pit water levels remain below the spill point, and therefore, minimise 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 is to achieve structural stability, resulting in no geotechnical damage beyond the NUMA (Section 6.3.1)

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. 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-tenure 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-tenure 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 a coal mining 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 increased hydraulic head gradients to groundwater systems and through 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 PRC Plan, maintains the strength of the groundwater sink and is key to managing risk of potential environmental harm outside of the SRM tenure boundary. Future tailings disposal may occur to the voids as per EA condition D6 subject to additional investigations that confirm the placement of the tailings in the void does not present an unacceptable risk of environmental harm (Section 6.2.1).

4.3 Community considerations

Residual voids as NUMAs as presented in the EA and this PRCP, is consistent with outcomes of community consultation completed to date (Section 2). No concerns on the proposed NUMAs were raised during community consultation, including:

- Consultation with the BBAC – the plan for residual voids as NUMAs has been shown to the BBAC as part of ongoing consultation in regard to the development of the PRCPs. This consultation included discussion of opportunity for BBAC's involvement in rehabilitation activities.
- Consultation with IRC – BMA has provided regular PRCP briefings to the IRC which have detailed the plan for residual voids as NUMAs. IRC and BMA have agreed to continue to engage on future opportunities, challenges and community aspirations, relevant to mine rehabilitation and closure, as they develop.

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 SRM 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 SRM 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 PRC Plan. The detailed report – *Saraji Mine Transitional PRCP Voids in Flood Plain Assessment* (SLR, 2022), is provided in Appendix E.

5.1 Background

The SRM closure landform includes four residual voids as pre-approved NUMAs (Jacaranda/Bauhinia, Coolibah/Dogwood, Ebony/Grevillea and Hakea) (Figure 17). The locations of these residual voids were not identified in the LOD and therefore, in accordance with the transitional PRC Plan 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 PRC Plan 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 Relevant watercourses

A 'relevant watercourse' is defined as (State of Queensland, 2022):

(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.

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

- Boomerang Creek
- Hughes Creek
- Phillips 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 tenure without 'artificial features' as defined by State of Queensland (2022). As SRM commenced operations in 1974, there is limited detailed information available for the pre-mining topography for the site. The landform used for the purpose of voids in flood plain modelling within this PRC Plan was developed using a combination of BMA-available LiDAR data from both SRM and PDM, historical aerial imagery and publicly available Geoscience Australia one second Shuttle Radar Topographic Mission (SRTM) Hydrological digital elevation model topographical data.

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

- Boomerang and Wattle residual voids (PDM)
- Boomerang and Wattle spoil dumps (PDM)
- Boomerang Creek Diversion (PDM)

Surrounding off-tenure roads, rail lines, Lake Vermont Mine and SSM were not included within the model as they were assessed not to have a material effect on the 0.1% AEP flood levels within the SRM tenure.

As described above, as a conservative approach, the location and footprint of the residual voids within the voids in flood plain modelling landform were the initial design locations; these represent the maximum footprint prior to refinement of the landform from the PRC Plan supporting technical study results. The final closure landform has reduced the extent of the residual voids when compared to that modelled, through partial backfilling, placement of landforms such as spoil dumps and increasing residual void set-backs.

5.4 Modelling

Hydrologic modelling was undertaken to estimate runoff hydrographs at various locations throughout the catchments of Boomerang Creek, Hughes Creek and Phillips Creek. The model was developed using the industry standard rainfall-runoff routing software package Watershed Bounded Network Model Version 2019 (WBNM).

The catchments of Boomerang Creek, Hughes Creek and Phillips Creek are tributaries of the Isaac River. To encompass the above catchments, a WBNM model of the Isaac River to the point immediately upstream of its junction with Devlin Creek was developed. The Isaac River model covers a catchment area of approximately 8,300km², of which sub-catchments were delineated using hydrologically enforced one second SRTM 30m digital elevation model (DEM) terrain data sourced from Geoscience Australia. From the Isaac River model a sub-model of the SRM area was developed to provide for sub-catchment delineation and the application of aerial reduction factors relevant to the local catchment.

A hydraulic model of the catchment was also developed for the purpose of assessing pre-mining flood extents. The industry standard hydrodynamic modelling software TUFLOW (build 2020-10-AA) was utilised for the hydraulic modelling with the sub-grid sampling feature utilised to provide an increased definition of model terrain and flow conveyance.

The hydraulic model developed as part of this assessment covered two main catchments:

- Boomerang and Hughes creeks
- Phillips Creek

Further details on the models, their calibration/sensitivity analysis, assumptions and parameters are detailed in Appendix E.

5.5 Results

The results of the SRM void in flood plain assessment for peak water surface levels and depths for the 0.1% AEP event are illustrated in Appendix E. The results indicate for the preliminary extents of the final voids:

- Jacaranda/Bauhinia void is located within the modelled flood plains of Boomerang Creek and Hughes Creek. Flows from Hughes Creek break out from the main flow path in a northerly direction before joining the Boomerang Creek flood plain. The Jacaranda/Bauhinia residual void is located within the inundation extent of this breakout.
- Coolibah/Dogwood and Ebony/Grevillea voids encroach into the modelled flood plains for Boomerang Creek/Hughes Creek and Phillips Creek, respectively. The encroachments for these pits occur on the fringes of the flood plain and at the ends of the voids.

Based on the results of the void in flood plain assessment, as well as the other PRC Plan supporting technical studies, landform modifications were made including:

- Locating the voids further away from the mining lease boundary i.e. increase the set-back from the lease boundary and watercourses
- Partial backfill of the northern and southern end-walls of each void to a level that provides protection from floodwater ingress up to and including a 0.1% AEP flood level based on rehabilitation landform flood modelling (Section 6.1.2)
- Placement of landforms along the high-wall to provide flood protection to the residual voids (Section 6.1.2 and Section 6.1.5)

The final closure landform design (Section 6.1.5) provides for flood protection to the final residual voids up to and including a 0.1% AEP flood level. This final closure landform design therefore ensures the proposed location of the residual voids minimises risks to the environment, as per the transitional requirements for voids in flood plains.

Relationship with PRCP schedule

The location and extent of the residual voids, combined with other aspects of the landform design, including increasing the set-back from the mining lease boundary and watercourses, partial backfill of final voids, placement of spoil dump and landforms, provides protection to the residual voids from flood events up to and including a 0.1% AEP and minimises risks to the environment, as per the transitional requirements.

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.

As mentioned in Section 1.2.5, a hydrogeological assessment including conceptual and numerical modelling, has been undertaken to support the development of this PRC Plan. The detailed report - *Saraji Mine Transitional PRC Plan Hydrogeology Assessment* (SLR, 2023), is provided in Appendix B.

The key hydrogeological units present within and immediately surrounding SRM are summarised in Section 1.2.5 and include:

- Cainozoic sediments:
 - Quaternary alluvium – unconfined aquifer (sporadically water-bearing strata of permeable unconsolidated sand or gravel) localised at and near to SRM along Phillips Creek, and regionally along the Isaac River
 - Tertiary alluvium and weathered units – unconfined and largely unsaturated unit at SRM and in surrounding area
- Permian - Blackwater Group (Fort Copper Coal Measures and Moranbah Coal Measures):
 - Low permeability interburden units with aquitard properties
 - Coal seams that exhibit water bearing properties associated with both primary porosity and secondary porosity. The coal seams within the Moranbah Coal Measures are the primary aquifer at SRM.
- Permian Back Creek Group

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 graphical user interface in conjunction with the modelling software 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, such as private supply bore or GDE's where groundwater impact mitigation/control measures may be necessary post-closure

The groundwater modelling completed for this PRC Plan built 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 (2023) hydrogeological assessment contained in Appendix B.

The groundwater model utilised the second iteration of the landform design (the final and third design proposed in this PRC Plan has since been modified based on outcomes of other studies). A review of the final closure landform design along with the revised void water balance model results, confirmed that changes to the landform design undertaken post the groundwater modelling do not have a material impact to the groundwater model results.

Climate change considerations have been included within the modelling and have been based on the BMA (2023) *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, the following three climate scenarios (Table 28), representative of the modelled maximum reasonable range of influence on the residual voids, were used to generate three sets of groundwater model predictions.

Table 28: Modelled climate scenarios as part of the groundwater assessment

Climate model	IPCC* RCP Scenario
ACCESS1-0Q	4.5
ACCESS1-0Q	8.5
MPI-ESM-LRQ	8.5

*Intergovernmental Panel on Climate Change (IPCC)

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 emplacements prior to recovery. Upon stabilisation of the void lakes and groundwater elevations, the modelling identified negligible difference in hydrogeological conditions between the assessed climate scenarios. Therefore, the hydrogeological information presented within the PRC Plan is focused on the mid climate change scenario (ACCESS1-0Q/RCP 8.5). Additional information on the model results for the other climate change scenarios assessed are detailed in the SLR (2023) hydrogeological assessment contained in Appendix B.

Void lake levels 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 generally into long-term sinks for all climate change scenarios modelled. Stabilised lake levels remain below the recovered groundwater levels.

The model simulations indicate that all voids establish and maintain an inward hydraulic gradient once the void lakes and groundwater levels have stabilised. The modelling results for the Hakea void, which is shallower and

smaller than the other SRM voids, indicate the hydraulic head difference between the stabilised groundwater immediately adjacent to the void within the deeper coal seams and the recovered northern portion of the void lake, is approximately 0.5m. The southern portion of the void lake recovers to 3.1m of the deeper coal seam aquifer elevations immediately adjacent to the void.

Changes to the landform design that have been incorporated post modelling include the partial backfilling of the southern end of the Hakea void, which significantly reduces the residual void's surface catchment area. The revised landform limits the void's catchment to the eastern low-wall side of the spoil dump and the immediate surrounds, compared to the larger catchment used within the water balance modelling (Appendix M), which also incorporates the southern side of the spoil dump. The water balance modelling indicates the main contributor to the void inflows is from surface water runoff, therefore the significant reduction in catchment area will further reduce the residual void's inflows and lake levels and all voids, including Hakea are expected to form long-term groundwater sinks. Void lake water levels are also modelled to stabilise below the lowest point of the base of the shallow geological formations (Tertiary and weathered units) adjacent the residual voids. PRCP monitoring and maintenance (Section 8.5) includes remodelling at the completion of mining and the monitoring of void lake levels and groundwater levels to confirm the establishment of the residual voids as sinks.

6.1.1.2 Residual void groundwater inflow

Prior to the recovery of the groundwater levels and within the first 100-years post-mining, groundwater fluxes to the voids are largely controlled by the lake levels within the residual voids. The lake levels are primarily influenced by climatic conditions (i.e. episodic and relatively large rainfall events, including climate change considerations) and are therefore, more variable than the recovering groundwater aquifers.

During the initial post-mining period and before recovery and stabilisation of groundwater levels, the void water balance and groundwater model simulations indicate there are potentially periods of rainfall derived surface water outflows from the residual voids to the spoil. The periodic outflows are simulated to occur immediately post-mining during the first 16-years at Jacaranda/Bauhinia void, 33-years at Coolibah/Dogwood void, 55-years at Ebony/Grevillea, and 95-years at Hakea void. The model simulations indicate the outflows from the voids are restricted to only the groundwaters hosted within the in-pit spoil emplacements and not to any groundwater aquifers hosted within the natural geological formations.

Consideration has been given to alternative residual void options, such as partial backfilling to above the groundwater levels. However, in the environmental setting in which the residual voids at SRM are located, void lakes are still expected to form on top of the backfill material, as void lake in-flows are primarily sourced from rainfall derived water. The void lakes that form on top of backfill material will have greater hydraulic head gradients towards the surrounding groundwater aquifers. This will increase the volumes and durations of outflows from the void lakes to both spoil and natural geology hosted groundwater aquifers. Therefore, the partial backfilling of residual voids results in poorer groundwater environmental outcomes. The maintenance of the residual voids as long-term sinks reduces potential exposure pathways to the surrounding environment and minimises the potential for environmental harm.

As shown in Figures 7-7 to 7-10 of the Hydrogeological Assessment (Appendix B), the modelled groundwater fluxes out of the voids rapidly decreases post-mining and becomes inflows as groundwater levels recover and void lakes elevations approach their long-term stabilised levels. The model simulations indicate that fluxes out of the void are limited to flows to the spoil where groundwater establishment is more dependent on the void lakes. Outflows from the void lakes to natural geological formations is not expected to occur.

The residual void water quality modelling (Appendix M) indicates that pH of void water will be relatively stable over time with neutral to slightly alkaline conditions prevailing and TDS to increase over time resulting from evapo-concentration processes. Within the period immediately post mining where outflows from the void lakes may occur, modelled TDS concentrations within the void lakes are within the TDS range recorded within the regional Moranbah Coal Measures (720 mg/L to 24,704 mg/L, average 7,598 mg/L). Therefore, fluxes of water out of the void lakes to the groundwater aquifer that will be establishing within the in-pit spoil, will not adversely impact the groundwater quality within the spoil or the surrounding Permian hosted aquifers. In addition to this, particle tracking modelling (see Section 6.1.1.4) indicates that particles that may outflow from the voids, return to the voids under subsequent sink conditions.

Upon stabilisation of the void lakes and the groundwater levels post-mining, model results indicate that greater than 99% of the long-term groundwater inflow to the voids comes via the spoil. Flows from the spoil to the void lakes have between 65% and 77% originating from local recharge applied to the spoil, and between 23% and

35% coming from natural geological formations. The equilibrium groundwater inflows to each of the voids only represents approximately 11% to 15% of the total volumetric inflow to each residual void's water balance (Appendix M), that is, groundwater volumetric contribution the residual voids are relatively small in comparison to surface water (rainfall and runoff) contribution.

6.1.1.3 Groundwater levels

Groundwater modelled post-mining equilibrium groundwater levels are illustrated in Figures 7-11 to 7-15 of Appendix B.

Pre-mining groundwater elevations are not well understood, as mining operations at SRM commenced in 1974 and prior to consistent and regular groundwater monitoring being undertaken. Therefore, pre-mining potentiometric surface maps for the coal measures cannot be generated due to the absence of data.

Groundwater elevations in the immediate vicinity of the residual voids are predicted to maintain long-term inwards groundwater flow gradients post-mining, with the groundwater elevations remaining below estimated pre-mining levels. The post-mining groundwater elevations are governed by the void lakes and the on-going groundwater inflows to the residual voids and the loss of water from the void lakes through evaporation. Steepest water table gradients occur on the northern end of the Jacaranda/Bauhinia void and the southern end of the Ebony/Grevillia void, along the coal seam strike, whereas gradients east and west of the residual voids are somewhat shallower, particularly to the west of the residual voids within the spoil. The reduction in the water table to the east of SRM is modelled to extend up to 2km from the edge of the ML for the Coolibah/Dogwood, Ebony/Grevillia and Hakea residual voids, and less than 0.5km off lease for the Jacaranda/Bauhinia void. The groundwater table is predicted by the model to remain close to predicted pre-mining groundwater elevations in the areas along Hughes, Boomerang and Phillips creeks east of SRM as a result of the recharge rates from the creeks.

The modelled groundwater levels for the Q, P, H and D seams of the Permian indicate the following:

- Groundwater levels in the Permian sequence are predicted to remain below the estimated pre-mining groundwater elevations in the long-term. This is driven by the ongoing groundwater discharge to the residual void lakes.
- The Q Seam is predicted to remain 'dry' in the long-term across SRM, where it is not mined, with non-saturation present up to approximately 1km east of SRM.
- The P Seam is predicted to remain unsaturated across much of the SRM, however remains saturated in areas along Phillips Creek between Ebony/Grevillia and Hakea voids.
- The H Seam is predicted to have similar patterns to the P Seam in the south of SRM, and levels approximately 60m lower in the northern part of SRM.
- D Seam is predicted to be similar to the H Seam, with the reduction in groundwater elevations extending to the east of SRM.

Predictive hydrographs (Appendix B, Figures 7-16 to 7-22), generated from the hydrogeological model, have been used to evaluate changes in groundwater levels over time. The predictive hydrographs indicate the following:

- Groundwater drawdown in the Permian occurs during the approved mining operations, with post-mining landforms (including the residual voids) not significantly impacting groundwater levels.
- Pre-mining groundwater depths at the GDE potential locations to the east of SRM are greater than 10m below ground surface and therefore, there is a low potential for these areas to support GDEs as the water depth indicates total plant groundwater use is likely to be negligible. Also, the drawdown in groundwater at the assessed GDE locations to the east of SRM predominantly occurs prior to completion of mining with comparatively little additional drawdown occurring over the post-mining period. The limited post-mining drawdown that is predicted is associated with residual time lag effects from the approved mining activities and not the final closure landform.
- Groundwater depths at the potential GDE location associated with One Mile Creek Dam are not predicted to be drawn-down during or post-mining.
- Groundwater drawdown at the six identified third party bores identified during the 2007 bore census (Section 1.2.5.3) ranges from negligible (bore located to the southwest in the Back Creek Group) to 12m (bores located in the Fort Copper Coal Measures to the east). Modelling shows drawdown in bores to the east of

SRM commences during mining operations and continue for approximately 130 to 500-years post-mining, before commencing recovery. As these bores are located in the Fort Copper Coal Measures - a geological unit that is not present over the majority of SRM, the predicted drawdowns are considered to be associated in part with regional influences which were included in the model (i.e., other mining activities) and the SRM approved mining activities. The final closure landform is not considered to contribute to additional drawdown within the assessed third-party bores.

6.1.1.4 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 2249-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 (Papadopoulos & Associates, Inc., 2018) used to simulate particle pathways along the groundwater flow field during recovery (i.e., 2249-years). 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 2249-year recovery simulation are shown in Figure 7-25 of Appendix B. The model results indicate that particles located within the shallower groundwater units generally move towards the deeper Permian and in the long-term towards the residual voids. At the commencement of the simulation period, select particles either commence movement away from the voids or out of the voids. This is consistent with the predicted relationship between void lake establishment and groundwater recovery where the void lake levels are more dynamic and climatically influenced. Once the void lakes and groundwater system reach equilibrium, the modelling indicates that particles, including those that flowed out of the voids, head towards and are captured within the residual voids.

Therefore, the particle tracking modelling indicates the residual voids collect groundwater from the tenure area, including the areas containing the spoil, TSFs, MIA, CHPP and other operational areas. The residual voids, which are long-term groundwater sinks, will act to assist in managing migration of contaminants within groundwater by limiting the potential for contaminants to migrate off-tenure.

To validate the flow path simulation model results, RM2 includes contaminated land investigations at the completion of mining activities to 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 than can be provided by the more regional flow path simulation.

6.1.1.5 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 levels stabilise 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 and weathered units)
- Residual groundwater drawdown within the Moranbah Coal Measures at and immediately surrounding SRM occurs primarily because of the approved mining operation. On-going evaporative discharge from the residual void lakes results in a continued inwards hydraulic flow gradients in the coal measures to the residual voids. No outflow has been identified in the long-term regardless of the climate scenario modelled.
- Residual voids continue to capture any seepage from spoil dumps
- Little to no additional impact on surficial aquifers, including the alluvial aquifers, 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 visual representation of the post-mining CSM is provided in Figure 18.

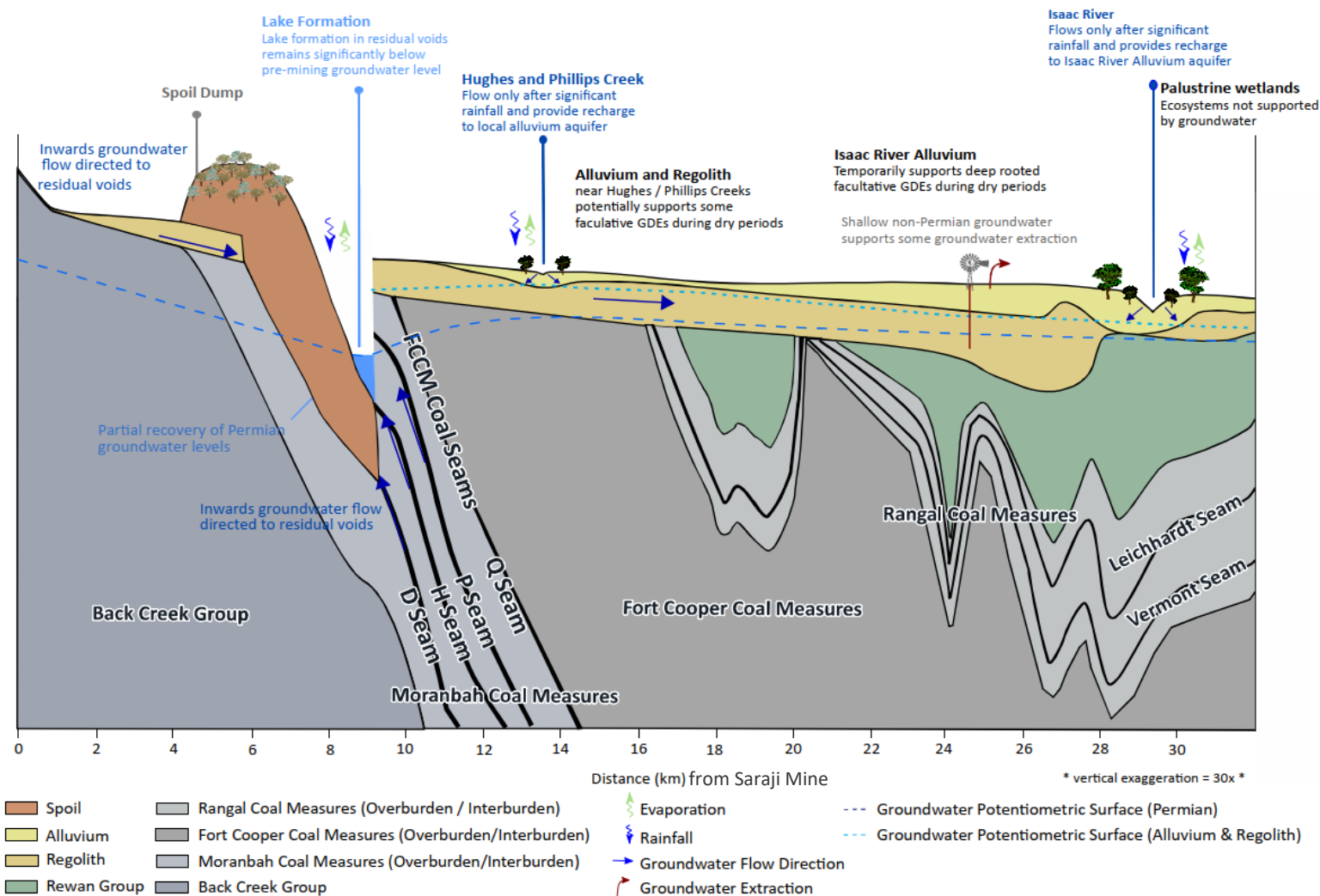


Figure 18: SRM post-mining hydrogeological conceptual site model (SLR, 2023)

Relationship with the PRCP schedule

Groundwater, once stabilised, will flow to the residual voids, which will act as sinks. Seepage from the spoil dumps, TSFs, 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 tenure. Modelled groundwater drawdown around SRM is a result of the approved 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, with the residual voids acting as sinks, is not anticipated to require any active management post-mining. Confirmation of groundwater quality, and the relationship between the void lakes and groundwater elevations to demonstrate the development of the residual voids as sinks, will be completed through groundwater monitoring and predictive groundwater modelling.

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, modelling 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 PRC Plan. The detailed report - *Rehabilitation Flood Modelling, Saraji Mine* (WMS, 2023), is provided in Appendix F.

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 mining lease and watercourses, removal of culverts and other infrastructure from watercourses/floodplains, and changes to landforms to provide increased 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 PRC Plan.

6.1.2.1 Modelling

The hydrologic modelling undertaken to support this PRC Plan was based on existing models for both SRM (Engeny, 2021a) and PDM (Engeny, 2021b), which had been completed using industry standard software RORB and XPRAFTS. A review of the models by WMS indicated that they were fit for purpose and provided appropriate model domains for Phillips, Spring, Hughes, One Mile and Boomerang creeks. An additional new RORB model was also created for an unnamed southern drainage line located at the southern end of the Hakea Pit, which was not covered by the previous models.

TUFLOW 2D hydraulic models were developed to determine flood behaviour around the closure landforms. TUFLOW (version 2020-10-AD) is an industry standard software hydraulic modelling package. Hydraulic models incorporating the closure landform design were developed for Phillips Creek, Hughes Creek, One Mile Creek, Boomerang Creek and the southern drain, and run for the 50%, 10%, 5%, 1%, 0.1% AEP and Probable Maximum Flood (PMF) events.

To evaluate alteration of flows, hydraulic models were also developed for the pre-mining landform for Phillips Creek, Hughes Creek, One Mile Creek and the southern drain. Boomerang Creek, which is predominantly located within the PDM has not been included within the pre-mining landform modelling. The pre-mining landforms utilised were consistent with those developed for the voids in flood plain modelling. Due to the age of operations at SRM (1974), a combination of BMA lidar and the publicly accessible one second SRTM Hydrological Digital Elevation Model topographical data (Geoscience Australia) were utilised to develop the pre-mining DEM. The resolution of the publicly accessible topographical data from pre-1974 is low but represents the best information available. Terrain modifiers were read into the model to better define watercourses due to the low resolution of the available pre-1974 topographic data.

Climate change considerations, in line with the *BMA Climate Change Adaption in Mine Water Planning and Hydrologic Assessments Guideline* (BMA, 2023), were included within the model through running of the following six climate change scenarios for the 2061 to 2099 period for both the 1% AEP and 0.1% AEP:

- RCP 4.5 10th percentile (5% rainfall intensity increase)
- RCP 4.5 50th percentile (11% rainfall intensity increase)
- RCP 4.5 90th percentile (20% rainfall intensity increase)
- RCP 8.5 10th percentile (8% rainfall intensity increase)
- RCP 8.5 50th percentile (17% rainfall intensity increase)
- RCP 8.5 90th percentile (28% rainfall intensity increase)

Further details on the model set up, assumptions, sensitivity testing, hydraulic roughness catchments, critical duration assessment, etc. are detailed in Appendix F.

6.1.2.2 Flood levels and rehabilitation domains

The modelled flood heights in the proximity of the residual voids indicated that all the residual voids are immune from flood ingress up to and including the 0.1% AEP, including upper climate change scenario RPC 8.5 P90 (28% rainfall intensity increase). This was achieved through the iterative landform design process that included the partial backfilling of voids and alteration/inclusion of other landforms that minimise the potential for environmental harm caused via inundation of the residual voids.

The Possible Maximum Precipitation (PMP) modelled events do indicate flood water ingress into the voids. However the inflows to the voids in a PMP event will not exceed the residual void storage capacity, overtop the voids, interconnect different hydrogeological units, or alter the long-term sink behaviour of the voids.

The modelling has identified several locations where floodwaters spill from the watercourses and interact with the rehabilitation landforms. This can occur in some locations in events as frequent as the 50% AEP. The flood water interaction with the spoil dumps is at the extremity of the flooding extent and therefore generally have relatively low velocities and flood heights. Landform design considerations, including for those areas subject to inundation, are detailed in Section 6.1.5.

Figures showing the modelling results, including flood levels, stream powers and velocities, are contained in Appendix F.

6.1.2.3 Alteration of flows

For the assessment of flow alteration downstream of the mine site, peak flows and total volumes for the closure landform and the pre-mining landform scenarios were extracted from a downstream location in each of the hydraulic models. Peak flows and total volumes through the selected downstream locations are summarised in Table 29.

Table 29: Peak flow comparison between the pre-mining condition and closure landform, immediately upstream of void locations

Model	Event	Peak flow (m³/s)			Total volume (ML)		
		Closure landform	Pre-mining condition	% change	Closure landform	Pre-mining condition	% change
Phillips Creek	50% AEP	37	17	117.6	247	220	12.4
	10% AEP	297	290	2.4	2,790	2,735	2.0
	5% AEP	418	417	0.2	3,834	3,809	0.6
	1% AEP	758	728	4.1	6,556	6,619	-1.0

Model	Event	Peak flow (m³/s)			Total volume (ML)		
		Closure landform	Pre-mining condition	% change	Closure landform	Pre-mining condition	% change
	0.1% AEP CC RCP8.5 P90	2,385	2,350	1.5	27,040	27,474	-1.6
	PMF	6,667	7,540	-11.6	70,252	71,597	-1.9
Hughes Creek	50% AEP	48	37	29.7	2,115	2,073	2.0
	10% AEP	315	313	0.6	9,851	9,419	4.6
	5% AEP	426	431	-1.2	13,451	12,879	4.4
	1% AEP	664	704	-5.7	24,373	23,193	5.1
	0.1% AEP CC RCP8.5 P90	1,817	1,881	-3.4	40,251	46,362	-13.2
	PMF	4,956	5,975	-17.1	99,825	98,537	1.3
One Mile Creek	50% AEP	12	21	-42.9	316	453	-30.2
	10% AEP	46	62	-25.8	718	970	-26.0
	5% AEP	66	80	-17.5	831	1,068	-22.2
	1% AEP	104	101	3.0	2,282	2,548	-10.5
	0.1% AEP CC RCP8.5 P90	231	267	-13.5	2,089	2,306	-9.4
	PMF	1,822	1,798	1.3	30,324	30,391	-0.2
Southern Drain	50% AEP	18	16	12.5	172	218	-21.0
	10% AEP	60	69	-13.0	479	597	-19.8
	5% AEP	80	100	-20.0	522	638	-18.2
	1% AEP	107	133	-19.5	823	1,012	-18.7
	0.1% AEP CC RCP8.5 P90	257	368	-30.2	1,842	2,317	-20.5
	PMF	925	1,230	-24.8	5,254	6,450	-18.5

Table 29 indicates that changes between the pre-mining and closure landform flows, downstream of SRM, are variable depending on the event size and the watercourse being considered. Change to the flows result from the following:

- Lower resolution of the publicly accessible pre-mining landform reduces the definition within drainage lines and therefore pre-mining flows can only be considered indicative
- Approved diversions such as Spring Creek and Southern Creek alter the catchment areas between the different watercourses
- Approved diversions retain more flow within the diversion channel compared to the pre-mining watercourses and therefore increase the flows
- Loss of catchment from the top of spoil dumps and voids, which have been removed as they will retain precipitation and not contribute runoff from the closure landform
- Changes to hydraulic roughness between the pre-mining open field/light vegetation to the closure landform that includes uncompacted spoil dumps

Although the modelling shows variability within individual models and events downstream of the site, the cumulative volumes from all four models (for Phillips Creek, Hughes Creek, One Mile Creek and the southern drain) show changes to discharge volumes from the entire SRM area are negligible. For example, the change in SRM cumulative volumes for pre-mining and closure landforms (excluding the climate change scenario) are within 4%. The climate change scenario modelled considers a 28% increase in rainfall intensity and shows a cumulative reduction of 10% in flow volumes from the site. Therefore, the modelling indicates there will be negligible change in flows and volumes entering the Isaac River located approximately 20km to the east of the site.

Flows upstream of the mine site are considered unaltered by the final closure landform.

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 contained in Appendix F and the SRM PRC Plan 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 SRM closure landform. Therefore, no critical controls were required.

Relationship with the 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 SRM rehabilitated area are similar to pre-mining conditions.

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 PRC Plan. The detailed report – *Saraji Mine PRCP Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste* (BHP, 2023b), is provided in Appendix G.

6.1.3.1 Background

SRM has three main types of mineral waste. The geochemical characteristics and potential hazards associated with the main types of mineral waste materials include:

- Spoil (overburden and interburden) currently comprises approximately 97% of all mineral waste at SRM and includes weathered waste (Tertiary and Permian-age – in approximately equal proportions) and fresh (unweathered) waste (all Permian-age). Approximately 95% of spoil is fresh and the remaining (approximately 5%) is weathered/oxidised. Spoil comprises several subtypes of material, the most relevant from a geochemical perspective being carbonaceous spoil (approximately 5% of all present and future spoil) and non-carbonaceous spoil (approximately 95% of all present and future spoil) subgroups. For the geochemical assessment, spoil samples have been sourced from drillholes (primarily as drill core).
- Tailings are generated at the CHPP from processing ROM coal and typically represent the clay, silt and fine sand fractions of ROM waste. Throughout operations at SRM, tailings has been disposed as a slurry into a number of TSFs – the current (active) TSF being Ramp 2/3. Tailings comprises approximately 0.5% of all mineral waste at SRM. For the geochemical assessment, tailings samples have been sourced from the CHPP and TSFs, representing fresh and aged material, respectively.
- Rejects are generated at the CHPP from processing ROM coal and typically represents coarser and rockier seam roof, partings and floor material. Rejects are trucked to spoil dumps and disposed (buried) within spoil. Reject comprises approximately 2.4% of all mineral waste at SRM – with this approximated proportion expected for the remaining life-of-mine plan. For the geochemical assessment, rejects samples have been sourced from the CHPP and historical landforms, representing fresh and aged material, respectively. 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 that may report to the spoil dump, 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/salinity at SRM and having a direct relevance to mineral waste characterisation and management at SRM at closure, are residual voids, spoil dumps and TSFs.

Currently SRM has five TSFs, of these only one TSF (Ramp 2/3 TSF) is operational. At closure, TSF no. 3 will remain as a rehabilitated landform. All other TSFs will be buried under spoil landforms (Section 6.2).

6.1.3.2 Geochemical assessment of mineral waste

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 PRC Plan requirements. Overall, the geochemical data available to assess the geochemical properties of key mineral waste types and associated landforms include:

- 934 samples of interburden, overburden, roof/floor and partings tested to assess the AMD hazard; and 1,857 samples tested to define the salinity hazard, with a subset of overburden/interburden samples assessed for dispersivity and sodicity.
- 77 samples of rejects tested to assess AMD hazard; comprising 41 'fresh' samples collected from the CHPP and 36 'aged' samples collected from onsite reject storage areas (ramps and TSF embankments), with a subset of samples selected to assess salinity hazard.
- 297 samples of tailings tested to assess the AMD and salinity hazard; comprising 105 'fresh' samples collected from the CHPP and 192 'aged' samples collected from TSFs.

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 geological variability encountered at SRM. Tailings and rejects samples from the CHPP were collected over several years to ensure that the mineral waste variability was captured at the plant. Tailings and rejects samples collected from the TSFs were representative of the vertical and spatial distribution of these materials at each TSF to capture the temporal and lateral variability of the tailings and rejects deposited in the TSFs.

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 was then used to infer the geochemical hazard posed by each mineral waste type in their relative proportions within each landform. The geochemical risk of each landform was assessed using a SPR approach, as detailed in Section 6.1.3.4.

This section details the geochemical characteristics of each individual material type (source). The key findings from the geochemical source assessment are:

- Tailings represent the material type that is characterised by the highest proportion of samples classified at potential for AMD. Approximately 55% of the samples tested have been characterised having potential for AD generation with an additional 5% showing potential for generation of NMD/SD.
- Laboratory leaching tests suggest that contact water from tailings classified as potential for AD is characterised by acidic pH, and moderate to elevated concentrations of soluble metals and metalloids for one or more of Al, Fe, Co, Cr, Cu, Mn, Ni and/or Zn. PAF tailings, if fully unsaturated, are expected to be relatively fast reacting. For NAF and non NMD-SD generating tailings, soluble multi-element results indicated that, under laboratory conditions, leachate has low concentration of soluble metals and metalloids. If the tailings samples tested are representative of the tailings produced at SRM (current, past and future), as a bulk single source material, tailings are expected to have a moderate capacity to generate AMD.
- Approximately 13% of the rejects samples were classified as potential for AMD. Leachate testwork conducted on NAF reject samples had low concentration of soluble metals and metalloids, and near-neutral to alkaline pH. Comparatively, laboratory leach extracts from PAF samples show that contact water is likely acidic and can contain moderate soluble metals and metalloid concentrations for one or more of Al, Fe, Co, Cu, Mn, Ni and/or Zn. Testwork shows that PAF rejects are relatively slow reacting. If the rejects samples assessed for this report are representative of the rejects produced at SRM (current, past and future), as a bulk single source material, rejects are expected to have a low-moderate capacity to generate AMD.
- Spoil has a similar proportion of samples classified as PAF as that of rejects samples (i.e. 13%). However, the majority of the PAF spoil samples were sourced from coal seam floor, roof and partings; these materials will ultimately report to the CHPP as rejects and therefore are not representative of “true” spoil. Overall, spoil as a material type has the lowest total S concentrations and highest acid buffering capacity compared to tailings and rejects, with the majority of the spoil samples having excess acid neutralising capacity. Similar to tailings and rejects, soluble multi-element results indicated that leachate from NAF spoil has low concentration of soluble metals and metalloids, while the few PAF samples encountered can mobilise moderate soluble metal concentrations of Al, Fe, Co, Mn, Ni and/or Zn. If the samples tested are representative of the spoil produced at SRM (current, past and future), as a bulk source material, spoil is expected to have excess acid neutralising capacity, and low 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 40% 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 controlled laboratory conditions. Based on the geochemical properties and samples assessed for this report, it is expected that as a bulk source material, coal will have a moderate to high capacity to generate AMD.
- Spoil, rejects and tailings can generate contact water that is slightly to moderately saline (i.e. EC less than 2,000µS/cm), largely as the result of non-oxidative processes (i.e. from the dissolution of salts and not oxidation of pyrite). Spoil is also ‘strongly sodic’ with potential for dispersion (based on the high sodicity values). Emerson aggregate class testing found that about 17% of the spoil samples tested displayed ‘some dispersion’. The remaining bulk of the samples tested had Emerson aggregate class values suggesting the

samples were non-dispersive. Sodidity and dispersivity testing was not undertaken on rejects and tailings 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 of spoil dumps, residual voids and one TSF (TSF no. 3). Each of these landforms at closure contain variable proportion of spoil, rejects, tailings and coal due to operational practices and planned life-of-mine waste management. In particular:

- Spoil landforms will comprise spoil (overburden, interburden), rejects, and tailings
- TSF no. 3 landform will comprise tailings (predominantly) with spoil/earth embankments and a spoil cap/cover. TSF no. 3 will remain as a surface tailings facility not incorporated into a spoil dump. All other existing TSFs will be buried within in the Jacaranda-Bauhinia spoil landform or Coolibah-Dogwood spoil landform.
- High-walls will comprise overburden, interburden and coal seams (including seam roof, partings and floor)
- Pit floors will comprise coal (conservatively)

A geochemical source hazard assessment was applied to the source material types comprising carbonaceous and non-carbonaceous spoil, tailings, rejects and coal (where relevant), to support the SPR assessment. 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 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. Consequently, the environmental geochemical risk is determined taking into account the geochemical source hazard of the landform (as described above), 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 SRM. Details on the identification of pathways and receptors are found in Section 6.1.1 and Appendix B.

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

- Source - spoil dumps:
 - Surface water run-off (pathway) from a nominated spoil dump reports to a nominated watercourse (receptor)
 - Seepage from a nominated spoil dump enters a shallow permeable stratum (pathway) and reports to a nominated watercourse (receptor)
 - Seepage from a nominated spoil dump enters groundwater (pathway) and reports to a nominated residual void (receptor)
- Source - TSF no. 3:
 - Surface water run-off (pathway) from TSF no. 3 reports to Barret Creek (receptor)
 - Percolation/seepage from TSF no. 3 enters shallow permeable strata (pathway) and reports to Barret Creek (receptor)
 - Percolation/seepage from TSF no. 3 enters groundwater (pathway) and reports to the residual void (receptor)
- Source – high-wall and floor:
 - Runoff from high-wall of residual void (pathway) reports to nominated residual void (receptor)

The outcomes of the SPR are:

- Spoil dumps: with respect to AMD, the overall SPR risk rating from final spoil landforms is Low. Where landforms contain buried tailings, such as the Jacaranda-Bauhinia landform containing Ramp 2/3 TSF and the Coolibah-Dogwood landform containing Ramp 6 TSF, TSF no. 2 and TSF no. 4, the risk rating with respect to AMD potentially making its way via shallow permeable strata into surface water features close to these buried TSFs was rated as Low to Medium. With respect to non-oxidative salinity the overall SPR risk from final spoil landforms is rated as Low to Medium.
- TSF no. 3: with respect to AMD the overall SPR risk rating from the TSF landform is Low to Low-Medium. With respect to non-oxidative salinity the overall SPR risk from the TSF landform is rated as Low.
- Residual voids: the final receptor for seepage from the spoil landform (for each spoil landform) and runoff from the high-wall (of each 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, 2022). 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 by (SLR, 2022) shows that seepage from the void lake (of each void) into groundwater, if any, would be limited.

6.1.3.5 Management and rehabilitation measures

The geochemical characterisation, SPR and residual risk assessment conducted in support of this PRC Plan informed the following mineral waste management and rehabilitation measures concerning AMD and salinity management:

- Residual voids: will remain as NUMAs.
- Spoil dumps: will be reshaped, covered with growth media, ripped and seeded. No specific AMD management measures are proposed for the spoil as operational mixing is expected to be sufficient to manage the small quantity of interburden/overburden 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.
- TSF no. 3 (above ground): will remain as a final TSF landform. No further AMD management measures are proposed for TSF no. 3 as the landform has been partially capped and revegetated. Following contamination assessment and further work to achieve a free draining landform, monitoring in accordance with the PRCP schedule will be conducted to ensure that this landform can achieve its nominated PMLU.
- All other TSFs (Ramp 2/3 TSF, Ramp 6 TSF, TSF no. 2 and TSF no. 4): no specific AMD management measures are proposed for these TSFs as they will be buried with spoil during operations. It is expected that the final spoil cover thickness over tailings will be variable due to the spoil dump designs. It is recommended that the optimal thickness of spoil cover to manage water and/or oxygen ingress will be determined following further assessment.
- Rejects: managed during operations (disposed within spoil) and progressively covered by spoil. No specific AMD management measures are proposed for the rejects (at closure). It is recommended that the optimal thickness of spoil cover to manage the AMD hazard of rejects will be determined following further assessment.
- ROM pad: remove remnant coal from the ROM Pad and dispose within spoil. The ROM Pad will be reshaped, covered with growth media, ripped and seeded.
- Coal stockpile: remove remnant coal from the coal stockpile pad and dispose within spoil. Cover with growth media, rip and seed.

Relationship with the PRCP schedule

The environmental risks posed by the mineral wastes likely to be present at closure are low. The management and rehabilitation measures proposed in this PRCP manage the risk associated with mineral waste during rehabilitation and closure.

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 PRC Plan. The detailed report – *Saraji Mine Materials Characterisation Study* (Landloch, 2022a), is provided in Appendix C. 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 quality of the topsoil stockpiles is more representative of the material available for rehabilitation once topsoil is stripped and mixed in stockpiles, compared to undisturbed soil (Landloch, 2022a). The key chemical and physical properties of the stockpiled topsoil within each soil management group at SRM are summarised in Table 30.

Table 30: Key physiochemical properties of stockpiled soil management groups

Analysis	Soil management groups		
	Light loams/sands	Heavy loams/clays	Cracking clays
Chemical properties			
pH1:5 (H₂O)	Slightly acidic to strongly alkaline (6.1 – 8.5)	Slightly acidic to moderately alkaline (6.1 – 8.2)	Slightly alkaline to strongly alkaline (7.8 – 8.8)
EC1:5 (dS/m)	Low (<0.16)	Very low to moderate (0.07 – 0.26)	Low to moderate (0.13 – 0.34)
ESP (%)	Non-sodic to strongly sodic (2.2 – 16.9)	Sodic to strongly sodic (6.0 – 23.8)	Non-sodic to sodic (2.7 – 10.5)
Total N (mg/kg)	Very low (<500)	Low (<700)	Low (<1,000)
Available P (mg/kg)	Low to moderate (14 – 37)	Low to moderate (14 – 37)	Low to moderate (11 – 35)
Available K (mg/kg)	Low (<140)	Low (<140)	Low to moderate (74 – 194)
Organic Carbon (%)	Low (<1.0)	Low (<1.0)	Low to moderate (0.65 – 1.29)
CEC (meg/100g)	Low (<7.0)	Low (<7.0)	Low to high (7.7 – 29.1)
Ca/Mg (ratio)	Strongly imbalanced to low (0.6 – 2.5)	Strongly imbalanced to low (0.6 – 2.5)	Strongly imbalanced to low (0.8 – 2.2)
Physical properties			
Clay content (%)	<20	20 – 40	>35
Rock content (%)	<10	<20	<10
Dispersion (EAT)	Dispersive to stable (2 – 7)	Dispersive to stable (2 – 7)	Slightly dispersive to stable (3 – 7)

Analysis	Soil management groups		
	Light loams/sands	Heavy loams/clays	Cracking clays
Permeability	Low	Moderate	Low
Erodibility	Moderate to high	Moderate	High
Associated regional soil	Va52 (Sodosol)	Va52 (Sodosol)	CC30 (Vertosol)
Associated SMU	2/20, 3, 12, 16/23, 18, 19, E1, T1, T2	8, 13, A1, A1V, A3, E3	4, 5, 17, A2, B1, B2, B2V, B3, B4, E2, E2V

Note: Chemical properties are based on average 10th and 90th percentile values for all stockpile samples analysed.

Fresh Permian spoil is also considered a resource for rehabilitation to provide the rock component to increase batter slope resistance to erosion and to stabilise steeper areas. The key chemical and physical properties of the fresh Permian spoil are summarised below, however Landloch (2022) recommend discrete testing should be conducted prior to rehabilitation, which will be completed by an AQP as part of their growth media assessment (Section 6.1.4.3):

- Strongly acidic to strongly alkaline (pH1:5 (H₂O) 2.7 – 10.1)
- Salinity is moderate to high (EC1:5 (dS/m) 0.6 – 1.3)
- High to extremely sodic (ESP 9 – 47%)
- Clay content 6 – 28%
- Rock content 20 – 50%
- Moderate to high permeability, indicating that movement of water to depth will be reasonably rapid and that deep-rooted plant species may be able to extract water from depth
- Moderate dispersion risk, however material ranges from non-dispersive to highly dispersive
- Slake durability moderate to high (60 - 95%)

6.1.4.2 Quantity of available resources

The rehabilitation at SRM requires growth media to support vegetation establishment for the planned PMLUs. There is sufficient quantity of topsoil available on-site for rehabilitation of disturbed areas to cattle grazing, grassland, woodland habitat and watercourse PMLUs, therefore all required growth media will be sourced within the tenure and within haul distance of rehabilitation areas.

The volume of topsoil available for rehabilitation includes the volume of topsoil currently stockpiled at site (11,395,583m³ (as at 07/01/2023)) and the future topsoil to be stripped (estimated at 4,187,558m³ for the future mining areas), totalling 15,583,141m³.

The volume of growth media required for rehabilitation of each PMLU is shown in Table 31. These volumes only include existing and future disturbance areas where growth media needs to be replaced. The required volumes do not include disturbed areas such as exploration, cleared and existing rehabilitation which already have topsoil. The areas in the Table 31 therefore do not align to the total area of the RAs. The volume shown for watercourse is conservative as it assumes all diversion and crossing areas require topsoil. Excess topsoil volume will be utilised in areas where there will be a beneficial outcome, such as cattle grazing areas.

Table 31: SRM required growth media volumes for PMLUs

PMLU	Growth media	Area (ha)*	Cover depth (m)	Volume required (m ³)
Cattle grazing	Topsoil	906	0.15	1,359,000
Grassland	Topsoil	41	0.15	61,500

PMLU	Growth media	Area (ha)*	Cover depth (m)	Volume required (m ³)
Woodland habitat	Topsoil	5,740	0.10	5,739,000
	Alternative growth media	1,350	0.30	4,050,000
Watercourse	Topsoil	211	0.15	316,500
Total	Topsoil	6,897		7,476,000
	Alternative growth media	1,350		4,050,000

**Only includes areas where topsoil has been removed and needs to be replaced*

Rock will be utilised on the steeper final landform slopes to improve the erosion resistance (Section 6.1.5.3). Rock will be sourced from the mined fresh Permian 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.

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 SRM MLs which can be accessed for loading and haulage to rehabilitation areas. The location of topsoil stockpiles (as at August 2021) and the associated soil management groups are shown in Appendix C. 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 (topsoil or Permian spoil) characteristics will be completed by an AQP prior to rehabilitation, to determine the growth media depth, amelioration requirements and surface treatments. The assessment will consider the growth media qualities, rock, landform, revegetation plan (Section 6.1.8) for the planned PMLU, plus the land suitability framework (Section 3.1.1.3) when planning cattle grazing rehabilitation.

The recommended amelioration and surface treatments will be undertaken as part of the rehabilitation execution activities. 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 growth media depth, potential amelioration options and the surface treatments to support the establishment of vegetation for each PMLU, are shown in Table 32. An AQP may at times recommend less growth media if beneficial for the rehabilitation, such as reduced topsoil depth to combat existing seed banks in the stockpiled topsoil. Opportunities to utilise Permian spoil materials as growth media and other amelioration and surface treatment methods may be investigated.

The relationship between soils and vegetation ecosystems for the PMLUs is detailed in Section 6.1.8.

Table 32: Growth media ameliorant options and surface treatments for the SRM PMLUs

PMLU	Growth media	Ameliorant options	Surface treatments
Cattle crazing and grassland	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 or grassland revegetation (Section 6.1.8.5)
Woodland habitat	Topsoil – minimum depth of 100mm to support establishment of woodland species and to limit the effects of competition from exotic pasture species Or Permian spoil – minimum depth of 300mm	• 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 6.1.8.7)
Watercourse	Topsoil – minimum depth of 150mm to encourage a vegetative cover to provide erosion resistance	• Elemental Sulphur • Manures • Superphosphate • Gypsum • Incorporated organic matter • Surface mulching (e.g. hay mulch)	• Ameliorate growth media as recommended by an AQP (if required) • Deep rip along contour as required • Direct seed as per seed mixes and rates for watercourse revegetation (Section 6.1.8.9)

Relationship with the PRCP schedule

There is a sufficient quantity of suitable quality growth media available on-site for rehabilitation of disturbed areas to cattle grazing, grassland, woodland habitat and watercourse PMLUs. Suitable Permian spoil may be ameliorated to develop an alternative growth media for the low-wall PMLU areas and potentially other woodland habitat PMLU.

An assessment of the growth media characteristics will be completed by an AQP prior to rehabilitation, to determine the growth media depth, amelioration and surface treatments required to achieve the planned PMLU.

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 PRC Plan. The detailed report – *Erosion and Landform Evolution Simulations to Support Waste Landform Design: Sarai Mine* (Landloch, 2024), is provided in Appendix H.

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 PRC Plan. The major refinements included changes to the mining limits to ensure geotechnical stability of the residual voids is achieved (Section 6.3.1), residual void extents to mitigate the risk of flooding (Section 6.1.2) and spoil dump slope angles for erosional stability (Section 6.1.5.3).

6.1.5.1 3D design

The conceptual 3D closure landform design for SRM is provided in Figure 19.

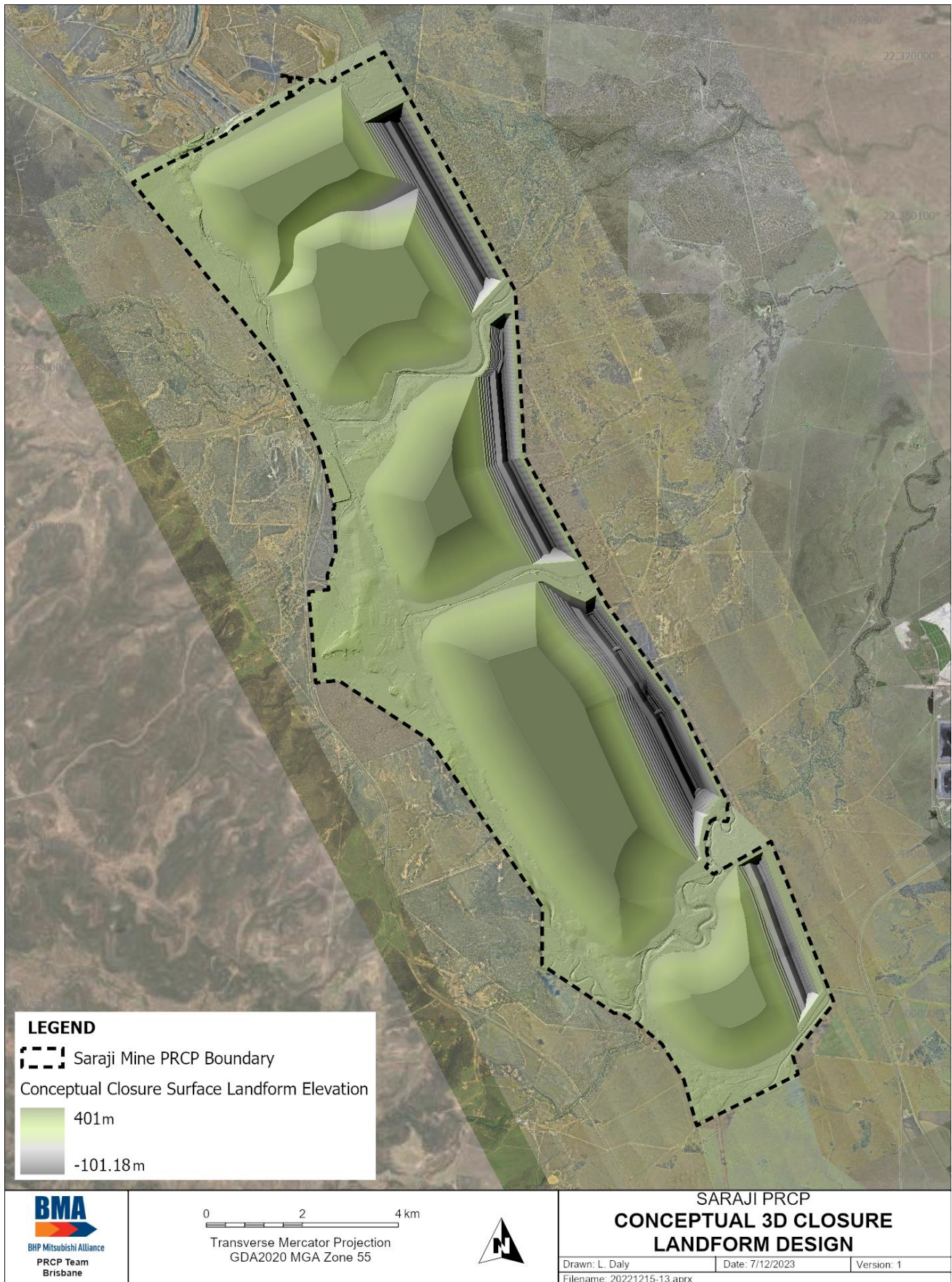


Figure 19: Conceptual 3D closure landform design

6.1.5.2 Method of determining landform design

Landform structures

The relevant activities (Section 1.4.1) considered when determining the landform design are detailed in Table 33.

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 33: Landform structures at SRM and proposed designs

Landform structure	Landform design
Spoil dumps (RA1)	- Maximum dump heights varying from 120m up to 180m above ground level to fit the waste scheduled to be mined 20m dump lift heights - Dump slopes within PMLU areas to be reshaped maximum 15% slopes or up to maximum 30% slopes with rock on the final landform - Runoff to be restricted from the top of the landform onto the batter slopes to where required manage erosion - Spoil dumps achieve FoS ≥ 1.5
TSFs (RA9)	- Area will be reshaped with maximum 15% slopes or up to maximum 30% slopes with rock on the final landform surface - Covered by a free draining landform (Section 6.1.6) - Minimum 2m spoil cover (Section 6.1.6) - Landform achieves FoS ≥ 1.5
Infrastructure and general areas – CHPP and associated infrastructure, workshop, buildings, stockpile areas, laydown areas, roads, mine dams, drains, exploration (RA3, RA4)	- Area will be reshaped with maximum 12% slopes for cattle grazing PMLU - Area will be reshaped with maximum 15% slopes for woodland habitat PMLU
Residual voids (IA1)	- Set-back from the high-wall and end-wall crest to achieve structural stability of FoS ≥ 1.5 within the NUMA extents or a minimum of 50m where against the tenure boundary (Section 6.3.1) - Set-back from the low-wall crest to achieve structural stability of FoS ≥ 1.5 within the NUMA extents or a minimum of 25m for erosion protection of the neighbouring PMLU (Section 6.3.1) - The location of the residual voids and associated safety bunds does not cause instability or degradation to the land outside of the tenure boundary - Flood mitigation to a level 1m above the 0.1% AEP flood levels where required to prevent flood ingress (Section 6.1.2): - Jacaranda/Bauhinia: partial void backfill on both the northern and southern end-walls and a landform along sections of the high-wall

Landform structure	Landform design
	- Coolibah/Dogwood: partial void backfill on both the northern and southern end-walls - Ebony/Grevillea: partial void backfill on both the northern and southern end-walls - Hakea: partial void backfill on both the northern and southern end-walls and a landform along the high-wall • Low-walls are free draining into the void lake with a maximum of 37 degree slopes • Retain an unmined area of 60ha between the residual void high-wall/end-wall crest and the ML700021 boundary, to align to the 2017 EA amendment application for Grevillea Pit expansion
High-wall landform	• Flood mitigation to a level 1m above the 0.1% AEP flood levels where required to prevent flood ingress (Section 6.1.2) • The functional requirements include: - Prevention of surface flow of floodwater into the void - Geotechnically stable when floodwater is against the watercourse-side batter - Prevention of seepage flow of floodwater into the void - No greater maintenance post-closure than other land with similar use, therefore utilise the same geometry, materials and rehabilitation treatments • The standard design for preliminary planning includes: - Key trench through any permeable layer on the ground surface - Not to be constructed out of dispersive material - Maximum 30% slopes with rock for scour protection - Minimum height to include appropriate freeboard for flood heights and materials - Minimum crest width of 10m • The final design will be completed by an AQP based on the latest flood modelling (flood duration against the landform, maximum water levels, flow velocity and bed shear stress), and materials data prior to construction

Materials available for landform rehabilitation

The landform at SRM utilises materials available on-site that will achieve the required landform stability. Rock will be utilised on the steeper final landform slopes 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 closure 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 water dams to be free-draining

- Removal of any road culverts and fill material from within the watercourse extents

Free draining is considered to be where the landform sheds the majority of the surface flows from the landform and towards the local drainage lines, and where any residual collection of water on the landform does not persist for more than one month under typical dry weather conditions.

A rehabilitation flood assessment, including hydrologic and hydraulic modelling has been completed for the closure landform (Section 6.1.2). The flooding risk profile developed as part of this assessment identified the risks to the landform from flooding to be low with mitigation measures in place. Mitigation includes partial final void backfill and landforms to mitigate the risk of flooding into the residual voids up to the 0.1% AEP flood level as detailed in Table 33. Landforms are permanent structures that will be constructed with the same materials, procedures and geometry as other spoil landforms and require no more maintenance than other rehabilitated areas. These landforms will be designed by an AQP based on the latest flood modelling and materials data prior to construction.

The flood water interaction with the spoil dumps is at the extremity of the flooding extent with relatively low velocities and flood heights (Section 6.1.2). Outer landform slopes that interact with flood waters up to a 0.1% AEP will incorporate controls, if required, to 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 6.3.2.1) identified that the residual voids, once the pit lakes and groundwater have stabilised, will continue to act as a sink. Therefore, groundwater in the proximity of the residual voids will remain depressed and will not impact on the landforms outside of the residual voids.

6.1.5.3 Long-term landform stability

Material testing, erosion modelling and landform evolution modelling of the spoil dumps has been completed by Landloch (2022a) to establish the slope profiles for the materials at SRM to ensure long-term landform stability (Appendix H).

The landform study included:

- Simulations of runoff and erosion for a range of spoil dump 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 the SRM 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 spoil dumps and slope profiles (Table 33) at SRM can be expected to be stable over the long-term, provided the target levels of groundcover are achieved. Total groundcover manages erosion risk, which includes a combination of rock, vegetation and organic litter cover (Appendix H Section 2.2). In the WEPP and SIBERIA models, the rock groundcover component is incorporated into the material parameters used in the models and a range of different vegetation cover is modelled. Vegetation cover includes plants, plant litter, tree leaf litter, twigs and woody debris that protect the soil surface from erosion.

The modelling in Appendix H gives an indication of the vegetation cover to meet target erosion rates for the representative materials modelled, but it does not determine the exact vegetation cover required. The results in Appendix H demonstrate that rockier materials require lower vegetation cover to achieve the target erosion rates on the same slopes. Exact vegetation cover varies with the rock component and therefore varies for the materials across the site.

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 where 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 pits and comprise of dragline spoil piles 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 33 are the key controls that will be put in place to manage the landform risks associated with achieving the PMLUs. Designs will be completed for each rehabilitation area prior to execution of the rehabilitation activities and earthworks, and included as part of the rehabilitation workpack, or current work process, at the time of execution.

Quality assurance and quality control activities are built into all necessary execution and verification activities of these controls. Monitoring and reporting processes 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 trajectory 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 closure landform design include:

- The final closure landform is dependent on the mining schedule, which can change due to increased geological knowledge as mining progresses, market factors and technology. These changes may result in differences to the landform, such as varying heights or ramp locations, 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 expected 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 material is 37°
- Landform evolution modelling has been completed up to 300-years based on the best available inputs at this time and the material testing completed at SRM to date. It is expected materials with higher levels of rock will become available as mining progresses, requiring lower levels of vegetation cover to limit erosion to target levels.
- 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 the proposed PRCP schedule

The final closure landform design has been refined based on the outcomes of the studies undertaken to support this PRC Plan and minimise risk. Dump slopes have been designed based on the materials available on-site and the erosion modelling. The closure landform design, including the spoil dumps, residual voids and other disturbed areas, achieves a safe and stable landform. The milestone criteria to achieve a stable condition is for total groundcover as this manages the erosion risk.

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, to ensure contaminants are not released to the receiving environment. As detailed in Section 6.1.3, the main types of waste materials at SRM include spoil, rejects and tailings.

Considering the quantities, the methods of disposal and the location of the material in relation to the final landform, the geochemical assessment concluded that no specific AMD management measures are required (Section 6.1.3).

Tailings are disposed in dedicated TSFs (Section 6.2) and will be covered with spoil dumps. Rejects are buried within the spoil extents during operations. Tailings and rejects will be covered by a free draining landform and covered with at least 2m of spoil.

6.1.6.1 TSF no. 3

TSF no. 3 is an above ground turkey's nest facility located to the north of the MIA. The TSF will be rehabilitated as a discrete single landform (RA9) and has been partially capped, although it requires further work to achieve a free draining landform.

24ha of the TSF no. 3 commenced RM1 in 2023, however, the remaining 17ha is not available for rehabilitation as a powerline runs in a generally north-south direction on the eastern side of the TSF landform. Rehabilitation of the final 17ha is therefore scheduled to commence in 2104, following the completion of mining and when other major infrastructure across site is decommissioned and removed.

Relationship with the PRCP schedule

The geochemical assessment of the spoil and rejects materials on-site concluded that the materials are managed during operations and no specific AMD management measures are 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 closure landform design for SRM is intended to provide landforms that meet the nominated PMLU and NUMA milestone criteria without the need for ongoing active water management or dewatering. The following key considerations, which are discussed in more detail in the relevant sections of this PRC Plan, 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 and One Mile Creek dam, the final landform surfaces will be predominantly free-draining where appropriate to prevent impacts, with runoff allowed to flow to the surrounding watercourses (Section 6.1.5)
- All mining-related dams will be decommissioned and removed, and the rehabilitated areas will be free-draining, with the exception of One Mile Creek Dam which will be retained as regional infrastructure (Sections 6.1.5 and 6.5)
- Final residual voids will remain as NUMAs and will establish and stabilise into long-term groundwater sinks (Section 6.3)
- Rehabilitated landforms provide residual void flood protection up to and including a 0.1% AEP flood event (Section 6.1.2)
- TSFs are either capped and rehabilitated to a stable landform, or are buried by spoil during mining operations (Sections 6.1.5 and 6.2)
- The acid neutralising capacity of the spoils is sufficient to neutralise acid forming materials within the spoil dumps (Section 6.1.3)
- Modelling of flow paths through particle tracking simulations within groundwater over a 499-year recovery period, within and surrounding the mining operations (including from the MIA, CHPP and TSFs), indicate the groundwater within the tenure will migrate toward the residual voids (NUMAs) and not into receiving environments (Section 6.1.1)
- Contaminated land investigations (RM2) will be undertaken at the completion of mining to confirm the suitability of the site for the PMLUs and provide additional information on source areas, preferential pathways and potential risks associated with migration of contaminants
- Forward work plans and any required realignment and rehabilitation works will be undertaken to render the watercourse diversions to a suitable condition, supporting their progression to a relinquishable state (Section 6.1.7.4)
- Conceptual site models that assess SPR linkages have been prepared for relevant technical studies including hydrogeology (Section 6.1.1), waste characterisation (Section 6.1.3) and voids (Section 6.3) and show a low likelihood of complete exposure pathways to off-tenure receptors

6.1.7.1 Contaminants and sources

Since SRM operations commenced in 1974, heavy industrial type activities including operation and maintenance of the processing facilities, vehicles and other plant infrastructure required to support the extraction and processing of coal, have occurred on the site. These heavy industrial type activities include the storage, use and disposal of a variety of hazardous materials. SRM's facilities have and will continue evolving over time with modern engineering and environmental standards; however, the duration and nature of the operations increase the likelihood of contaminated land being present at closure. Therefore, it is considered likely that contaminated

land will be present at closure which will require investigation and some remediation/management. In line with the requirements of the EP Act 1994 and the EA, areas of identified land contamination that present an unacceptable risk to human health or the environment during the operations will be subject to investigation and remediation efforts, where appropriate. Remediation works will be undertaken to render the area suitable for the operational land use. Further contaminated land investigations and remediation/management works are likely to be required at SRM upon decommissioning of infrastructure.

The predominant hazardous materials identified to have a potential to cause contamination at SRM and impact PMLUs and/or the receiving 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) species of concern
- Nitrogen: associated with explosive formulation
- Carbonaceous materials
- Metals: aluminium (Al), arsenic (As), barium (Ba), beryllium (Be), iron (Fe), cobalt (Co), manganese (Mn), mercury (Hg), nickel (Ni), selenium (Se), sulphur (S), and/or zinc (Zn) (as detailed in the geochemical assessment contained in Appendix G)

Current operational water management includes the segregation of water from mine operational areas from non-mine affected areas. Water from mine operational areas is collected within on-site mine dams and recycled within the mine operations, transferred to other BMA operations, or released under the conditions of the EA. Mine affected water includes pit water, TSF water, CHPP water and runoff from areas such as the CHPP and MIA. Mine affected water 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, as well as metals and salinity. All mine affected water dams will be assessed for potential accumulation of contaminants and appropriately decommissioned to form free-draining areas.

The AMD geochemical risks from the residual voids and spoil dumps including those with buried TSFs, once pit lakes have established, has been assessed as Low to Medium based on the SPR assessment (Section 6.1.3.4). The spoil at SRM has been identified to contain moderate to high acid neutralising capacity with sufficient capacity to neutralise any acid forming materials within the spoil dumps. In addition, the depth to groundwater and the results of hydrogeological particle tracking indicates that potential contaminated seepage that enters the groundwater will migrate towards the residual voids (long-term sinks), and hence will remain within the NUMA. Surface water monitoring – as per the operational EA requirements, and Section 8.5 of this PRC Plan will identify any potential geochemical risks from site and progressively rehabilitated landforms that enters the surface water environments.

The AMD geochemical risks from the TSFs have been rated as Low to Low-Medium based on the SPR assessment. Potential contaminants from the tailings material include metals, salinity and acid (low pH). However, the majority of the existing TSFs will be covered within the spoil dumps, with only the historical out of pit TSF no. 3 remaining, as rehabilitated woodland habitat (Section 6.2). Particle tracking modelling indicates that particles within the groundwater within the locations of the TSFs, including TSF no. 3, migrate towards the residual voids and remain within the NUMA. Surface water monitoring and contaminated land investigations (RM2) will provide for identification of any seepage to watercourses that presents potential risks.

Solubility testing to understand potential metal/metalloid mobility (in addition to pH and EC) has been undertaken on a range of mineral waste materials using solvents such as deionised water, saline water and peroxide leach to assess the range of potential post-mining conditions (details provided and discussed in Section 4.4 of the waste characterisation report – Appendix G). The solubility test-work results have indicated the majority of spoil, tailings and coarse rejects samples generate contact water that was generally alkaline with low concentrations of soluble metals/metalloids – including arsenic (As), molybdenum (Mo) and selenium (Se). Therefore, spoil landforms in the post-mining environment, are not expected to mobilise metals/metalloids at concentrations of concern.

Contaminated land investigations will be undertaken to assess areas for potential contamination (RM2). This investigation will assess the range of potential contaminants that are utilised or generated during operations

and will provide an assessment of the risk presented to achievement of the PMLUs and the receiving environment.

6.1.7.2 Pathway of contaminants

The closure landform surfaces will predominantly be free-draining where appropriate to prevent impacts, directly to the surrounding watercourses. Any contaminants present at the surface of the closure 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 at the completion of mining will inform required remediation works to manage identified unacceptable risks associated with potential pathways to surface contamination.

Prior to rehabilitation, runoff from areas generating mine affected water are captured within the mine water management system. Dams and other infrastructure within the mine water management system will be assessed for potential contaminants, decommissioned and rehabilitated as part of mine closure. The surface of mine dam rehabilitation areas will be free-draining.

Modelling of flow paths through groundwater particle tracking indicates that groundwater within the tenure, including those areas containing the MIA, CHPP, mine dams, TSFs and spoil dumps, will migrate towards the residual voids post-mining. During the initial stabilisation phase of the groundwater and pit lakes, the more dynamic climate influenced pit lakes (when compared to groundwater) may result in some variability in the flux between groundwaters and pit lakes. Outflows (mainly within the first 20-years post-mining) are predominantly into the spoil dumps, prior to the recovery of groundwater within the spoil. Flow path modelling indicates that these events do not result in loss of groundwaters beyond the tenure boundary, with groundwaters returning to the residual voids which, once stabilised, will continue to act as sinks post-closure (Sections 6.1.1 and 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 receiving environment will be subject to investigation and remediation. Where appropriate, draft Site Management Plans (SMPs) will be prepared in accordance with the requirements of the EP Act 1994. The SMPs will be submitted to the administering authority for consideration where any ongoing management of contamination is required.

6.1.7.4 Surface water diversions

SRM has diversions within seven watercourses – Plumtree, Hughes, Barrett, One Mile, Spring, Southern and Phillips creeks, which were designed and constructed to enable mining. Of these, the diversions within six watercourses, some of which have multiple diverted reaches (and multiple water licences), will remain at closure. Each watercourse diversion was assessed against the EA watercourse PMLU goals of being safe, stable, not causing environmental harm and able to sustain a watercourse PMLU. The assessments concluded that diversions in three of the watercourses (Plumtree, Phillips and the yet to be constructed Spring/Southern creeks), in their current or planned alignments, are expected to progress towards the EA PMLU goals. The diversion details and forward work plan commitments for relinquishment for these creek diversions are summarised in Table 34.

The other three watercourses with diversions require realignment and rehabilitation. Diversion concept designs, based on both the Natural Resources, Mines and Energy (DNRME) - *Guideline: Works that interfere with water in a watercourse for a resource activity—watercourse diversions authorised under the Water Act 2000* (DNRME, 2019) and ACARP (2014) guidelines, have been developed for these diversions:

- *PRCP Concept Design Report – Hughes Creek* (Engeny, 2023a), provided in Appendix I
- *PRCP Concept Design Report – Barrett Creek* (Engeny, 2023b), provided in Appendix J
- *PRCP Concept Design Report – One Mile Creek* (Engeny, 2023c), provided in Appendix K

The forward work plan commitments for the relinquishment of these creek diversions requiring realignment are summarised in Table 35. The diversion concept designs be progressed to functional designs. Prior to commencing any watercourse diversion rehabilitation construction works, all applicable environmental approvals, including under the *Water Act 2000*, will be obtained.

Table 34: Forward work plans for creek diversions retaining their current or planned alignment

Details	Plumtree Creek	Phillips Creek	Spring/Southern Creeks
Water licence(s)	34346F	178206, 172682	623114
River catchment	Isaac River	Isaac River	Isaac River
Upstream catchment area (km²)	7	380	32
Year of construction	~1978	2006	Yet to be constructed
Diversion length (km)	3.4	2.9	Planned: 6.3
Diversion assessment outcome	Diversion in its existing alignment is meeting or will continue progressing towards achieving the 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 is meeting or will continue progressing towards achieving the EA watercourse PMLU goals. Diversion will be relinquished in its existing alignment following implementation of the forward work plan commitments.	Diversion in its planned alignment will achieve the EA watercourse PMLU goals. Diversion will be relinquished in its planned alignment following construction and 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 (once constructed).
Forward work plan – diversion construction	N/A	N/A	Construction of the diversion channel in line with the approved functional design.

Details	Plumtree Creek	Phillips Creek	Spring/Southern Creeks
Forward work plan – infrastructure	Removal and rehabilitation of the haul road, ramps, culverts (which will cause Lake Swan to become free-draining) and other mine infrastructure near the diversion.	Removal and rehabilitation of any current or future mine infrastructure near the diversion.	Removal and rehabilitation of any future mine infrastructure in or near the diversion including the haul road.
Forward work plan – final landform	Re-grade, topsoil and revegetate adjacent spoil dumps.	Re-grade, topsoil and revegetate adjacent spoil dumps.	Re-grade, topsoil and revegetate adjacent spoil dumps.

Table 35: Forward work plans for creek diversions requiring realignments and rehabilitation

Details	Hughes Creek	Barrett Creek	One Mile Creek
Water licence(s)	34358F, 52666F, 0426546F	30970F	30972F
River catchment	Isaac River	Isaac River	Isaac River
Upstream catchment area (km²)	133	35	29
Year of construction	Unknown	~1976 Diversion alignment approved in 2020 yet to be constructed	1976 Diversion extension constructed in 2008
Diversion length (km)	6.0	Current: 2.5; Planned: 2.4	3.5
Diversion assessment outcome	At closure, the existing diversion alignment is not expected to achieve the watercourse PMLU RM15 milestone criteria. Diversion requires implementation	At closure, the planned diversion alignment (yet to be constructed) is not expected to achieve the watercourse PMLU RM15 milestone criteria. Diversion requires	At closure, the existing diversion alignment is not expected to achieve the watercourse PMLU RM15 milestone criteria. Diversion requires implementation of the forward work

Details	Hughes Creek	Barrett Creek	One Mile Creek
	of the forward work plan commitments, including rehabilitation as per the concept design form and alignment.	implementation of the forward work plan commitments, including rehabilitation as per the concept design form and alignment.	plan commitments, including rehabilitation as per the concept design form and alignment.
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 design & rehabilitation	When surrounding rehabilitation activities are planned, progress concept design (Appendix I) to functional design, including undertaking site-specific investigations to ensure the design addresses key risks. Construction of the diversion in line with the final functional design developed based on DNRME (2019) and ACARP (2014) guidelines.	When surrounding rehabilitation activities are planned, progress concept design (Appendix J) to functional design, including undertaking site-specific investigations to ensure the design addresses key risks. Construction of the diversion in line with the final functional design, developed based on DNRME (2019) and ACARP (2014) guidelines.	When surrounding rehabilitation activities are planned, progress concept design (Appendix K) to functional design, including undertaking site-specific investigations to ensure the design addresses key risks. Construction of the diversion in line with the final functional design, developed based on DNRME (2019) and ACARP (2014) guidelines.
Forward work plan – infrastructure	Removal and rehabilitation of current or future mine infrastructure near the diversion.	Removal and rehabilitation of any current or future mine infrastructure near the diversion. Backfilling of Dudley's Dam to make free-draining.	Removal and rehabilitation of culvert crossings, haul road, light vehicle crossings and any other mine infrastructure near the diversion. Backfilling of Campbells Dam to make free-draining.
Forward work plan – final landform	Re-grade, topsoil and revegetate adjacent spoil dumps.	Re-grade, topsoil and revegetate adjacent spoil dumps.	Re-grade, topsoil and revegetate adjacent spoil dumps.

6.1.7.5 Water storages

One Mile Creek Dam will be the only existing dam that will be retained at closure. The dam is included as excised land due to it being utilised as regional infrastructure (Figure 28). One Mile Creek Dam was originally built in the 1970s for flood attenuation purposes to reduce downstream peak flows to downstream diversions and mine operational areas, however the dam is now utilised as a staging point for water transfer as part of the Bingegang water pipeline. Inflows into the dam are from One Mile Creek, two minor tributaries and the Bingegang water pipeline. Outflows from the dam are via the Bingegang water pipeline and overflows through the spillway to Campbells Dam (to be decommissioned and rehabilitated as part of the PRCP). The One Mile Creek Dam has a catchment of approximately 20.6km² and receives water from a non-mine affected catchment.

The Bingegang water pipeline sources water from the Nogo-Mackenzie Scheme located approximately 100km to the south-east of SRM. The pipeline supplies raw water to the township of Dysart, to Sunwater for their customers, BMA operated mines and other surrounding mining operations. The pipeline is used to transport raw water (i.e. not potable or treated water), which is treated by the receiver to render the water suitable for the intended purpose. One Mile Creek Dam is used as a staging point along the pipeline. Removal of the dam would require the construction of an alternative facility/infrastructure to support the on-going use of the pipeline.

The One Mile Creek Dam water licence (27661F), which authorises impounding water, will expire on 30 June 2111. Under the current licensing of One Mile Creek Dam, it is authorised to impound up to 900ML of water and to a maximum depth of 5.5m. Under the licence conditions, surface water flows into One Mile Creek Dam are to be released downstream at a rate that is equal to the rate at which water is entering, or the unrestricted capacity of the spillway. The current licencing does not provide for the taking of surface water inflows from the dam, only water volumes that are pumped into it through the Bingegang water pipeline.

BMA is the lessee of the underlying land for One Mile Creek Dam under a State land lease (TL 0/233440). That lease can continue to be renewed by BMA independently of the relinquishment of the SRM mining tenures, and provides rights of occupation by BMA for the purposes of 'infrastructure'. Further, as owners and operators of the Bingegang water pipeline and as lessees under the term lease, BMA would be able to continue to utilise the water licence for One Mile Creek Dam to support the ongoing operation of the pipeline after the mining tenures are relinquished. This provides for the continued use of the dam after closure to support the supply of raw water to the township of Dysart, to Sunwater, other BMA operated mines and surrounding mining operations.

6.1.7.6 Ongoing water management

On completion of rehabilitation works, ongoing water management/dewatering is not envisaged to be required due to the following:

- The surface of the closure landform, excluding One Mile Creek Dam and the residual voids, will be free-draining where required to prevent impacts
- Contamination will be remediated and/or appropriately managed
- The residual voids will generally continue to act as long-term sinks capturing and containing any groundwater seepage from the site, and will not overtop or interconnect with groundwater aquifers
- Watercourse diversions will be realigned where required and rehabilitated to form a stable landform that allows relinquishment of the water licences.

Section 8 of this plan includes both groundwater and surface water monitoring programs that will be undertaken as part of the rehabilitation works. The monitoring program provides the assessment of groundwater quality and levels within key locations that will inform 5-yearly updates of the numerical groundwater model. Through the groundwater model predictive outputs, groundwater flow paths, levels and the progression of the residual voids developing into groundwater sinks will be confirmed.

Relationship with the PRCP schedule

The closure landform with residual voids will provide a landscape that does not require any ongoing active water management. The watercourse diversions will be realigned, where required, and rehabilitated to form a stable watercourse PMLU that allows for relinquishment of the water licences.

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, grassland woodland habitat and watercourse are consistent with the rehabilitation milestone criteria:

- Cattle grazing:
 - Achieve >50% vegetation groundcover
 - Establishment of cattle grazing pasture with land suitability class ≤3
- Grassland:
 - Achieve groundcover ≥50% on slopes ≤15% (at least 50% vegetation groundcover on slopes ≤5%), or ≥80% on slopes >15%
 - Establishment of grass species to support stability
- Woodland habitat:
 - Achieve groundcover ≥50% on slopes ≤15% or ≥80% on slopes >15%
 - Establishment of vegetation with BioCondition site-based attributes, or a target RE for areas adjacent to established vegetation communities (Section 1.2.8)
- Watercourse:
 - Achieve riparian vegetation index ≥ upstream or downstream values

There are no revegetation objectives for the planned NUMAs.

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.

Infrastructure, such as fencing, may be required to restrict livestock from areas revegetated to achieve a grassland PMLU. No infrastructure is proposed for the other areas.

6.1.8.2 Species of conservation significance

SRM has no obligations under the EA requiring specific inclusion of species of conservation significance in the revegetation planning. Nonetheless, areas adjoining undisturbed Endangered or Of Concern regional ecosystems (Section 1.2.8) or threatened species habitats (Section 1.2.9) 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 obligations under the EA to establish fauna habitat and/or fauna use in the rehabilitation areas for SRM. However, areas adjoining undisturbed threatened fauna species habitats (Section 1.2.9) 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 rehabilitation will include a combination of *Eucalyptus*, *Corymbia* and non-Eucalyptus framework tree species and woody understorey species that will provide broad habitat values for more highly mobile fauna taxa including birds and mobile mammals (e.g. kangaroos and wallabies), as well as longer term foraging and shelter opportunities for common fauna species and several species of conservation significance (e.g. koala, echidna).

6.1.8.4 Revegetation seed provenance

The provenance (where the seed comes from) is consideration for all species. Although the local provenance boundary locations may differ between species, as a preference seed should be sourced 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 and grassland revegetation species and seeding rates

Cattle grazing PMLU is 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). Grassland PMLU is planned for areas that require shallow rooted species, but where cattle may impact the stability and integrity of the TSF or rejects cover (RA9).

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

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

The recommended species list and seeding rates are detailed in Table 36. A seeding rate of 16kg/ha of coated pasture seed and 4kg/ha of uncoated legume seed is recommended for a cattle grazing PMLU and a seeding rate of 25kg/ha of coated grass seed is recommended for a grassland PMLU. All seed mixes will also include 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 3P grasses, including at least two native species, and two legumes listed in Table 36 are required for cattle grazing revegetation. The cattle grazing or grassland seed mix composition and seeding rates may be adjusted by an AQP based on the results of ongoing rehabilitation monitoring (Section 8).

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.

No seeding of *Leucaena* (*Leucaena leucocephala*) is planned at SRM.

Table 36: Recommended species list and seeding rates for cattle grazing and grassland PMLUs

Scientific name	Common name	Topsoil suitability		Seeding rate (kg/ha)	
		Cracking clays & heavy loams/clays	Light loams/sands	Cattle grazing	Grassland
Grass species					
<i>Astrebla lappulacea</i> , <i>A. squarrosa</i> , <i>A. elymoides</i>	Mitchell grasses (curly, bull and hoop)	✓	-	2 ^c (per species)	5 ^c (per species)
<i>Bothriochloa bladhii</i>	forest blue grass	-	✓	4 ^c	5 ^c
<i>Bothriochloa insculpta</i> cvv. <i>Bisset</i> *	Bisset creeping blue grass	✓	✓	4 ^c	5 ^c
<i>Chloris gayana</i> cvv. <i>Callide</i> *	Callide Rhodes grass	✓	✓	4 ^c	5 ^c
<i>Chloris gayana</i> cvv. <i>Katambora</i> *	Katambora Rhodes grass	✓	✓	4 ^c	5 ^c
<i>Dichanthium sericeum</i> subsp. <i>sericeum</i>	Queensland blue grass	✓	-	4 ^c	5 ^c
<i>Digitaria brownii</i>	cotton panic	-	✓	2 ^c	5 ^c
<i>Heteropogon contortus</i>	black spear grass	✓	✓	2 ^c	5 ^c
<i>Megathyrsus maximus</i> var. <i>pubiglumis</i> *	green panic	-	✓	4 ^c	5 ^c
<i>Panicum coloratum</i> var. <i>makarikariense</i> *	bambatsi Panic	✓	-	4 ^c	5 ^c
<i>Setaria incrassata</i> *	purple pigeon	✓	-	4 ^c	5 ^c
<i>Urochloa mosambicensis</i> *	Sabi grass	-	✓	4 ^c	5 ^c
Grass species - Total seed weight (coated)				16 ^c	25 ^c
Legume species					
<i>Stylosanthes seabrana</i> *	stylo	✓	-	2	-
<i>Macroptilium bracteatum</i> *	burgundy bean	✓	-	2	-
<i>Stylosanthes hamata</i> *	shrubby stylo	-	✓	2	-
<i>Chamaecrista rotundifolia</i> *	Wynn cassia	-	✓	2	-
<i>Rhynchosia minima</i> var. <i>minima</i>	rhynchosia	✓	✓	2	-
<i>Rhynchosia minima</i> var. <i>australis</i>	rhynchosia	✓	✓	2	-
Legume species - Total seed weight (uncoated)				4	0
Crop cover					
<i>Echinochloa esculenta</i>	Japanese millet	✓	✓	5	10

^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

Woodland habitat PMLU are planned on landforms associated with the spoil dumps and areas near existing vegetation communities.

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 species selection for the woodland habitat revegetation areas has considered the ecological functional groupings according to the role or function they perform in both rehabilitation and non-mined environments

(Emmerton et al., 2016a and 2016b) (Table 37). 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 (Emmerton et al., 2016b). Competitive pasture species have also been excluded from the seed mix and only non-aggressive and native grass species have been recommended (Emmerton et al., 2016b).

Table 37: 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	<i>Eucalyptus</i> , <i>Corymbia</i> , and occasionally <i>Angophora</i> 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 can become 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 (e.g. <i>Acacia shirleyi</i> , <i>Acacia rhodoxylon</i>)
Woody understorey components		
Shrubby understorey	SU	A shrub is defined as: a woody plant that is multi-stemmed from the base (or within 200mm 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 that 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 wattles (<i>Acacia</i> spp.) 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

Life form and functional group	Code	Explanatory notes
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)
Native grasses	NG	Perennial and annual native grasses. Includes grass like plants (e.g. genera include: <i>Cyperus</i> , <i>Dianella</i> and <i>Lomandra</i>)

6.1.8.7 Woodland habitat seed species and seeding rates

The spoil dumps are elevated, sloped anthropogenic landforms comprised 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 SRM, 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 land forms (i.e. growth media, physical and chemical variation, variation in slope, aspect, altitude).

The representative REs in the SRM region (Section 1.2.8.1) that best align with the woodland habitat rehabilitation landforms (i.e. hilly, rocky terrain and/or substrates with poorer soils) include:

- RE 11.5.3 – *Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains and/or remnant surfaces
- RE 11.5.9 – *Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains and/or remnant surfaces
- RE 11.10.1 – *Corymbia citriodora* woodland on coarse-grained sedimentary rocks (dominant)
- 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 growth media for woodland habitat includes pre-stripped topsoil and ameliorated Permian spoil as discussed in Section 6.1.4. The growth media will be ameliorated, if recommended by an AQP, prior to deep ripping and seeding. Where topsoil is used, the depth will be a minimum of 100mm, or as advised by an AQP, 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, A, & Doley, D., 2016).

For RA1, the recommended woodland habitat species are listed in Table 38 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 10kg/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 for RA1 should ensure that at least six species from each of the main revegetation groups listed in Table 38, including framework tree species, woody understorey species and grasses, are sown at the overall recommended rate to achieve the required species richness. If recommended species are not available, substitute species from RE 11.5.3, RE 11.5.9, RE 11.10.1 or RE 11.10.3 should be used.

For RA4, rehabilitation should aim to achieve woodland habitat similar to the surrounding vegetation communities. The revegetation seed mix 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 rates listed in Table 38. Minimal disturbance is planned for some areas of RA4; therefore, growth media replacement and seed application may not be required in all areas. 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 38: Recommended species list and seeding rates for woodland habitat PMLU

Species* name	Common name	Life form and functional group code	Cracking clays & heavy loams/ clays	Light loams/ sands	Seed rates (kg/ha - uncoated weight)
Framework tree species					
<i>Acacia catenulata</i>	bendee	LLA	✓	✓	1 - 2
<i>Acacia rhodoxylon</i>	rosewood	LLA	-	✓	0.3 - 1
<i>Acacia shirleyi</i>	lancewood	LLA	-	✓	0.3 – 1
<i>Allocasuarina littoralis</i>	black she oak	NE/NA	-	✓	0.3 – 0.5
<i>Allocasuarina luehmannii</i>	bull oak	NE/NA	-	✓	0.3 – 0.5
<i>Alphitonia excelsa</i>	red ash	NE/NA	✓	✓	0.3 – 0.5
<i>Angophora leiocarpa</i>	smooth barked apple	E/C	-	✓	0.3 – 0.5
<i>Atalaya hemiglauca</i>	whitewood	NE/NA	✓	✓	0.3 – 0.5
<i>Callitris glaucophylla</i>	cypress pine	NE/NA	✓	✓	0.3 – 0.5
<i>Casuarina cristata</i>	belah	NE/NA	✓	✓	0.3 - 0.5
<i>Corymbia citriodora</i> subsp. <i>citriodora</i> **	lemon scented gum	E/C	✓	✓	0.6 - 2
<i>Corymbia clarksoniana</i>	Clarkson's bloodwood	E/C	✓	✓	0.3 - 1
<i>Corymbia dallachiana</i>	Dallachy's gum	E/C	✓	✓	0.3 – 0.5
<i>Corymbia erythrophloia</i>	red bloodwood	E/C	✓	✓	0.3 - 1
<i>Eucalyptus cambageana</i>	Dawson gum	E/C	✓	✓	0.2 – 0.5
<i>Eucalyptus crebra</i>	narrow leafed ironbark	E/C	✓	✓	0.6 - 2
<i>Eucalyptus decorticans</i>	gum-top ironbark	E/C	-	✓	0.3 – 0.5
<i>Eucalyptus exserta</i>	Queensland peppermint	E/C	-	✓	0.3 – 0.5
<i>Eucalyptus melanophloia</i>	silver leaved ironbark	E/C	✓	✓	0.3 - 1
<i>Eucalyptus populnea</i>	poplar box	E/C	✓	✓	0.3 – 0.5

Species* name	Common name	Life form and functional group code	Cracking clays & heavy loams/ clays	Light loams/ sands	Seed rates (kg/ha - uncoated weight)
<i>Eucalyptus thozetiana</i>	Thozets gum	E/C	✓	✓	0.3 - 0.5
<i>Lysiphyllum carronii</i>	red bauhinia	NE/NA	✓	✓	0.3 – 0.5
<i>Lysiphyllum hookeri</i>	white bauhinia	NE/NA	✓	-	0.2 – 0.5
<i>Terminalia oblongata</i>	yellowwood	NE/NA	✓	-	0.2 – 0.5
Framework tree species - total seed weight (uncoated)					6
Woody understory species					
<i>Acacia conferta</i>	crowded-leaf wattle	SU	-	✓	0.3 – 0.5
<i>Acacia crassa</i>	curracabah	ILA	-	✓	0.3 – 0.5
<i>Acacia excelsa</i>	ironwood wattle	LLA	✓	✓	0.3 – 0.5
<i>Acacia flavescens</i>	yellow wattle	LLA	-	✓	0.3 – 0.5
<i>Acacia holosericea</i>	silver wattle	LLA	-	✓	0.3 – 0.5
<i>Acacia leiocalyx</i>	black wattle	LLA	-	✓	0.3 – 0.5
<i>Acacia sericophylla</i>	desert oak	ILA	-	✓	0.3 – 0.5
<i>Alstonia constricta</i>	bitterbark	SU/NE/NA	✓	✓	0.3 – 0.5
<i>Atriplex nummularia</i>	oldman saltbush	SU	✓	✓	0.3 – 0.5
<i>Capparis lasiantha</i> , <i>C. canescens</i> , <i>C. loranthifolia</i>	wait-a-while	V/C	✓	✓	0.2 – 0.5
<i>Breynia oblongifolia</i>	coffee bush	SU	✓	✓	0.3 – 0.5
<i>Carissa ovata</i>	currant bush	GCS	✓	✓	0.3 – 1
<i>Cassia brewsteri</i> **	Leichhardt bean	SU	✓	✓	0.3 – 0.5
<i>Dodonaea viscosa</i> **	sticky hop bush	SU	✓	✓	0.3 – 0.5
<i>Eremophila mitchellii</i>	false sandalwood	SU/NE/NA	✓	✓	0.3 – 0.5
<i>Erythroxylon australe</i>	cocaine tree	SU	✓	✓	0.2 – 0.5
<i>Geijera parvifolia</i>	wilga	SU	✓	✓	0.2 – 0.5
<i>Grevillea striata</i>	beefwood	SU/NE/NA	-	✓	0.3 – 0.5
<i>Grewia latifolia</i>	dogs balls	SU	✓	✓	0.3 – 0.5
<i>Hakea lorea</i>	bootlace oak	SU/NE/NA	✓	✓	0.3 – 0.5
<i>Jasminum didymum</i>	native jasmine	V/C	✓	✓	0.3 – 0.5
<i>Myoporum acuminatum</i>	waterbush	SU	✓	✓	0.3 – 0.5
<i>Myoporum montanum</i>	waterbush	SU	✓	✓	0.3 – 0.5
<i>Petalostigma pubescens</i>	quinine	SU/NE/NA	✓	✓	0.3 – 0.5
<i>Pittosporum angustifolium</i>	Gumby Gumby	SU/NE/NA	✓	✓	0.3 – 0.5

Species* name	Common name	Life form and functional group code	Cracking clays & heavy loams/ clays	Light loams/ sands	Seed rates (kg/ha - uncoated weight)
<i>Senna artemisioides</i>	silver cassia	SU	✓	✓	0.3 – 0.5
Woody understory species - total seed weight (uncoated)					4
Grass species					
<i>Aristida</i> spp. (i.e. <i>A. calycina</i> , <i>A. latifolia</i> , <i>A. ramosa</i> , <i>A. caput-medusae</i> , <i>A. jerichoensis</i> , <i>A. personata</i> , <i>A. calycina</i>)	three awned spear grass	NG	-	✓	1 - 2
<i>Bothriochloa bladhii</i>	forest bluegrass	NG	✓	-	1 – 2
<i>Bothriochloa decipiens</i> var. <i>decipiens</i>	pitted bluegrass	NG	✓	✓	1 - 2
<i>Bothriochloa ewartiana</i>	desert bluegrass	NG	✓	✓	1 - 2
<i>Chloris truncata</i>	windmill grass	NG	✓	✓	1 – 2
<i>Chrysopogon fallax</i>	golden beard grass	NG	✓	✓	1 - 2
<i>Cymbopogon refractus</i>	barbwire grass	NG	✓	✓	1 - 2
<i>Cynodon dactylon</i> var. <i>dactylon</i> **	couch	IG	✓	✓	2
<i>Panicum decompositum</i>	native millet	NG	✓	✓	1 – 2
<i>Panicum effusum</i>	hairy panic	NG	✓	✓	1 - 2
<i>Paspalidium distans</i>	shot grass	NG	-	✓	1 - 2
<i>Themeda triandra</i>	kangaroo grass	NG	✓	✓	1 - 2
Grass species - total seed weight (uncoated)					10
Crop cover					
<i>Echinochloa esculenta</i>	Japanese millet	Cover crop	✓	✓	5

* If recommended species are not available, substitute species from RE 11.5.3, RE 11.5.9, RE 11.10.1 or RE 11.10.3

**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 for the following areas:

- Existing watercourse diversions requiring realignment or additional revegetation activities
- Natural watercourses which have been disturbed by mining activities e.g. crossings

The existing watercourse diversions that have previously been revegetated are discussed in Section 6.1.7.4 and will be monitored to inform operational maintenance requirements (Section 8.3).

The revegetation zones for natural watercourses (Figure 20) are defined as follows:

- Upper bank: defines the lateral limits of both sides of the watercourse. 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 (i.e. *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.

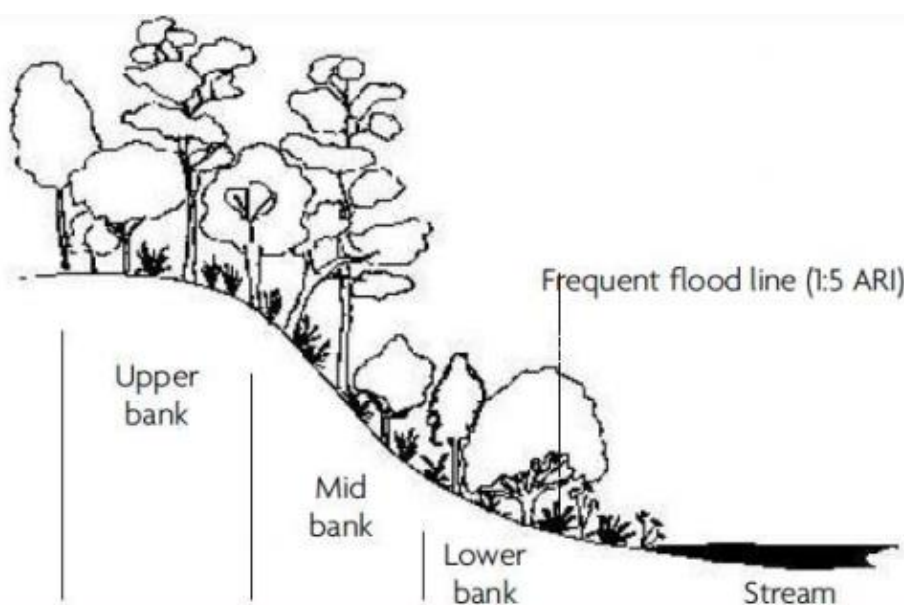


Figure 20: Typical riparian revegetation plantings zone (Vegetation Matters, 2014)

The growth media for watercourse PMLU will be pre-stripped topsoil, spread over the bank areas of the rehabilitated landforms at a depth $\geq 150\text{mm}$, 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 predominant natural watercourse RE 11.3.25 occurring on the SRM site (Figure 10).

The recommended watercourse revegetation species and seeding rates are listed in Table 39 and Table 40. The planned seeding rate for upper and mid banks is 20kg/ha (uncoated) comprised of 6kg/ha framework tree, 4kg/ha woody understorey species and 10kg/ha grasses and other groundcover species.

The planned seeding rate for lower banks is 15kg/ha (uncoated) comprised of 5kg/ha framework tree and 10kg/ha 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 39: Recommended species list and seeding rates for watercourse PMLU – upper and mid banks

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
Framework tree species			
<i>Acacia stenophylla</i> *	river myall	LLA	0.5 - 1
<i>Alphitonia excelsa</i>	red ash	NE/NA	0.5 - 1
<i>Angophora floribunda</i>	rough barked apple	E/C	0.5 - 1
<i>Angophora leiocarpa</i>	smooth barked apple	E/C	0.5 - 1
<i>Angophora subvelutina</i>	broadleaf apple	E/C	0.5 - 1
<i>Casuarina cristata</i> *	belah	E/C	0.5 - 1
<i>Casuarina cunninghamiana</i> *	river she oak	NE/NA	0.5 - 1
<i>Corymbia tessellaris</i> *	Moreton Bay ash	NE/NA	0.5 - 1
<i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> *	river red gum	E/C	1 - 2
<i>Eucalyptus coolabah</i> subsp. <i>coolabah</i>	Coolabah	E/C	1 - 2
<i>Eucalyptus melanophloia</i>	silver leaved ironbark	E/C	0.5 - 1
<i>Eucalyptus populnea</i>	poplar box	E/C	0.5 - 1
<i>Eucalyptus tereticornis</i> subsp. <i>tereticornis</i> *	Queensland blue gum	E/C	0.5 - 1
<i>Lysiphyllum hookeri</i>	white bauhinia	NE/NA	0.5 - 1
<i>Melaleuca bracteata</i> *	black tea tree	NE/NA	0.5 - 1
<i>Terminalia oblongata</i>	yellowwood	NE/NA	0.5 - 1
Framework tree species - total seed weight (uncoated)			6
Woody understorey species			
<i>Carissa ovata</i>	current bush	GCS	0.5 - 1
<i>Acacia excelsa</i>	ironwood wattle	ILA	0.5 - 1
<i>Acacia fasciculifera</i>	scaly bark	ILA	0.5 - 1
<i>Cassia brewsteri</i> *	Leichardt bean	SU	0.5 - 1
<i>Dodonaea viscosa</i>	sticky hop bush	SU	0.5 - 1
<i>Eremophila mitchellii</i>	false sandalwood	SU	0.5 - 1
<i>Erythroxylum australe</i>	cocaine tree	SU	0.5 - 1
<i>Ficus coronata</i>	creek sandpaper fig	SU	0.5 - 1
<i>Ficus fraseri</i>	white sandpaper fig	SU	0.5 - 1
<i>Ficus opposita</i>	sandpaper fig	SU	0.5 - 1
<i>Grevillea striata</i>	beefwood	SU	0.5 - 1

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
<i>Grewia latifolia</i>	dogs balls	SU	0.5 - 1
<i>Hakea lorea</i>	bootlace oak	SU	0.5 - 1
<i>Mallotus philippensis</i>	red kamala	SU	0.5 - 1
<i>Petalostigma pubescens</i>	quinine	SU	0.5 - 1
Woody understorey species - total seed weight (uncoated)			4
Ground species			
<i>Cymbopogon refractus</i>	barbwire grass	NG	1 - 2
<i>Bothriochloa bladhii</i>	forest blue grass	NG	1 - 2
<i>Capillipedium spicigerum</i>	scented top	NG	1 - 2
<i>Cynodon dactylon</i> *	couch	IG	2
<i>Dichanthium sericeum subsp. sericeum</i>	Queensland bluegrass	NG	1 - 2
<i>Digitaria brownii</i>	cotton panic	NG	1 - 2
<i>Eulalia aurea</i>	silky brown top	NG	1 - 2
<i>Eustrephus latifolius</i>	wombat vine	V/C	1 - 2
<i>Heteropogon contortus</i>	black speargrass	NG	1 - 2
<i>Jasminum simplicifolium subsp. australiense</i>	stiff jasmine	V/C	0.2 - 0.5
<i>Lomandra longifolia</i>	mat rush	NG	0.2 - 0.5
<i>Panicum effusum</i>	hairy panic	NG	1 - 2
<i>Paspalidium distans</i>	shot grass	NG	1 - 2
<i>Rhynchosia minima</i>	Rhynchosia	V/C	1 - 2
<i>Themeda triandra</i>	kangaroo grass	NG	1 - 2
Ground species - total seed (uncoated)			10
Crop cover			
<i>Echinochloa esculenta</i>	Japanese millet	Cover crop	5

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

Table 40: Recommended species list and seeding rates for watercourse PMLU – lower banks

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
Framework tree species			
<i>Casuarina cunninghamiana</i> *	river she oak	NE/NA	0.5 - 1
<i>Melaleuca bracteata</i> *	black tea tree	NE/NA	0.5 - 1
<i>Melaleuca fluviatilis</i>	weeping tea-tree	NE/NA	0.5 - 1
<i>Melaleuca linariifolia</i> *	snow in summer	NE/NA	0.5 - 1

Species name	Common name	Life form and functional group code	Seed rate (kg/ha - uncoated weight)
<i>Melaleuca leucadendra</i> *	broad-leaved tea tree	NE/NA	0.5 - 1
<i>Melaleuca viminalis</i> *	red bottlebrush	NE/NA	0.5 - 1
<i>Melaleuca trichostachya</i>	flax-leaf paperbark	NE/NA	0.5 - 1
<i>Lophostemon suaveolens</i>	swamp box	NE/NA	0.5 - 1
Framework tree species - total seed weight (uncoated)			5
Ground species			
<i>Cymbopogon refractus</i>	barbwire grass	NG	0.5 - 1
<i>Dichanthium sericeum</i> subsp. <i>sericeum</i>	Queensland bluegrass	NG	1 – 2
<i>Themeda triandra</i>	kangaroo grass	NG	0.5 - 1
<i>Bothriochloa bladhii</i> subsp. <i>bladhii</i>	forest blue grass	NG	1 – 2
<i>Lomandra longifolia</i>	spiny-headed mat rush	NG	2 - 3
<i>Eustrephus latifolius</i>	wombat vine	V/C	0.5 - 1
<i>Cyperus</i> spp. (<i>C. gracilis</i> , <i>C. polystachyos</i>)**	sedge	NG	2 - 3
<i>Cynodon dactylon</i> *	couch	IG	2 - 3
Ground species - total seed weight (uncoated)			10
Crop cover			
<i>Echinochloa esculenta</i>	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.

Relationship with the 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/ground species from REs suited to the landforms and substrates. The recommended species will best support achievement of the cattle grazing, grassland, woodland habitat and watercourse PMLUs.

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.*

A tailings characterisation report has been compiled to support the development of this PRC Plan. The detailed report – *PRCP Tailings Storage Facility Description, Saraji Mine* (WSP Golder, 2022), is provided in Appendix L.

6.2.1 Tailings context

Tailings is generated at the CHPP from washing ROM coal, and typically represents the clay, silt and fine sand fraction of rejects. Tailings comprises approximately 0.5% of all mineral waste at SRM (Appendix G) and are disposed into TSFs.

There are currently five TSFs at SRM - Ramp 2/3, Ramp 6, TSF no. 2, TSF no. 3 and TSF no. 4. Only Ramp 2/3 is currently active. Locations of the five SRM TSFs are shown in Figure 21, with the current status of each summarised in Table 41.

Tailings transportation and deposition at SRM has conventionally been carried out via pumping as a slurry through pipelines to each respective facility and deposition sub-aerially to form a beach and an operational decant pond. Initially SRM used above-ground turkey's nest style containment structures located in close proximity to the CHPP (TSF no. 2, TSF no.3 and TSF no.4), but in the late 1990s the storage philosophy changed to utilise void structures (ramp excavations) from the open pit mining operation, again in close proximity to the CHPP (Ramp 6 and Ramp 2/3).

As is typical of historical TSFs, engineering documentation for TSF no. 2, TSF no. 3, TSF no. 4 and Ramp 6 is limited. To address this, BMA has recently completed investigation and assessment works to retrospectively describe the blueprint and characterisation for these TSFs. The TSF design specifications based on these studies are summarised in Table 42.

Table 41: Summary of SRM TSFs

TSF	Structure		Current status	Operational period	Regulated structure	Rehabilitation strategy
	Type	Description				
Ramp 2/3	In-ramp	Disused mining pit ramps filled with tailings	Active	Ramp 3: 2006 - 2013 Ramp 2: 2009 - 2013 Ramp 2/3: 2013 - current	Yes	- Contamination assessment and management (RM2) - Bury with spoil (beneath Jacaranda/Bauhinia spoil landform), reshape spoil, growth media and seed (RM3, RM5, RM8)
Ramp 6	In-ramp		Inactive	~1998 – 2008	No	- Contamination assessment and management (RM2) - Bury with spoil (beneath Coolibah/Dogwood spoil landform), reshape spoil, growth media and seed (RM3, RM5, RM8)
TSF no. 2	Down slope Turkey's nest	Above ground facilities with partial or complete perimeter embankments. The depth of tailings is typically less than 20m, with material having been deposited such that supernatant water was collected at a decant pond at one edge of the facility	Historic; decommissioned and partially capped	Mid-1970 to late 1980s/early 1990s	No	- Contamination assessment and management (RM2) - Bury with spoil (beneath Coolibah/Dogwood spoil landform), reshape spoil, growth media and seed (RM3, RM5, RM8)
TSF no. 3	Turkey's nest		Historic; decommissioned and partially capped	Mid-1970s to 1985	No	- Remove infrastructure (RM1) - Contamination assessment and management (RM2)

TSF	Structure		Current status	Operational period	Regulated structure	Rehabilitation strategy
	Type	Description				
						Partially capped - further cover, topsoil and seed as required (RM3, RM4, RM7)
TSF no. 4	Down slope Turkey's nest		Historic; decommissioned and capped	1988 to late 1990s	No	- Contamination assessment and management (RM2) - Bury with spoil (beneath Coolibah/Dogwood spoil landform), reshape spoil, growth media and seed (RM3, RM5, RM8)

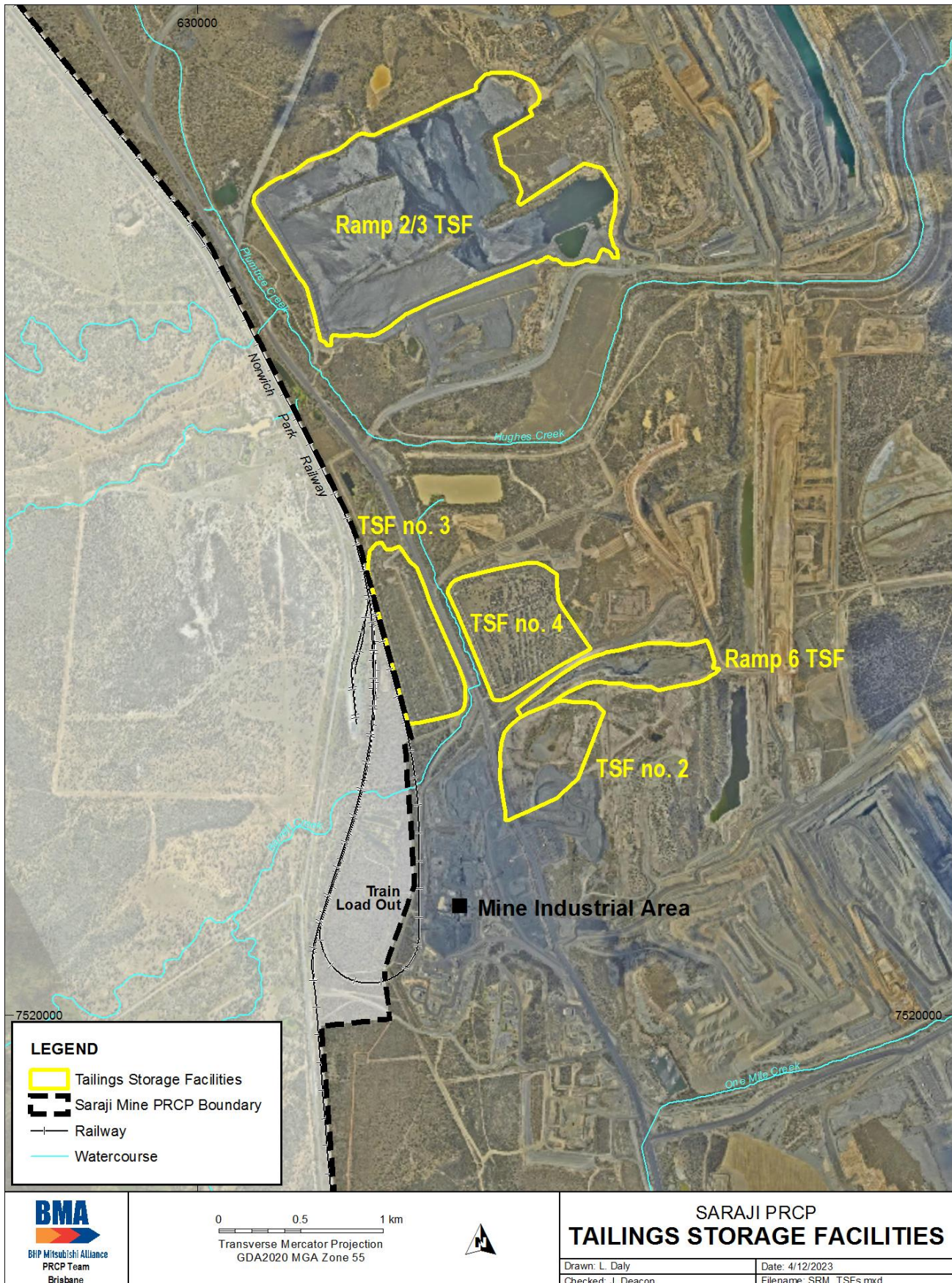


Figure 21: SRM tailings storage facilities

Table 42: SRM TSF design specifications

TSF	Current status	Storage				Containment structures				Spillway		Decant	
		Dimensions (L x W, nom, km)	Surface area (ha)	Full supply level (RL, m)	Stored volume (m ³)	Material type	Crest width (Nom, m)	Crest elevation (RL, m) Max height (m)	Downstream Slope	Description	Location	Description	Location
Ramp 2/3	Active	1.7 x 1.1	160	215	2.4 x 10 ⁶	Coarse rejects or Tertiary/Permian sandy clay	8	216 12	1V:4H	Capacity: 1:1,000 AEP + 1:10 AEP wind and wave run-up	Eastern end of southern embankment	Maintained below RL 211.85m. Pontoon mounted electric pump with capacity of 170L/s	South-eastern corner
Ramp 6	Inactive	1.2 x 0.2	40	NA	2 x 10 ⁶	Low-wall spoil	70	208 60	1V:2.5H	No spillway present. Preferential pathway during overtopping	NA	Gravity decant through 3 x 200mm HDPE pipes	Southern side of eastern embankment
TSF no. 2	Historic; decommissioned and partially capped	0.6 x 0.5	18	NA	1 x 10 ⁶	Sandy clay	Unknown	220 - 220 15	1V:1.6H to 1V:1.35H	No spillway present	NA	Unintentionally pond formed at localised topographical low	Centrally
TSF no. 3	Historic; decommissioned and partially capped	1.0 x 0.4	26	NA	4.5 x 10 ⁶	Sandy clay	8 - 9	216 - 217 15	1V:1.5H	Access ramp spillway	Northern embankment	Facility historically capped. No decant present. Historically located at northern end	NA
TSF no. 4	Historic; decommissioned and capped	0.8 x 0.7	38	NA	6.2 x 10 ⁶	Coarse rejects	9	216 - 219 16	1V:1.5H	No spillway present	NA	Facility capped. No decant present. Historically located in north-western corner	NA

Of the existing TSFs, TSF no. 3 will remain as a discrete TSF within the rehabilitated mine site. This facility has been partially capped and requires further rehabilitation activities to complete the cover, topsoil and seed. The other four existing TSFs will be buried by spoil during mining operations - TSF no. 2, TSF no. 4 and Ramp 6 will lie beneath the Coolibah/Dogwood spoil landform, and Ramp 2/3 will lie beneath the Jacaranda/Bauhinia spoil landform. The future tailings disposal strategy for the site will be in accordance with EA condition D6 and will be developed during the remaining life-of-mine, accompanied by a PRCP amendment, if required.

As per condition D6 of the EA, future tailing disposal may include the placement of tailings into voids provided a consequence category assessment in accordance with EA condition G1 has been completed. As well as a consequence category assessment, additional assessments will be undertaken as per the void requirements of the PRCP Guideline to confirm the placement of the tailings in the void does not present an unacceptable risk of environmental harm, prior to future tailings disposal.

The void suitability assessment will include the following:

- Consequence category assessment: in accordance with EA condition G1
- Hydrogeological assessment: including characterisation of the immediately surrounding groundwater aquifer (quality and heights), numerical modelling, groundwater fate and transport modelling and an evaluation of the sink/source relationship with the void
- Void water balance modelling: including an assessment of the sink/source relationship with the groundwater
- Geochemistry and water quality modelling: including an assessment of the impact the placement of the tailings in the void will have on void water quality
- Conceptual site modelling: including an assessment of potentially complete exposure pathways
- Geotechnical stability and safety assessment

The assessments will provide the following:

- Assessment by an AQP that residual voids continue to meet required stability and safety criteria;
- Assessment by an AQP that residual voids continue to manage risk of causing environmental harm by:
 - Continuing to act as a long term groundwater sink
 - Permian aquifers and shallower hydrogeological units are not inter-connected
 - No identified, reasonably likely complete exposure pathways, beyond the tenure boundary
- Identification of changes if required to the PRCP schedule

Where the above studies confirm the placement of tailings does not present an unacceptable risk of causing environmental harm, and there are no changes to the management of the residual void or the PRCP schedule, the residual void will remain a NUMA as outlined within this PRCP. This will typically be where: residual void lakes are maintained on top of the tailings; the residual voids post-mining are modelled to establish as long term groundwater sinks; Permian aquifers and shallower hydrogeological units are not inter-connected; there are no identified reasonably likely complete exposure pathways; and any leachate is not likely to impact environmental values beyond the tenure boundary.

Where the placement of the tailings in the void requires changes to the PRCP schedule, a PRCP amendment will be submitted prior to the future tailings disposal.

The rehabilitation strategy for each TSF informed the scope of tailings characterisation, closure design principles and rehabilitation or management strategies, as described in Sections 6.2.2, 6.2.3 and 6.2.4, respectively.

6.2.2 Tailings characterisation

Geochemical, rheological and geotechnical characterisation of all the SRM TSFs has been completed in accordance with the requirements of Section 3.6.2 of the PRCP Guideline, where relevant to the TSF operation and life cycle status.

Detailed characterisation work has been undertaken through extensive site investigation programs and comprehensive laboratory testing suites for both fresh (CHPP sourced) and aged (TSF sourced) samples. Site

investigations have occurred to extract in-situ samples of tailings from each TSF. Sampling has generally been carried out across the footprint and vertical profile of the TSFs, where safe access was possible³.

A dedicated tailings geotechnical characterisation report providing detailed TSF descriptions and consolidated tailings characterisation data collected and analysed to date is provided in Appendix L. Tailings geochemical characterisation is detailed in Appendix G. Key characterisation parameters that could influence the rehabilitation or management strategies of the TSFs are summarised below.

6.2.2.1 Geochemical characterisation

Dedicated sampling and analysis has been undertaken at the SRM TSFs to evaluate the geochemical nature of the tailings (Section 6.1.3 and Appendix G). The geochemical characteristics differed between fresh tailings from the CHPP (Ramp 2/3) versus aged tailings from the older TSFs (Ramp 6, TSF no. 2, TSF no. 3 and TSF no. 4) for different parameters – particularly total sulphur (and, by inference, maximum potential acidity), acid neutralising capacity and pH; however, the overall geochemical AMD hazard posed by tailings from the two sources (fresh vs aged) was generally similar.

As Ramp 2/3, Ramp 6, TSF no. 2 and TSF no. 4 will be buried beneath spoil landforms, the geochemical characterisation and associated hazard scores of these tailings is considered in Section 6.1.3.4.

Geochemical data from samples collected from TSF no. 3 was used to assess the geochemical AMD source hazard of this facility. The source hazard assessment has utilised the same general methodology as applied to the spoil landforms. The source hazard assessment has found that mixed spoil (cover) poses a Low AMD source hazard, and tailings within the landforms pose a Moderate AMD source hazard. Notably, the source hazard lies with the tailings, not the spoil capping layer.

The SPR assessment for TSF no. 3, which considered the AMD source hazard, and potential linkage of the facility to receptor, rated TSF no. 3 at Low to Low-Medium risk for AMD.

6.2.2.2 Rheological characterisation

Rheological testing suites were completed for each SRM TSF by the Department of Chemical and Biomolecular Engineering at the University of Melbourne. Laboratory testing covered the range of solids concentrations from low density slurry to typical long-term settled condition but did not reach the high solids concentrations that would be expected after consolidation under significant surcharge, for example under $\geq 5\text{m}$ cover. As expected, shear yield stress, that is, strength, increased exponentially with solids concentration, meaning that strength increases markedly as tailings settle and then start to consolidate.

Shear viscosity decreased by about three orders of magnitude as shear rate was increased over three orders of magnitude, but increased more than one order of magnitude as solids concentration was increased from about 47 weight percentage (wt%) to 67 wt%. These results are again typical of saturated fine-grained materials - they become more fluid the faster loading or stress change occurs but become less fluid as they settle and densify.

Rheological characterisation primarily relates to pumpability and flow behavior soon after deposition and therefore has limited relevance to the long-term behaviour in TSFs. It can provide an indication of the relative potential for liquefaction in the period from deposition to closure; however, any tendency to flow behaviour reduces over time as the tailings consolidate past a critical state.

6.2.2.3 Geotechnical characterisation

Geotechnical properties for tailings should be considered in the following two groups:

- Those that are inherent to the material regardless of its situation (e.g. particle size distribution, specific gravity, plasticity)
- *In-situ* properties that are affected by the inherent characteristics but also by the stress conditions and moisture distribution within the TSF (e.g. moisture content and dry density, settling density, shear strength,

³ Sampling at Ramp 6 has not yet been completed due to safe accessibility limitations.

consolidation). Subsequently, stress and moisture are governed by containment, the weight of overlying material, the location of drainage paths, and time since deposition.

While the inherent properties are essentially constant for a particular sample of tailings, *in-situ* properties may vary with location and time. Some *in-situ* properties may be monitored during operation of the TSF to assess the effectiveness of deposition practices, but strength and moisture-density profiles are most useful after deposition has finished and close to when detailed rehabilitation works are being designed and undertaken.

Inherent properties

Results of testing for inherent properties undertaken to date at SRM are summarised in Table 43. Based on this data, tailings at SRM predominantly range from intermediate plasticity Sandy silty clay, through Sandy silt, to Clayey sand. This is typical of coal tailings in the Bowen Basin, including the absence of high plasticity clays (that cause the greatest problems with settlement and strength). There is no obvious trend in composition over time – TSF no. 2 is not significantly different from Ramp 2/3, which suggests that the variation in composition is more due to the particular coal being processed at the time than to the methods of coal beneficiation. The results suggest an increase in specific density over time that could be an artefact of limited testing but could also reflect increased coal recovery, and therefore less coal lost to tailings, in current operations.

Table 43: Summary of SRM tailings testing of inherent geotechnical properties

Parameter*	Unit	TSF no. 2	TSF no. 3	TSF no. 4	Ramp 2/3	Ramp 6
Particle size distribution						**
Clay/silt	%	55 - 82	27 - 80	58 - 84	9 - 80	
Sand	%	18 - 45	20 - 73	8 - 40	19 - 91	
Gravel	%	0 - 2	0 - 6	0 - 2	0 - 5	
Specific gravity	t/m³	1.60 – 1.66	1.68 – 1.78	1.69 – 1.82	1.93 – 1.99	
Atterberg limits						
Liquid limits	%	26 - 53	26 - 45	26 - 40	34 - 36	
Plastic limit	%	13 - 23	18 - 29	20 - 28	24 - 26	
Plasticity index	%	8 - 36	8 - 21	6 - 18	9 - 11	

* Values presented are averaged or are representative ranges

** No sampling or testing of Ramp 6 tailings has been completed due to accessibility limitations

In-situ properties

Settling characteristics are relevant to the performance of TSFs in their operational phase - specifically, how the tailings solids beach, how quickly the surface water clears and can be decanted, and the volume of decant water that can be recovered. By the time a TSF reaches closure, the tailings will have settled and hence this settling is not an important property in the context of SRM's rehabilitation planning.

Consolidation and desiccation parameters, obtained from laboratory oedometer tests and soil water characteristic curve (SWCC) tests respectively, are not *in-situ* measurements but are used with other *in-situ* data to predict settlement (as distinct from settling) and densification over time.

Oedometer consolidation tests were carried out on samples from Ramp 2/3 TSF, TSF no.2, TSF no. 3 and TSF no. 4, and indicate (Appendix L):

- Compression index (C_c): generally about 0.1 with a couple of results higher
- Coefficient of saturated permeability (k): 1 to 5 x 10⁻⁹m/s
- Coefficient of consolidation (c_v): mainly in the range of 15 to 40 m²/year, with one result significantly higher

Compression index is somewhat lower than is typical for Queensland coal tailings, but the other two parameters are well within the expected ranges. It is noted that laboratory consolidation testing is very sensitive to sample preparation and results should only be used for indicative estimates of actual field performance.

Detailed results of the SWCC testing undertaken (Appendix L) are summarised in Table 44. The three samples from Ramp 2/3 TSF showed notably higher water holding capacity than all other samples; given that there was no apparent difference in particle size distribution – that is, the tailings in Ramp 2/3 were not obviously finer – this disparity may simply be due to the fact that tailings in the current active storage facility are presently less consolidated and therefore have more pore space to hold water. However, it should be noted that water holding behaviour can be affected by historic wetting/drying cycles, which is why it is not considered an inherent property.

Table 44: Summary of soil water characteristic testing of tailings

Sample location	Volumetric water content (cm ³ /cm ³)		
	Saturated	Field capacity	Wilting point
Ramp 2/3: TP-01 – 0.4-0.6m	0.51	0.30	0.16
Ramp 2/3: TP-02 – 0.3-0.5m	0.48	0.30	0.18
Ramp 2/3: TP-03 – 0.3-0.5m	0.56	0.34	0.20
TSF no. 2: CPT14 – 2.00-2.80m	0.32	0.21	0.13
TSF no. 2: CPT11 – 3.00-3.70m	0.39	0.24	0.15
TSF no. 3: CPT09 – 7.00-7.80m	0.36	0.18	0.13
TSF no. 3: CPT07 – 5.00-5.50m	0.38	0.16	0.11
TSF no. 4: CPT06 – 8.00-8.80m	0.35	0.16	0.10
TSF no. 4: CPT06 – 11.00-11.80m	0.36	0.22	0.15
TSF no. 4: CPT07 – 7.50-8.00m	0.38	0.24	0.16

Moisture content and dry density have use in computing consolidation stresses but give only an indirect and approximate indication of strength. A limited number of moisture-density determinations were made on samples from all tested TSFs and most gave dry densities in the range of 1.0 to 1.2 t/m³, which is typical of coal tailings.

More important in the rehabilitation context, a number of strength profiles in the form of vane shear tests and cone penetrometer tests were measured on the four accessible TSFs. Detailed results (Appendix L) indicate that there was: generally a stronger, probably unsaturated layer 1-2m thick at the top of tailings in the inactive TSFs; and below that layer, wide variation in strength with both grid location and depth, including some very low strength profiles. It is reiterated that these profiles represent a point in time and that strengths are expected to increase in the longer-term as consolidation continues.

In summary, geotechnically, tailings in the SRM TSFs are typical of coal tailings produced and deposited in the Bowen Basin.

6.2.3 Rehabilitation and closure design context

All SRM TSFs are designed, constructed and operated in accordance with the relevant design standards and guidelines as outlined in Appendix L. The philosophy for closure includes the adoption of design loadings that are commensurate with the facility's consequence category and assurance that, under these loading conditions, the TSF will remain as a safe, stable and non-polluting landform.

The rehabilitation and closure design incorporates consideration of the following potential closure risks - geotechnical instability (foundation and slope failure), geochemical instability (seepage to surface- and groundwater), and erosional stability (inability to achieve a functional PMLU) (Section 7).

Based on the TSFs design specifications and characterisation, and the need to mitigate and/or control closure-related risks associated with the rehabilitated TSFs, the following context guides design of rehabilitation and management strategies for SRM's TSFs:

- Geotechnically, all TSFs will be capped to a free draining landform. As no fluid will be stored on the surface, *overtopping without dam-break* will no longer be a feasible failure scenario. Only turkey's nest TSFs - that is, TSFs with containing embankments - have potential for dam-break failure. TSF no. 2 and TSF no. 4 will be encapsulated in spoil landforms and so will no longer be turkeys' nest structures at closure. Consequently, dam-break failure (foundation or slope failure) is only a rehabilitation consideration for TSF no. 3, for which the following loading conditions will be relevant:
 - Normal long-term conditions – in general, the loading regime will equilibrate over time and then remain constant. In this state, the materials comprising the TSF landform – foundation, embankments, tailings and capping, show effective stress behaviour.
 - Seismic (earthquake) events – ground vibration associated with earthquakes can provoke undrained loadings that, in the worst case, cause liquefaction of saturated loose fine-grained materials like tailings. The Bowen Basin is not a seismically active region, and consolidation will make the tailings less susceptible; however, good practice requires that the condition is considered.
- Any geochemical hazard associated with the tailings.
 - The four TSFs to be buried by spoil pose a Low to Medium AMD source hazard; and TSF no. 3 poses a Low to Low-Medium AMD source hazard.
 - The landforms containing buried TSFs had an AMD SPR rating of Low to Medium, while the SPR assessment for TSF no. 3 ranked this facility at Low to Low-Medium risk for AMD (Section 6.1.3). In particular, the TSFs (and associated tailings contained therein) are unlikely to present an unacceptable risk of environmental harm outside of the tenure boundary, because:
 - a. Tailings comprise approximately only 0.5% of all mineral waste at SRM
 - b. Hydrogeological particle tracking across the site indicates groundwater flow in the direction of the residual voids
 - c. The residual voids will remain as long-term sinks
- Erosionally, whether encapsulated in spoil or as a discrete landform, the TSFs will be no different from other rehabilitation areas, and hence no specific consideration is required.

6.2.4 Rehabilitation or management strategies

6.2.4.1 Ramp 2/3, Ramp 6, TSF no. 2 and TSF no. 4

Ramp 2/3, Ramp 6, TSF no.2 and TSF no. 4 will be part of the final closure landform whereby the tailings will be buried beneath the spoil landforms (Section 6.1.5). The spoil dumps will be constructed and progressively rehabilitated throughout the future mining operation. The landform above the TSFs will be free draining with at least 2m of spoil cover over the tailings.

6.2.4.2 TSF no. 3

TSF no. 3 ceased operation in 1985. Between 2009 and 2012 it was covered with a 2–3m thick capping layer, rock mulch, topsoiled and seeded. Powerline infrastructure for SRM operations has since been installed through the area.

Routine monitoring and assessments have identified:

- The computed FoS for geotechnical stability of the walls is currently ≥ 1.3
- Standing water levels are low, such that much of the tailings is unsaturated but retains variable water content

- Particle tracking as part of the site's groundwater modelling indicates that any seepage from TSF no. 3 would report to the residual voids. The residual voids will generally act as long-term groundwater sinks (Sections 6.1.1.2 and 6.3.2.3) and will not overtop (Section 6.3.2.3)
- The tailings have potential for acid generation; with the majority of the tailings tested (aged and fresh) being classified as PAF (Section 6.1.3.2)
- The capping material is classed as NAF, or uncertain, but likely non-acid forming [UC(NAF)]. It is also low salinity, has low total S and is alkaline and therefore is not expected to release metals/metalloids to contact water/runoff (Section 6.1.3.2)
- Negligible erosion in the capping layer
- Areas of ponding on the cover
- Vegetation on the capped surface is establishing trees, shrubs and grasses

Based on these assessments, the rehabilitation strategy for TSF no. 3 includes the removal of the powerlines at the end of mining (RM1), contamination assessment (RM2), further landform work to achieve a free draining cover, the required FoS and embankment erosion stability (RM3), plus topsoil (RM4) and grassland seed (RM7), as required, to achieve a grassland PMLU. Monitoring will continue to be undertaken to assess performance and residual hazards and to identify corrective actions, if required.

Relationship with the PRCP schedule

Ramp 2/3, Ramp 6, TSF no. 2 and TSF no. 4 will be fully encapsulated within the spoil dumps and will be assessed according to the rehabilitation milestones for RA1 (spoil dumps).

TSF no. 3 (RA9) has been partially capped, and further work is scheduled to achieve a free draining landform that achieves the required FoS and a grassland PMLU.

6.3 Voids

A void closure plan has been compiled to support the development of this PRC Plan. The detailed plan – *Saraji Mine Void Closure Plan* (WSP/Golder, 2024), is provided in Appendix M.

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

For SRM, there are four residual voids in the final closure landform:

1. Jacaranda/Bauhinia
2. Coolibah/Dogwood
3. Ebony/Grevillea
4. Hakea

These residual voids are pre-approved as NUMAs (Section 4). The NUMA extents achieve an area that is safe and structurally stable and include: the residual void high-wall and end-wall below natural ground level and the residual void low-wall 20m below ground level; additional set-backs from the low-wall, high-wall and end-wall crests if required to achieve wall geotechnical stability (FoS=1.5); and a safety bund (or equivalent landform) and fence.

6.3.1 Geotechnical stability

The Void Closure Plan (Appendix M) 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 if required to meet the minimum FoS of 1.5.

The set-back distance from the void 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 45. The as-dumped design of the residual void low-walls meets the minimum FoS for all residual voids except Ebony/Grevillea; therefore, an additional set-back distance has been included in the final closure landform design to ensure the minimum FoS is also achieved for this residual void low-wall. A minimum 25m set-back will be designed between the low-wall crest within the NUMA area and the PMLU boundary to ensure erosion within the NUMA does not impact the surrounding PMLUs.

Table 45: Summary of SRM 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)	
Jacaranda/Bauhinia	390	4.5	1.7	2.2	0
Coolibah/Dogwood	405	3.5	2.1	2.2	0
Ebony/Grevillea	490	4.9	1.5	2.2	25
Hakea	300	4.0	2.3	2.3	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 46. The as-mined design of the residual void high-walls and end-walls do not meet the minimum FoS and therefore additional set-back distance from the high-wall crest has been included in the final closure landform design to ensure the minimum FoS is achieved. A minimum distance of 50m will be designed between the residual void crest and the toe of the safety bund where the residual void is near a tenure boundary.

Table 46: Summary of SRM residual void high-wall and end-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)
Jacaranda/Bauhinia	34	198	1.37	321
Coolibah/Dogwood	32	174	1.44	268
Ebony/Grevillea	26	222	1.32	364
Hakea	27	118	1.61	196

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 2080 to 2199 (120-years) to understand water balance behaviour (including climate change considerations) within the residual voids over time (Appendix M). For Hakea void, the water balance simulation was extended and covers a period of 180-years from 2080 to 2259. Key findings are summarised in Table 47.

Key findings show that after 2140 the water levels start to stabilise for all voids, with a simulated mean inflow being 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 four 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 47: Summary of SRM water balance model

Pit	Spill Level (m AHD)	Mean water flows (2180-2199)		Long-term mean void lake level (m AHD)
		Inflows (ML/yr)	Outflows (ML/yr)	
Jacaranda/Bauhinia	183	1,008	969	3
Coolibah/Dogwood	192	768	763	14
Ebony/Grevillea	192	1,204	1,171	-16
Hakea*	195	433	429	74

* Water levels for Hakea are demonstrated in the years 2240 - 2259

6.3.2.2 Groundwater modelling

Numerical groundwater modelling (Section 6.1.1 and Appendix B) shows establishment of sustained inward hydraulic flow gradients to the residual voids. The hydraulic gradient is driven by the evaporative discharges from void lakes, which stabilise below the modelled groundwater elevations and below the shallow hydrogeological units, (i.e., alluvium, basalt and Tertiary) minimising potential for interconnectivity between the deeper and shallower aquifers.

As per the modelled predictions (Appendix B and Appendix M), fluxes of water from the void lakes to groundwater occur in the period immediately after cessation of pit dewatering. The period of outflows is governed by the difference in the time taken between the more dynamic void lake recovery and slower groundwater recovery. Once groundwater recovery reaches a point where it establishes an inward hydraulic gradient to the void, the residual voids establish as long term groundwater sinks. The outflows occur predominantly to the in-pit spoil where groundwater aquifers are only established post mining and the height of which are driven by the void lakes.

Flow path simulation modelling undertaken in conjunction with the numerical groundwater modelling indicates the residual voids, which generally act as groundwater sinks, will collect and retain groundwater from the tenement areas including the MIA, CHPP, spoil dumps and TSFs. Therefore, the residual voids will retain potential contaminated seepage from the mining operations and minimise the potential for environmental harm beyond the mining tenement boundary. Validation of the flow path simulation will be undertaken through contaminated land investigations (RM2) at the completion of mining.

6.3.2.3 Water quality

The Void Closure Plan (Appendix M) includes an analysis of the voids' water quality (geochemical stability), and identifies the following key findings across the residual voids:

- Evapoconcentration processes will drive water quality in the residual voids
- Acidic conditions are unlikely to develop (due to no significant sources of acid generation associated with surface water hydrology of the SRM closure landform), with pH conditions being stable over time
- TDS concentration increases over time, resulting in predicted brackish to mildly saline conditions
- Preliminary, high-level screening based on predicted EC levels suggest that all four void lakes may become stratified

During the limited period in which source conditions occur, predominantly to the in-pit spoil, the neutral to slightly alkaline pH of the void lakes and the low potential for generation of elevated metal concentrations within leachate (Appendix G), means the concentrations of metals that may flow from the void lake to the spoil hosted groundwater are not considered to have a reasonable potential to cause environmental harm.

As all 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 mined out pits will be progressively backfilled during the operation to minimise the final void to the final operational mining strip. Ramp voids are planned to also be progressively backfilled, minimising the number of ramps remaining in the final voids. Approximately 79% 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 SRM 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 48.

Table 48: Proposed SRM residual void dimensions and overall wall angles

Void	Average depth (m)	Average length (m)	Average width (m)	High-wall overall slope	End-wall overall slope	Low-wall overall slope
Jacaranda/ Bauhinia Pit	232	4,320	890	45°	37°	21°
Coolibah/ Dogwood Pit	206	5,220	780	43°	37°	21°
Ebony/ Grevillea Pit	248	5,370	980	43°	37°	21°
Hakea Pit	145	3,440	650	41°	32°	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 40 to 45°. 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 dump lifts are offset from the dragline spoil by two spoil peaks and each truck dump lift is offset, reducing the overall low-wall angle to approximately 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 wall crests if required to achieve a minimum FoS of 1.5, plus a safety bund (Section 6.3.1). Set-backs from the void high-wall and end-wall crests are required for all pits and a minor additional set-back is required for the Ebony/Grevillea low-wall. 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 48. The overall high-wall/end-wall angle to the NUMA extent is approximately 30° for Jacaranda/Bauhinia Pit, 32° for Coolibah/Dogwood Pit void, 34° for Ebony/Grevillea Pit and 30° for Hakea Pit.

6.3.5 Improvement and management strategies

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

All four 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 49 will be undertaken.

Table 49: Improvement and/or management strategies for the SRM residual voids

Residual void closure aspect	Closure objective			Improvement and/or management strategy
	Safety	Stability	No environmental harm	
Geotechnical stability	✓	✓	-	- As mining approaches the final limits, re-assess the geotechnical wall designs and set-backs based on the latest available data by an AQP. - Use a minimum FoS of 1.5 as 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). - A minimum distance of 50m to be designed between the residual void high-wall crest and the toe of the safety bund where the residual void is near a tenure boundary.
Void hydrology	-	-	✓	- At cessation of mining activities, review and update the void water balance modelling, incorporating identified changes to the closure landform and spill point elevations, rainfall and evaporation, surface water runoff, groundwater inflows, and climate projections. - Implement management strategies if future modelling identifies an unacceptable risk of environmental harm outside the tenure boundary (not identified in current modelling).

Residual void closure aspect	Closure objective			Improvement and/or management strategy
	Safety	Stability	No environmental harm	
				- Obtain certification from an AQP that the residual voids do not present an unacceptable risk of environmental harm outside the tenure boundary. - Low-walls are free draining into the void lake with a maximum of 37 degree slopes
Void hydrogeology	-	-	✓	- At cessation of mining activities, review and update the groundwater modelling, incorporating updated void water balance model outputs and in-field groundwater sampling data, as required. - Implement management strategies if future modelling identifies an unacceptable risk of environmental harm outside the tenure boundary (not identified in current modelling). - 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. - Residual voids must not overtop - Residual voids collectively act as groundwater sinks within the tenure boundary post closure (demonstrated through groundwater modelling)
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. - Implement management strategies if future modelling identifies an unacceptable risk of environmental harm outside the tenure boundary (not identified in current modelling). - 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:

Residual void closure aspect	Closure objective			Improvement and/or management strategy
	Safety	Stability	No environmental harm	
				- Construct a safety bund at the geotechnical set-back distance. - Erect fencing and signage (where required) around the safety bund. - Obtain certification from an AQP that the residual void is safe to humans and livestock. - Undertake monitoring and maintenance of exclusion fences and bunds.
Erosion	✓	✓	✓	- A minimum distance of 25m to be designed between the residual void low-wall crest within the NUMA and the PMLU. - Any erosion sediment to be contained within the residual void. - The location of the residual voids and associated safety bunds does not cause instability or degradation to the land outside of the tenure boundary

Relationship with the PRCP schedule
The four SRM 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 generally stabilise to be ongoing groundwater sinks after equilibrium has been reached post mining and 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.

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 SRM.

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 EA condition E15 (at the time of the development of the transitional PRCP): *"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 applicable for parts of SRM (Section 1.2.12).

Table 50 details the infrastructure associated with the mining activities at SRM. BMA owned surface infrastructure not beneficial to the PMLU will be removed in accordance with EA conditions. Surface infrastructure that may be retained to support the PMLUs will have a demonstrable benefit and required agreements in place prior to rehabilitation and may include selected: fencing; access tracks; services related infrastructure; sheds and buildings; hardstand areas/transport logistics areas; and water related infrastructure. As mining is planned until 2098, no landholder agreements are currently in place to retain infrastructure and the PRCP will be amended prior to closure with these details if required.

Infrastructure not constructed for the purpose of mining, such as dams used for grazing, gates, cattle gates, 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 50: Infrastructure associated with the approved SRM 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
	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 for the end of mining, processing of the final coal, rehabilitation activities for SRM operation.

Any public and regional infrastructure associated with roads, power, water and communications supply to landowners or townships is not included in this PRC Plan or Schedule. This includes One Mile Creek Dam which is planned to be retained to support the supply of raw water to the region (Section 6.1.7.5).

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 PRC Plan.

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, bitumen and aggregate 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
- Disposing of demolition-related putrecible and hazardous wastes at an appropriately licenced facility

Below-ground infrastructure, services and waste deeper than 0.5m in relation to the final landform surface can be retained provided it can meet the following:

- Pipelines have been drained
- Below-ground infrastructure (installed after the approval date of the transitional PRCP – 4 September 2024) is mapped
- The intended PMLU is not compromised

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 to the residual voids or in accordance with:
 - 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 for the purpose of: supplying stock water subject to compliance with the quality release limits specified in Table F7 (Stock Water Release Limits); or supplying irrigation water subject to compliance with quality release limits in Table F8 (Irrigation Water Release Limits); or supplying water for construction and/or road maintenance in accordance with the conditions of this environmental authority”.*
 - EA condition F24: *“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 dams or tanks, for the purpose of supplying water to any operation licensed for either ERA13 (mining black coal) or ERA31 (mineral processing). The volume, pH and electrical conductivity of water transferred must be monitored and recorded”.*
 - EA condition F25: *“If the responsibility for mine affected water is given or transferred to another person in accordance with conditions F23 or F24: a) the responsibility for the mine affected water must only be given or transferred in accordance with a written agreement (the third party agreement); and b) the third party agreement must include a commitment from the person utilising the mine affected water to use it in such a way as to prevent environmental harm or public health incidents and specifically make the persons aware of the General Environmental Duty (GED) under section 319 of the Environmental Protection Act 1994, environmental sustainability of the water disposal and protection of environmental values of waters; and c) the third party agreement must be signed by both parties to the agreement”.*
- 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

6.5.3 Contaminated land assessment

In accordance with the EA conditions, during operations, 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 by a suitably qualified person (SQP) in accordance with the National Environment Protection (Assessment of Site Contamination) Measure for the relevant RAs (RM2). 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. A Contaminated Land Investigation Document will be completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan to allow the ML area to be safely utilised for the nominated PMLUs.

Where the progressive rehabilitation areas being investigated for contaminated land do not align with a legal cadastral property boundary, the investigation will not fulfil the requirements of an EP Act compliant Contaminated Land Investigation Document. To support the assessment of contaminated land risks of individual progressive rehabilitation areas, the contaminated land investigations will be completed by a SQP to a standard that can be used as part of a future EP Act compliant Contaminated Land Investigation Document.

Relationship with the PRCP schedule
Surface infrastructure owned by BMA and 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 provided there is no ongoing risk of environmental harm and the intended PMLU is not compromised. 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.

6.6 Summary of key rehabilitation and management practices

The key rehabilitation activities and associated rehabilitation milestones are shown in Table 51 and the key management/improvement activities and associated management milestones are shown in Table 52.

Table 51: Key rehabilitation activities and rehabilitation milestones for SRM

Rehabilitation area	Relevant activities	Rehabilitation activities	Commencement of rehabilitation timing	Rehabilitation milestones
RA1	Spoil dumps	- Assessment of contaminated land risks - Reshape the landform with maximum 30% slopes - Cover >15% slopes with minimum 0.5m rock or as advised by an AQP - Tailings and rejects within RA1 to be covered by a free draining landform with at least 2m of spoil cover - Construct landforms to restrict runoff from landform tops onto batter slopes, if required using appropriate controls - Install erosion and sediment control systems, if required - Landform achieves d FoS ≥ 1.5 - Spread topsoil a minimum thickness of 100mm or alternative growth media to a minimum thickness of 300mm - Assess growth media characteristics to determine ameliorants and other treatment requirements - Apply ameliorants and other treatments (if required) - Deep rip along contour of slopes - 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 - Indicative areas available for rehabilitation are shown in Figure 15	RM2 RM3 RM5 RM8 RM11 RM14
RA2	- Watercourse 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	Dependent on the location in relation to mining and closure activities, areas are available either as neighbouring mining activities are complete, at the end of mining or at the end of the major	RM1 RM3 RM6 RM9 RM12

Rehabilitation area	Relevant activities	Rehabilitation activities	Commencement of rehabilitation timing	Rehabilitation milestones
		- For watercourse diversions requiring realignment and rehabilitation, construct diversions in line with the final functional/ detailed designs - Install erosion and sediment control systems, if required - Spread topsoil a minimum thickness of 150mm, where topsoil has previously been removed - Assess growth media characteristics to determine ameliorants and other treatment requirements - Apply ameliorants and physical treatments (if required) - Deep rip along contour of slopes as required - Seed as per recommended seed mix and rates - Undertake monitoring and maintenance to demonstrate achievement of a watercourse PMLU	rehabilitation activities, including low-wall reshape	RM15
RA3	- CHPP and associated infrastructure - Administration, crib and general buildings - Workshop, fuel, oil and chemical storage - Coal stockpiles - Mine dams - Roads	- Disconnect services - Remove BMA owned surface built and service infrastructure where there is no beneficial use to the PMLU - Remove BMA owned 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 TLO and rail infrastructure (to be removed by third party owners) - 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 machinery and equipment where there is no beneficial use to the PMLU	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
	- TLO and rail infrastructure - Laydown areas - General disturbance	- Remove waste not authorised under the EA waste schedule, including demolition waste - Assess mine dam water and sediment and dispose appropriately - Assessment of contaminated land risks - Reshape the landform maximum 12% slopes - Install erosion and sediment control systems, if required - Spread topsoil a minimum thickness of 150mm, where topsoil has previously been removed - Assess growth media characteristics to determine ameliorants and other treatment requirements - Apply ameliorants and physical treatments (if required) - Rip along contour of slopes - Seed with recommended seed mix and rates - Undertake monitoring and maintenance to demonstrate achievement of a cattle grazing PMLU		
RA4	- Exploration - Roads - Laydown areas - General infrastructure and disturbance	Where required, dependent on the extent of disturbance: - Disconnect services - Remove BMA owned surface built and service infrastructure where there is no beneficial use to the PMLU - Remove BMA owned 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	- Progressive rehabilitation has commenced - 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	RM1 RM3 RM5 RM8 RM11

Rehabilitation area	Relevant activities	Rehabilitation activities	Commencement of rehabilitation timing	Rehabilitation milestones
		- 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 waste not authorised under the EA waste schedule, including demolition waste - Decommission drillholes, bores, sediment ponds and sumps - Install erosion and sediment control systems, if required - Reshape the landform maximum 15% slopes - Spread topsoil to minimum thickness of 100mm, where topsoil has previously been removed - Assess growth media characteristics to determine ameliorants and other treatment requirements - Apply ameliorants and physical treatments (if required) - Rip along contour of slopes - Seed with seed mix as recommend by an AQP - Undertake monitoring and maintenance to demonstrate achievement of a woodland habitat PMLU	remaining available at the end of the major rehabilitation activities, including low-wall reshape	
RA7	Spoil dumps – existing rehabilitation	Undertake monitoring and maintenance to demonstrate achievement of a cattle grazing PMLU	Rehabilitation has commenced	RM10 RM17
RA9	TSF	- Remove infrastructure, such as powerlines - Assessment of contaminated land risks	Rehabilitation has commenced	RM1 RM2 RM3 RM4

Rehabilitation area	Relevant activities	Rehabilitation activities	Commencement of rehabilitation timing	Rehabilitation milestones
		- Cover (free-draining landform with minimum of 2m of spoil cover) - Reshape the landform with maximum 30% slopes - Cover slopes >15% with at least 0.5m rock unless an alternative is justified by an AQP - Install erosion and sediment controls, if required - Install mitigation measures on landforms that interact with floodwaters up to 0.1% AEP, if required to prevent instability - Landform achieves FoS ≥ 1.5 - Spread topsoil a minimum thickness of 150mm - Assess growth media characteristics to determine ameliorants and other treatment requirements - Apply ameliorants and physical treatments (if required) - Rip along contour of slopes - Seed as per recommended seed mix and rates - Install temporary fencing if required to restrict livestock access while vegetation establishes - Undertake monitoring and maintenance to demonstrate achievement of a grassland PMLU		RM7 RM19 RM20
RA10	Spoil dumps – existing rehabilitation	- Seed as per recommended seed mix and rates - Undertake monitoring and maintenance to demonstrate achievement of a woodland habitat PMLU	Rehabilitation has commenced	RM8 RM11 RM18

Table 52: Key management/improvement activities and management milestones for SRM

Improvement area	Relevant activities	Management/improvement activities	Timing	Management milestones
IA1	Residual voids	- Design high-walls, end-walls and low-walls to achieve a FoS ≥ 1.5 within the NUMA extents - Design a minimum distance of 50m between the residual void high-wall/end-wall crest and the toe of the safety bund, where against a tenure boundary or watercourse - Design a minimum distance of 25m between the residual void low-wall crest within the NUMA and the safety bund or equivalent landform - Design residual voids to prevent overtopping - Undertake predictive groundwater modelling - Backfill voids or construct highwall landforms at the end of mining for flood mitigation as per final flood model - Low-walls to free-drain into the void lake with maximum 37 degree slopes - Construct safety bund or equivalent landform at geotechnical set-back distance to prevent access to the residual voids - Erect fencing and signage around the perimeter of the safety bund, where required - Retain an unmined area of 60ha between Grevillea residual void and the eastern boundary of mining lease ML700021 - the safety bund can be positioned within the 60ha area - Undertake monitoring to demonstrate achievement of sufficient improvement - Undertake monitoring and maintenance of exclusion fences and bunds	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 has been applied to the SRM PRC Plan, following the method described in Figure 22.

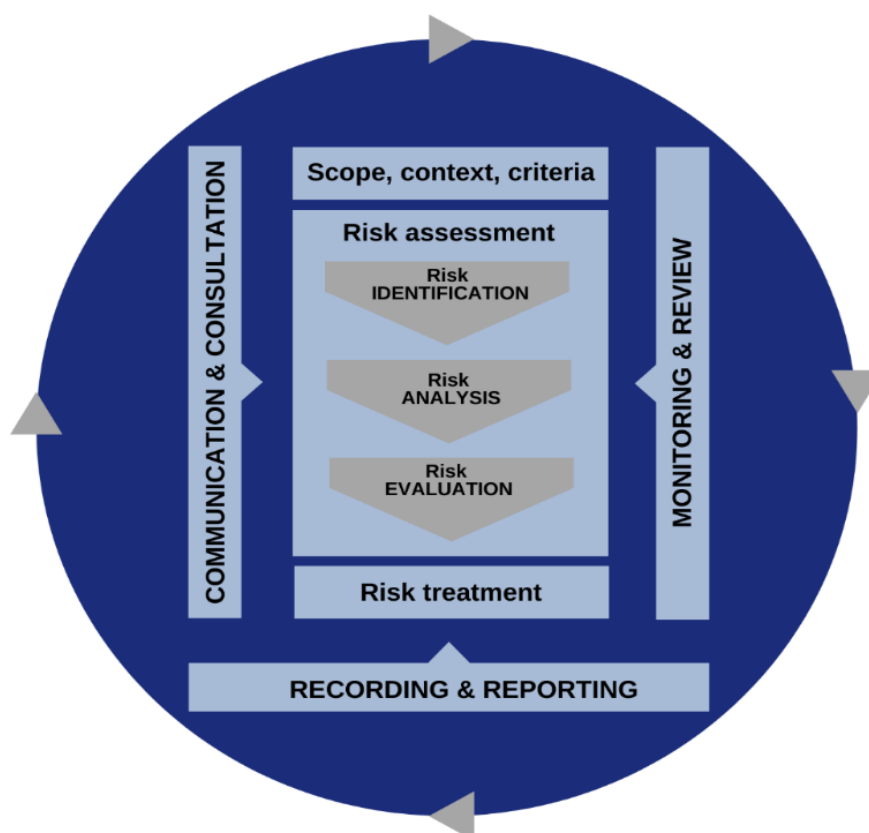


Figure 22: ISO 31000-compliant risk-based approach followed for the SRM PRC Plan

7.1.2 Risk identification

Two risk events have been assessed in accordance with ISO 31000 methodology described in Figure 22

1. Stable condition for land described as a PMLU is not achieved - where stable condition is defined as per section 111A of the EP Act. For SRM, the PMLUs being assessed are cattle grazing, grassland, woodland habitat and watercourse (Section 3).
2. NUMA causes environmental harm off tenure and is not safe and structurally stable.

7.1.3 Risk analysis, evaluation and relevant treatments

The full risk assessment – *Saraji Mine PRCP Risk Assessment* is provided in Appendix N and provides the risk analysis, risk evaluation and risk treatment for these scenarios.

Worst case outcomes were assessed for each scenario (maximum foreseeable loss (MFL)), preventative and mitigating controls identified, and the resultant residual risk rating (RRR) was calculated. The BHP likelihood and impact tables, as well as the outcomes of the RRR heat map ratings are provided in Table 53, Table 54 and Table 55, respectively.

Table 53: BHP risk likelihood table

Likelihood	Frequency ¹	Probability ²	Likelihood factor
Highly Likely	Risk likely to occur within a 1-year period	≥80% chance of the risk occurring	3
Likely	Risk likely to occur within a 1 – 5-year period	60 – 79% chance of the risk occurring	1
Possible	Risk likely to occur within a 5 – 20-year period	30 – 59% chance of the risk occurring	0.3
Unlikely	Risk likely to occur within a 20 - 50-year period	10 – 29% chance of the risk occurring	0.1
Highly Unlikely	Risk likely to occur beyond a 50-year period	<10% chance of the risk occurring	0.03

¹ Typically used when assessing ongoing or enduring Risks

² Typically used when assessing project or one-off/discrete Risks

Table 54: BHP risk impact table

Impact level	Descriptor	Impact factor
5	Significant and lasting impact to environment, climate, community or Indigenous peoples	1000
4	Significant impact to environment, climate, community or Indigenous peoples	300
3	Moderate impact to environment, climate, community or Indigenous peoples	100
2	Measurable but limited or temporary impact to environment, climate, community or Indigenous peoples	30
1	Minor, low level impact to the environment, climate, community or Indigenous peoples	10

Table 55: BHP residual risk rating (RRR) heat map

			Impact level	1	2	3	4	5
			Impact 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
	Possible	0.3	Within 5 - 20 years	3	9	30	90	300
	Unlikely	0.1	Within 20 - 50 years	1	3	10	30	100
	Highly Unlikely	0.03	Beyond 50-years	0.3	0.9	3	9	30

With controls in place and implemented effectively, the RRR for the identified risk scenarios of this risk event - a stable condition for land described as a PMLU not being achieved, is deemed to be low (RRR of 30). The timeframes required for the risk to be assessed, and appropriate controls to be identified and implemented, have been factored into the duration of the RMs for each RA.

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 56.

Table 56: 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 use (cattle grazing, grassland, 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 closure landform
Responsibility for plan: - Approval - Implementation	- Mine planning - Site operations
Proposed actions	- Materials characterisation - Growth media assessment 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

Aspect	Risk treatment
	- Erosion modelling - Equipment capabilities - Survey - Rehabilitation monitoring data - Growth media assessment - Stockpile surface materials if required
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 show that these treatments achieve a stable condition for the proposed closure landform
Responsibility for plan: - Approval - Implementation	- Site operations - Environment team
Proposed actions	- Contaminated land investigation to be undertaken at the completion of operations to identify contamination that has the potential to cause impacts to groundwater - Appropriate management, placement, and monitoring of waste (spoil, tailings, rejects) during operations - Landforms designed and constructed to minimise contaminant generation and transport, and minimise catchments and the potential for flooding of the residual voids
Resource requirements	- Groundwater monitoring infrastructure - Sample collection/gauging and laboratory analysis as per PRCP
Performance measures and constraints	Compliance with milestone criteria
Reporting and monitoring	Reporting of identified releases of contaminants to waters 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	

Aspect	Risk treatment
Reasons for selecting treatment option	Studies and analysis performed show that these treatments achieve a stable condition for the proposed closure 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 - Mine affected water 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 practical after land becomes available - Rehabilitation and monitoring of disturbed reaches of creeks undertaken - Appropriate management, placement, and monitoring of waste (spoil, tailings, rejects) during operations - Landforms constructed to minimise the potential for flooding of the residual voids - Tailings and other waste disposal facilities appropriately capped
Resource requirements	- Undertake surface water sampling - Sampling equipment and infrastructure to allow collection of samples
Performance measures and constraints	Surface water milestone criteria and water quality objectives (WQO)
Reporting and monitoring	- Monitoring when sufficient runoff or surface water flow events occur - Reporting under existing EA requirements
Risk timing and scheduling	During runoff or surface water flow events suitable for the collection of surface water samples
PMLU Scenario 4. Watercourse diversions not achieving 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

Aspect	Risk treatment
Proposed actions	- Watercourse diversion concept designs to be progressed to functional designs when rehabilitation of surrounding areas commences - Construction of any diversion channels in line with the final functional designs - 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 - Watercourse diversion monitoring to relevant IDC standard and maintenance to be undertaken
Resource requirements	- Progress concept designs to functional designs, including flood modelling - Watercourse 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 milestone criteria and WQO
Reporting and monitoring	- Watercourse diversion monitoring - IDC method - Surface water quality data
Risk timing and scheduling	As scheduled frequencies from commencement of rehabilitation activities to final achievement of PMLU
PMLU Scenario 5. Contaminated land impacting on environmental receptors, rehabilitation and attainment of PMLUs	
Reasons for selecting treatment option	Studies and analysis performed show that these treatments achieve a stable condition for the proposed closure 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. - At the completion of operations, all stored hazardous materials and infrastructure within the MIA and CHPP, that have the potential to release contaminants to groundwater, will be appropriately recycled or disposed - Contaminated land investigation to be undertaken at the completion of operations to identify contamination that has the potential to cause adversely impact PMLUs - Implementation of remediation and/or management plans as required to reduce potential contaminate land risks

Aspect	Risk treatment
Resource requirements	- Suitably Qualified Persons (SQP) to undertake contaminated land investigations and oversee on-going monitoring requirements - Sample collection, laboratory analyses and engineering controls
Performance measures and constraints	Attainment of surface water milestone 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 show that these treatments achieve a stable condition for the proposed closure landform
Responsibility for plan: - Approval - Implementation	- Technical Services - Site operations
Proposed actions	- Removal of infrastructure from watercourses (e.g. culverts) that could adversely impact flows - Decommissioning of dams - Design of landforms within flood extents that are safe and stable - Establishment of vegetation suitable for the environment and reduces erosion risks - Undertake monitoring for potential landform risks and undertake rectification works to attain PRCP milestone criteria
Resource requirements	- Flood modelling - Rehabilitation monitoring 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 show that these treatments achieve a stable condition for the proposed closure landform
Responsibility for plan: Approval	Site operations

Aspect	Risk treatment
Implementation	
Proposed actions	- Removal of infrastructure within watercourse alignments (e.g. culverts) that could adversely impact flows - Decommissioning of dams - Establishment of landforms that are stable - Provide appropriate level of flood protection through landforms for the residual voids - Undertake monitoring and maintenance works where required to maintain landforms
Resource requirements	- Flood modelling - Monitoring post flood events
Performance measures and constraints	No unacceptable damage to infrastructure or ecosystems as a result of changes to flood regime or change to flood extent
Reporting and monitoring	Rehabilitation monitoring
Risk timing and scheduling	As per PRCP monitoring program
PMLU Scenario 8. Insufficient or inappropriate growth media and rock resources required for rehabilitation activities	
Reasons for selecting treatment option	Studies and analysis performed show that these treatments achieve a stable condition for the proposed closure landform
Responsibility for plan: - Approval - Implementation	- Technical Services - Environment team - 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 to determine ameliorant and fertiliser requirements - Application of ameliorants and physical treatment requirements - Rehabilitation monitoring and maintenance
Resource requirements	- Topsoil inventory - Burden model - Survey - Equipment capabilities - Rehabilitation monitoring data - Growth media assessment

Aspect	Risk treatment
Performance measures and constraints	Tracking against milestone criteria
Reporting and monitoring	Rehabilitation monitoring
Risk timing and scheduling	From planning of soil stripping to final achievement of PMLU
PMLU 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 closure landform
Responsibility for plan: - Approval - Implementation	- Environment team - Engineering team - Site operations
Proposed actions	- Waste characterisation during operations - Surface and groundwater monitoring during operation - Ongoing sampling during operations - Tailings and reject material appropriately placed in spoil dumps - Install tailings cover as per design
Resource requirements	- Data from waste characterisation - Mineral waste sampling data - Rehabilitation monitoring data - Surface and groundwater monitoring data
Performance measures and constraints	Tracking against surface water milestone criteria
Reporting and monitoring	- Rehabilitation monitoring - Waste characterisation sampling and analysis - Surface and groundwater monitoring
Risk timing and scheduling	Throughout operations to final achievement of PMLU
PMLU Scenario 10. Failure of, or inappropriate cover	
Reasons for selecting treatment option	Rehabilitation monitoring and performance tracking showed that the constructed rehabilitated landform will achieve PMLU criteria
Responsibility for plan: - Approval - Implementation	- Site operations - Dam engineers
Proposed actions	Material characterisation during operations

Aspect	Risk treatment
	- Ongoing sampling of tailings and rejects from processing plant - Tailings and rejects material appropriately disposed on-site - Tailings capped with at least 2m of competent benign spoil - Cover to be a free draining landform - Restrict livestock from areas with a cover
Resource requirements	- Monitoring program - Maintenance and remediation where rehabilitation outcomes do not meet planned performance criteria
Performance measures and constraints	Tracking against milestone criteria
Reporting and monitoring	As per the PRCP schedule
Risk timing and scheduling	From installing cover to final achievement of PMLU
PMLU Scenario 11. Inadequate and/or inappropriate revegetation	
Reasons for selecting treatment option	Studies and analysis performed show that these treatments achieve a stable condition for the proposed closure landform
Responsibility for plan: - Approval - Implementation	- Environment team - Site operations
Proposed actions	- Growth media assessment to determine ameliorant and physical treatment requirements for the PMLU - Management of seed selection, provenance and quality - Rehabilitation and reference site monitoring - Rehabilitation maintenance as identified
Resource requirements	- Rehabilitation and reference site monitoring data - Growth media assessment - Seed
Performance measures and constraints	Tracking against milestone criteria
Reporting and monitoring	Rehabilitation and reference site monitoring
Risk timing and scheduling	From rehabilitation seeding to final achievement of PMLU
PMLU Scenario 12. Deterioration of built infrastructure conditions	
Reasons for selecting treatment option	Studies and analysis performed show that these treatments are what is recommended to achieve a stable condition for the proposed closure landform

Aspect	Risk treatment
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	- SQP to undertake contaminated land investigations and oversee on-going monitoring requirements - Rehabilitation monitoring data
Performance measures and constraints	Tracking against milestone criteria
Reporting and monitoring	Rehabilitation monitoring
Risk timing and scheduling	Throughout operations to final achievement of PMLU

With controls in place and implemented effectively, the RRR for the identified risk scenarios of the risk event – NUMA causes environmental harm off tenure and is not safe and structurally stable, is deemed to be low (RRR of 10). The timeframes required for the risk to be assessed, and appropriate controls to be identified and implemented, have been factored into the duration of the MMs for the IA.

The risk treatments for each scenario that are necessary for achieving a safe and structurally stable NUMA are shown below in Table 57.

Table 57: Necessary risk treatments identified to achieve a safe and structurally stable NUMA that does not cause environmental harm

Aspect	Risk treatment
Risk event: NUMA causes environmental harm and is not safe and structurally stable	
NUMA Scenario 1. Residual void walls do not achieve geotechnical stability	
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	- Geotechnical assessment and final void wall design - Pit floor treatments as required during operations to improve low-wall stability - Geotechnical monitoring during operations

Aspect	Risk treatment
	- 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 or equivalent landform, fencing and signage placed at FoS limit
Resource requirements	Geotechnical assessment and design
Performance measures and constraints	Tracking against milestone criteria
Reporting and monitoring	Geotechnical monitoring
Risk timing and scheduling	From detailed closure design of each void to relinquishment
NUMA Scenario 2: Uncontrolled access to NUMA	
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	- Safety bund or equivalent landform, fencing and signage placed at FoS limit where required to restrict access - Geotechnical modelling to determine FoS limit
Resource requirements	- Geotechnical modelling - Monitoring and maintenance
Performance measures and constraints	Tracking against milestone criteria
Reporting and monitoring	- Document visual inspection - Monitoring
Risk timing and scheduling	From detailed closure design of each void 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/dam engineer
Proposed actions	Flood modelling including climate change scenarios

Aspect	Risk treatment
	- Void flood mitigation (partial backfill and/or landform) designed to 0.1% AEP correct flood event - Void flood mitigation installed - Monitoring
Resource requirements	- Flood modelling - Landform design - Monitoring and maintenance
Performance measures and constraints	Tracking against milestone criteria
Reporting and monitoring	- Document visual inspection - Monitoring
Risk timing and scheduling	From detailed closure design of each void to relinquishment
NUMA Scenario 4. Water in the residual void causes environmental harm outside of the mining tenure	
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	- Mine planning - Site operations
Proposed actions	- Modelling - Void flood mitigation designed to 0.1% AEP flood event - Void flood mitigation (partial backfill and/or landforms) installed - Groundwater quality and level monitoring - Water quality monitoring - Landform design to enable establishment of collective groundwater sink within tenure boundary
Resource requirements	- Groundwater and void lake water balance modelling - Landform design - Monitoring
Performance measures and constraints	Tracking against milestone criteria
Reporting and monitoring	- Groundwater level and quality monitoring - Water quality monitoring
Risk timing and scheduling	From detailed closure design of each void to relinquishment

Relationship with the proposed PRCP schedule

A risk-based approach was adopted by BMA to develop the milestone criteria in the PRCP schedule. This is primarily driven by the RRR for the identified risk scenarios of the risk event. 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.

Although no rehabilitation trials are currently planned at SRM, rehabilitation trials have previously been and will continue to be conducted at SRM as part of continuous improvement. Current rehabilitation practices will be executed in line with the PRC Plan rehabilitation and management methodologies outlined 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 SRM by an AQP (as per condition A5 of the EA) to demonstrate achievement of the RMs, as they relate to achieving the PMLUs of cattle grazing, grassland woodland habitat or watercourse.

The RMs and associated milestone criteria for SRM are detailed in Section 1.4.2 and Section 10.4. A combination of monitoring, reporting and data analysis approaches will be used to demonstrate the achievement of the RMs as detailed in Table 58. Monitoring and maintenance activities will continue after rehabilitated areas achieve the final rehabilitation milestone (achievement of PMLU to a stable condition) and/or are certified.

Table 58: Rehabilitation milestones with relevant reporting requirements

Milestone reference	Rehabilitation milestone	Reporting requirements
RM1	Infrastructure decommissioning and removal	• Document visual inspections • Map of retained below-ground infrastructure (installed after the approval date of the transitional PRCP – 4 September 2024) • Document regulated waste removal • Assessment report for mine water dams
RM2	Remediation and/or management of contaminated land	• Contaminated Land Investigation Document, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan

Milestone reference	Rehabilitation milestone	Reporting requirements
		Site assessment reports for individual progressive rehabilitation areas that are suitable to form part of future Contaminated Land Investigation Documents
RM3	Landform development and reshaping	- Survey/LiDAR of landform - Analysis of final landform against design - Analysis of final landform, cover and sediment control systems against design - Assessment that the landform is geotechnically stable with FoS ≥ 1.5 (RA1, RA9)
RM4	Surface preparation (cattle grazing)	- Document growth media depth - Growth media assessment and amelioration and physical treatment plan - Document ameliorants and physical treatments applied
RM5	Surface preparation (woodland habitat)	- Document growth media depth - Growth media assessment and amelioration and physical treatment plan - Document ameliorants and physical treatments applied
RM6	Surface preparation (watercourse)	- Document growth media depth - Growth media assessment and amelioration and physical treatment plan - 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)	Rehabilitation monitoring as per Section 8.1, 8.2 and 8.5
RM11	Achievement of surface requirements (woodland habitat)	Rehabilitation monitoring as per Section 8.1, 8.2 and 8.5
RM12	Achievement of surface requirements (watercourse)	Rehabilitation monitoring as per Section 8.1, 8.3 and 8.5
RM19	Achievement of surface requirements (grassland)	Rehabilitation monitoring as per Sections 8.1, 8.2 and 8.5

Milestone reference	Rehabilitation milestone	Reporting requirements
RM13	Achievement of post-mining land use to a stable condition (cattle grazing - RA3)	- Rehabilitation monitoring as per Sections 8.1, 8.2 and 8.5 - Hazard assessment - Built infrastructure survey
RM14	Achievement of post-mining land use to a stable condition (woodland habitat – RA1, RA4)	- Rehabilitation monitoring as per Sections 8.1, 8.2 and 8.5 - Hazard assessment - Landform geotechnical FoS assessment (RA1) - Built infrastructure survey
RM15	Achievement of post-mining land use to a stable condition (watercourse – RA2)	- Rehabilitation monitoring as per Sections 8.1, 8.3 and 8.5 - Hazard assessment - Functional diversion design (if required for realigned diversions) - Built infrastructure survey
RM17	Achievement of post-mining land use to a stable condition (cattle grazing, existing rehabilitation – RA7)	- Rehabilitation monitoring as per Section 8.1 and 8.2 - Hazard assessment
RM18	Achievement of post-mining land use to a stable condition (woodland habitat, existing rehabilitation – RA10)	- Rehabilitation monitoring as per Section 8.1 and 8.2 - Hazard assessment
RM20	Achievement of post-mining land use to a stable condition (grassland – RA9)	- Rehabilitation monitoring as per Sections 8.1, 8.2 and 8.5 - Hazard assessment - Landform geotechnical FoS assessment

8.1.1 Remote sensing and technology

The current rehabilitation monitoring program is highly dependent on 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.

8.1.2 Erosion monitoring

Erosion monitoring will be conducted for all PMLUs at the frequencies in Table 60 and Table 65, and will support achievement of surface requirements and the PMLU to a stable condition.

“There is no consensus in Australia on a quantitative or precise definition of what constitutes minor, moderate and/or severe erosion” (National Committee on Soil and Terrain, 2024). For this reason, the best approach to assess the state and severity of erosion is by an AQP during monitoring. Type of erosion and the associated severity according to the Australian soil and land survey field handbook (National Committee on Soil and Terrain, 2024) will be recorded as per Table 59. For gully erosion, gully depth will also be recorded as 0.3 – 1.5m, 1.5 – 3.0m, or >3m.

Sheet, rill or gully erosion classified as severe will be remediated (Table 59). Minor or moderate erosion, plus other erosion types, such as tunnel erosion, will be assessed by an AQP and will be remediated if assessed as requiring intervention to ensure the PMLU is achieved. This ensures the erosion is assessed holistically, such as to ensure remediation will not cause more damage, instead of a purely quantitative assessment.

The rehabilitation milestones for the achievement of PMLU to a stable condition also require a safety hazard assessment to be completed, which also ensures any erosion that is a safety hazard is remediated.

Table 59: Erosion type and severity

Erosion type*	Erosion severity			
	No erosion	Minor	Moderate	Severe
Sheet erosion	No sheet erosion present	Indicators may include shallow soil deposits in downslope sediment traps (fencelines, farm dams). Often very difficult to assess as evidence may be lost with cultivation, pedoturbation or revegetation.	Indicators may include partial exposure of roots, moderate soil deposits in downslope sediment traps (fencelines, farm dams)	Indicators may include loss of surface horizons, exposure of subsoil horizons, pedestalling, root exposure, substantial soil deposits in downslope sediment traps (fencelines, farm dams)
Rill erosion (≤0.3m deep)	No rill erosion present	Occasional rills	Common rills	Numerous rills forming corrugated ground surface
Gully erosion (>0.3m deep)	No gully erosion present	Gullies are isolated, linear, discontinuous and restricted to primary or minor drainage lines	Gullies are linear, continuous and restricted to primary and minor drainage lines	Gullies are continuous or discontinuous and either tend to branch away from primary lines and on to footslopes, or have multiple branches within primary drainage lines

*Erosion classification definitions (National Committee on Soil and Terrain, 2024)

8.2 Cattle grazing, grassland and woodland habitat monitoring

8.2.1 Monitoring schedule

The rehabilitation monitoring program follows a phased approach as detailed in Table 60. Initial monitoring is undertaken on an annual basis for the first three-years to primarily assess vegetation establishment. 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, RM11, RM19) and achievement of PMLU to a stable condition (RM13, RM14, RM17, RM18 and RM20). 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 60 and will be implemented as per the monitoring schedule from Year 3.

Table 60: 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/grassland/woodland habitat PMLUs					
Landform and erosion	✓	✓	✓	✓	✓
Soil and spoil	✓	-	✓	✓	✓
Cattle grazing PMLU					
Groundcover	✓	✓	✓	✓	✓
Species richness (3P grasses)	✓	✓	✓	✓	✓
Invasive plants	✓	✓	✓	✓	✓
Grazing land suitability assessment	✓	-	✓	✓	✓
Land condition	-	-	✓	✓	✓
Pasture cover	-	-	✓	✓	✓
Grassland PMLU					
Species richness (grasses)	✓	✓	✓	✓	✓
Invasive plants	✓	✓	✓	✓	✓
Groundcover	✓	✓	✓	✓	✓
Woodland habitat PMLU					
Groundcover (including native perennial grass cover, little cover, non-native plant cover)	✓	✓	✓	✓	✓
Species richness (trees, shrubs, grass, forbs/other)	✓	✓	✓	✓	✓
Tree height	-	-	✓	✓	✓
Tree canopy and shrub layer cover	-	-	✓	✓	✓
Recruitment	-	-	✓	✓	✓
Invasive species	✓	✓	✓	✓	✓
Tree stem count/basal area	-	-	✓	✓	✓

8.2.2 Rehabilitation monitoring sites

Permanent rehabilitation monitoring sites will be established as part of the initial rehabilitation monitoring 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)

Selection of suitable reference sites for cattle grazing, woodland habitat and watercourse PMLUs are discussed in Section 8.4.

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 (Table 60). 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, 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. Erosion will be assessed based on the classifications in Section 8.1.2.

8.2.3.2 Soil and spoil

The parameters detailed in Table 61 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 the top 0 – 10cm; and sub-surface sampling depth refers to layers at 10 – 30cm, 30 – 60cm and 90 – 100cm (sampling down to refusal).

Table 61: 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.	✓	✓
	ESP	ESP is a measure of the dominance of Na 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.	✓	-

Category	Analyte	Purpose of analyte	Depth	
			Surface	Sub-surface
		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.	✓	-

8.2.4 Cattle grazing specific rehabilitation parameters

8.2.4.1 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 native and non-native species recorded), standing dry cover, organic litter (fine and coarse organic material, such as fallen leaves, twigs, branches and hay), rocks, or bare ground. The percentage of total groundcover (anything in contact with the soil surface) is calculated. The percentage of cover will be assessed within five 1m x 1m quadrats and averaged to give a value for the monitoring point.

8.2.4.2 Species Richness

The number of 3P grasses will be recorded as part of all monitoring phases.

8.2.4.3 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. Prohibited invasive plants are currently not present or known to be present in Queensland and have therefore been excluded from any criteria. A complete list of invasive plant species is listed in Schedule 2, Part 2 (Restricted matter – invasive biosecurity matter) of the *Biosecurity Act 2014*.

'Restricted' invasive plants will be assessed at the permanent rehabilitation monitoring sites and reference 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.

No seeding of leucaena (*Leucaena leucocephala*) is proposed at SRM. Leucaena is an acceptable species within a cattle grazing PMLU, when leucaena stem density is managed as per the milestone criteria transitioned from the EA (at the time of the development of the transitional PRCP).

8.2.4.4 Grazing land suitability assessment

Land suitability class (Section 3.1.1) will be assessed at Year 1 to determine the effectiveness of ameliorants or if further treatments are required. Ongoing grazing 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 class 1 to 5 as per the limitations in *Rehabilitated mined land suitability for beef cattle grazing in the Bowen Basin: Technical Paper 1* (Short, 2025) (Table 24).

8.2.4.5 Land condition

Grazing Land Management ABCD land condition, as described in the *Queensland Reef Protection Regulations Farming in Reef Catchments Grazing Guide* (DES, 2022a), will be assessed at the permanent cattle grazing 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 Grazing Land Management ABCD land condition framework based on indicators associated with pasture and soil condition (Table 62).

Table 62: Grazing Land Management 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) - 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

8.2.4.6 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 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 per the condition indicators in Table 63.

Table 63: 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 Grassland specific rehabilitation parameters

8.2.5.1 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 native and non-native species recorded), standing dry cover, organic litter (fine and coarse organic material, such as fallen leaves, twigs, branches and hay), rocks, or bare ground. The percentage of total groundcover (anything in contact with the soil surface) is calculated. The percentage of cover will be assessed within five 1m x 1m quadrats and averaged to give a value for the monitoring point.

8.2.5.2 Species richness

The number of grasses (exotic and native) for each survey plot will be recorded as part of all monitoring phases.

8.2.5.3 Invasive plants

'Restricted' 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.

8.2.6 Woodland habitat specific rehabilitation parameters

The monitoring method for woodland habitat rehabilitation will be a modified *BioCondition – A condition assessment framework for terrestrial biodiversity in Queensland assessment manual – version 2.2* (BioCondition Assessment Manual) (Eyre, et al., 2015). The applicable site-based attributes will be assessed

and recorded. The modified BioCondition Assessment Manual method will involve reducing the length of the transect when assessing some parameters (e.g. tree canopy and shrub layer cover).

The BioCondition Assessment Manual scoring tables will be used to determine the site-based attribute scores, whereby the 'benchmarks' to be used for the scoring will be the average of the combined representative REs' benchmarks. The applicable site-based attributes have a maximum possible site score of 60.

Table 64: BioCondition benchmarks and scoring of site-based attributes for representative regional ecosystems

Representative regional ecosystems	Maximum score for attributes	Benchmarks*				Averaged benchmarks
		RE 11.5.3	RE 11.5.9	RE 11.10.1	RE 11.10.3	Combined regional ecosystems
Recruitment of dominate canopy species (%)	5	100	100	100	100	100
Native plant species richness - trees (#)	5	6	3	4	3	4
Native plant species richness - shrubs (#)	5	6	6	4	4	5
Native plant species richness - grasses (#)	5	6	9	9	7	8
Native plant species richness – forbs/other (#)	5	10	11	17	9	12
Tree canopy height (m)	5	16	17	24	15	18
Tree canopy cover (%)	5	20	25	30	41	20**
Shrub layer cover (%)	5	3	10	13	3	7
Native perennial grass cover (%)	5	19	26	16	23	21
Litter cover (%)	5	20	30	50	32	33
Non-native plant cover (%)	10	0	0	0	0	0
Maximum site score	60					

* Benchmarks for each applicable site-based attribute for the representative REs (State of Queensland, 2024)

** Tree canopy cover reduced to 20% as agreed with the administering authority.

RA10 will be monitored for the site-based attributes listed in Table 64, however rehabilitation performance will be measured by species richness and tree canopy cover attributes.

8.2.6.1 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 native and non-native species recorded), standing dry cover, organic litter (fine and coarse organic material, such as fallen leaves, twigs, branches and hay), rocks, or bare ground. The percentage of total groundcover (anything in contact with the soil surface) is calculated. The percentage of cover will be assessed within five 1m x 1m quadrats and averaged to give a value for the monitoring point. 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 includes a full floristic assessment and count of trees, shrubs, grasses (native and exotic), and forbs and other ground species at each site.

8.2.6.2 Tree height

Tree height and height range will be assessed at the permanent rehabilitation monitoring sites from Year 3. Tree 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).

8.2.6.3 Tree canopy and shrub layer cover

Tree canopy cover and shrub layer 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 at each monitoring site.

8.2.6.4 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.

8.2.6.5 Invasive plants

'Restricted' invasive plants will be assessed at the permanent rehabilitation monitoring sites and reference 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.

8.2.6.6 Tree stem count/basal area

Tree stem count provides another measure of species' abundance which helps describe the vegetation community. The tree stem count records the number of individual trees in a 50m x 10m plot by species. A tree that branches into two or more stems 30cm above the ground is counted as one individual (Neldner, 2022).

Basal area is recorded by species using a single sweep of a Bitterlich stick or similar with basal area factor of 1 (BAF1) from the centre of the plot (Neldner, 2022).

8.3 Watercourse monitoring

Watercourse monitoring will be conducted at SRM 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 the final PMLU milestone criteria (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 vegetation condition of diversions; however, it can be utilised for both diverted and rehabilitated reaches of watercourses. For rehabilitated watercourses reaches which are not diversions (such as where culverts are removed), a modified IDC method, with a reduced number of monitoring points within each reach, is required due to the reduced impact area.

The SRM watercourse monitoring schedule is detailed in Table 65. The monitoring schedule indicates the IDC parameters are measured in Year 1, Year 2, Year 5 and then 5-yearly thereafter.

The IDC methodology and monitoring consist of:

- 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

In addition to the IDC index parameters, several other parameters will also be monitored as listed in Table 65.

Table 65: 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)
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 vegetation 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	✓	✓	✓	✓
Additional parameters					
Erosion	Assessment of sheet, rill, gully, tunnel and mass movement	✓	✓	✓	✓
Groundcover	Groundcover (%)	✓	✓	✓	✓

Monitoring parameters		Monitoring schedule			
Parameter	Monitoring detail	Year 1	Year 2	Year 5	Year 10+ (5-yearly thereafter)
Species richness - trees and shrubs	Native plant species richness for life-forms trees and shrubs	✓	✓	✓	✓
Tree canopy cover	Native tree canopy cover (%)	-	-	✓	✓
Tree canopy height	Tree median canopy height (m) for ecologically dominant layer or canopy layer	-	-	✓	✓
Recruitment of woody perennial species	Recruitment of woody perennial species in ecological dominant layer	-	-	✓	✓

8.4 Reference sites

Cattle grazing and woodland habitat reference sites have been established at the locations shown in Figure 23.

8.4.1 Cattle grazing reference sites

Cattle grazing reference sites have been summarised in Table 66, and will continue to be monitored in accordance with the cattle grazing monitoring requirements outlined in Sections 8.1 and 8.2. Land suitability classes for cattle grazing reference sites were assessed against the land suitability framework (Short, 2025). Additional or alternative cattle grazing reference sites may be established in the future.



Table 66: SRM Cattle grazing reference sites

Site ID	SRM_REF01	SRM_REF03	SRM_REF14
Image			
Monitoring year	2023	2023	2023
Coordinates	634478E 7514463N	638166E 7510322N	628838E 7526668N
Mean slope (%)	3	1	4
Total groundcover (%)	100	96	53
Pasture Species	<i>Cenchrus ciliaris</i> (buffel grass*), <i>Urochloa mosambicensis</i> (sabi grass*), <i>Heteropogon contortus</i> (black spear grass)	<i>Setaria incrassata</i> (purple pigeon grass*), <i>Bothriochloa pertusa</i> (Indian couch*), <i>Cenchrus ciliaris</i> (buffel grass*)	<i>Cenchrus ciliaris</i> (buffel grass*), <i>Bothriochloa pertusa</i> (Indian couch*), <i>Eriochloa crebra</i> (spring grass)
Dry matter yield (kg/ha)	2,500 – 4,000	1,500 – 2,000	2,000
Land Condition	B - Fair	C - Poor	C - Poor
Land Suitability Class	5	4	3
Limiting Factors	Plant Available Water Capacity (PAWC) in Effective rotting depth (ERD) = 25mm Available Phosphorus (P) in 0.1m = 5	Heavily grazed poor pasture condition Available phosphorus (P) in 0.1m = 4	Heavily grazed poor pasture condition

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 23. The reference sites results have been provided in Table 67, and will continue to be monitored in accordance with the woodland habitat monitoring requirements outlined in Sections 8.1 and 8.2. Additional or alternative woodland habitat reference sites may be established in the future.

Table 67: SRM Woodland habitat reference sites

Site ID	SRM_REF02	SRM_REF09
Image		
Monitoring year	2023	2023
Coordinates (MGA2020 Zone 55)	635822E 7512982N	630323E 7525736N
Mean Slope (%)	3	3
Regional Ecosystem	11.5.9	11.5.3
Total Groundcover (%)	97	95
Tree Canopy Cover (%)	59	32
Tree Species	<i>Eucalyptus crebra</i> (narrow leaved ironbark), <i>Eucalyptus populnea</i> (poplar box), <i>Eucalyptus camaldulensis</i> (river red gum), <i>Corymbia dallachiana</i> (Dallachy's gum), <i>Petalostigma pubescens</i> (quinine bush), <i>Alphitonia excelsa</i> (soap ash), <i>Acacia salicina</i> (sally wattle), <i>Cassia brewsteri</i> (Leichhardt bean)	<i>Eucalyptus populnea</i> (poplar box), <i>Atalaya hemiglaucula</i> (whitewood), <i>Cassia brewsteri</i> (Leichhardt bean), <i>Grevillea striata</i> (beefwood), <i>Corymbia clarksoniana</i> (long fruited bloodwood), <i>Corymbia dallachiana</i> (Dallachy's gum), <i>Grevillea parallela</i>
Evidence of recruitment	Yes	Yes
Shrub species	<i>Acacia leiocalyx</i> (black wattle), <i>Petalostigma pubescens</i> (quinine bush), <i>Owenia acidula</i> (emu apple), <i>Acacia bancroftiorum</i> (Bancroft's wattle), <i>Cassia brewsteri</i> (Leichhardt bean), <i>Eremophila mitchellii</i> (false sandalwood), <i>Carissa ovata</i> (currant bush), <i>Erythroxylon australe</i>	<i>Carissa ovata</i> (currant bush), <i>Cassia brewsteri</i> (Leichhardt bean), <i>Erythroxylon australe</i> (dogwood), <i>Grevillea striata</i> (beefwood), <i>Grewia latifolia</i> , <i>Myoporum acuminatum</i> (boobialla), <i>Eremophila mitchellii</i> (false sandalwood), <i>Capparis mitchellii</i> (native orange)

Site ID	SRM_REF02	SRM_REF09
	(dogwood), <i>Grewia latifolia</i> , <i>Acacia</i> sp. (wattle), <i>Archidendropsis basaltica</i> (dead finish), <i>Breynia oblongifolia</i>	
Grasses	<i>Aristida calycina</i> (dark wiregrass), <i>Heteropogon contortus</i> (black spear grass), <i>Bothriochloa bladhii</i> (forest bluegrass) <i>Cenchrus ciliaris</i> (buffel grass*), <i>Megathyrsus maximus</i> var. <i>maximus</i> (guinea grass*), <i>Melinis repens</i> (red natal grass*)	<i>Heteropogon contortus</i> (black spear grass), <i>Aristida calycina</i> (dark wiregrass), <i>Cymbopogon refractus</i> (barbwire grass), <i>Cymbopogon bombycinus</i> (citronella grass), <i>Enneapogon nigricans</i> (nine awn dark bottle washer), <i>Themeda triandra</i> (kangaroo grass), <i>Eragrostis</i> sp. <i>Cenchrus ciliaris</i> (buffel grass*), <i>Melinis repens</i> (red natal grass*), <i>Megathyrsus maximus</i> var. <i>pubiglumis</i> (green panic*)
Invasive plants	<i>Cryptostegia grandiflora</i> (rubber vine*), <i>Opuntia</i> sp. (tree pear*)	N/A

*Exotic species

8.4.3 Watercourse reference sites

Watercourse reference sites have been established in the existing watercourse diversions associated with Plumtree, Hughes, Barrett, One Mile, Spring, Southern and Phillips creek diversions as shown in Figure 24 and detailed in Table 68. Reference sites will be monitored in accordance with the watercourse monitoring requirements outlined in Section 8.3. Where revegetation is required in a natural watercourse (such as where culverts are removed), a proportional number of reference sites utilising a modified IDC method (ID&A, 2001) will be established due to the reduced impact area. New watercourse reference sites will be established in relatively unmodified upstream sections of each watercourse.

Table 68: SRM watercourse reference site locations

Stream	Reference Type	Location	Easting (MGA2020 Zone 55)	Northing (MGA2020 Zone 55)
Plumtree Creek	Upstream	PTC-U2	628375	7526626
Plumtree Creek	Upstream	PTC-U3	628602	7526821
Plumtree Creek	Upstream	PTC-U4	628786	7526906
Hughes Creek	Upstream	HC-U1	629449	7523550
Hughes Creek	Upstream	HC-U2	629739	7523787
Hughes Creek	Upstream	HC-U3	629996	7523902
Hughes Creek	Upstream	HC-U4	630289	7524070
Hughes Creek	Downstream	HC-D1	634535	7525787
Hughes Creek	Downstream	HC-D2	634628	7525944
Hughes Creek	Downstream	HC-D3	634889	7526090
Hughes Creek	Downstream	HC-D4	634964	7526208
Barrett Creek	Upstream	BC-U1	630432	7520884

Stream	Reference Type	Location	Easting (MGA2020 Zone 55)	Northing (MGA2020 Zone 55)
Barrett Creek	Upstream	BC-U2	630638	7521139
Barrett Creek	Upstream	BC-U3	630860	7521318
Barrett Creek	Upstream	BC-U4	631170	7521335
One Mile Creek	Upstream	OMC-U1	633003	7519359
One Mile Creek	Upstream	OMC-U2	633269	7519544
One Mile Creek	Upstream	OMC-U3	633579	7519645
One Mile Creek	Upstream	OMC-U4	633833	7519694
One Mile Creek	Downstream	OMC-D1	636383	7520139
One Mile Creek	Downstream	OMC-D3	636692	7520235
Spring Creek	Upstream	SPC-U1	633999	7515030
Spring Creek	Upstream	SPC-U2	634086	7515067
Spring Creek	Upstream	SPC-U3	634273	7515056
Spring Creek	Upstream	SPC-U4	634404	7515123
Southern Creek	Upstream	SOC-U1	636205	7512418
Southern Creek	Upstream	SOC-U2	636129	7512478
Southern Creek	Upstream	SOC-U3	636131	7512332
Southern Creek	Upstream	SOC-U4	636014	7512287
Phillips Creek	Upstream	PHC-U1	637691	7511149
Phillips Creek	Upstream	PHC-U2	637566	7511617
Phillips Creek	Upstream	PHC-U3	637695	7511954
Phillips Creek	Upstream	PHC-U4	637765	7512344
Phillips Creek	Downstream	PHC-D1	638570	7513627
Phillips Creek	Downstream	PHC-D2	638763	7513879
Phillips Creek	Downstream	PHC-D3	639143	7513894
Phillips Creek	Downstream	PHC-D4	639143	7514040
Phillips Creek	Upstream	PHC-HR-U1	637567	7511513
Phillips Creek	Upstream	PHC-HR-U2	637562	7511562
Phillips Creek	Upstream	PHC-HR-U3	637566	7511608
Phillips Creek	Upstream	PHC-HR-U4	637582	7511655

Stream	Reference Type	Location	Easting (MGA2020 Zone 55)	Northing (MGA2020 Zone 55)
Phillips Creek	Downstream	PHC-HR-D1	637674	7511811
Phillips Creek	Downstream	PHC-HR-D2	637695	7511865
Phillips Creek	Downstream	PHC-HR-D3	637697	7511920
Phillips Creek	Downstream	PHC-HR-D4	637694	7511979

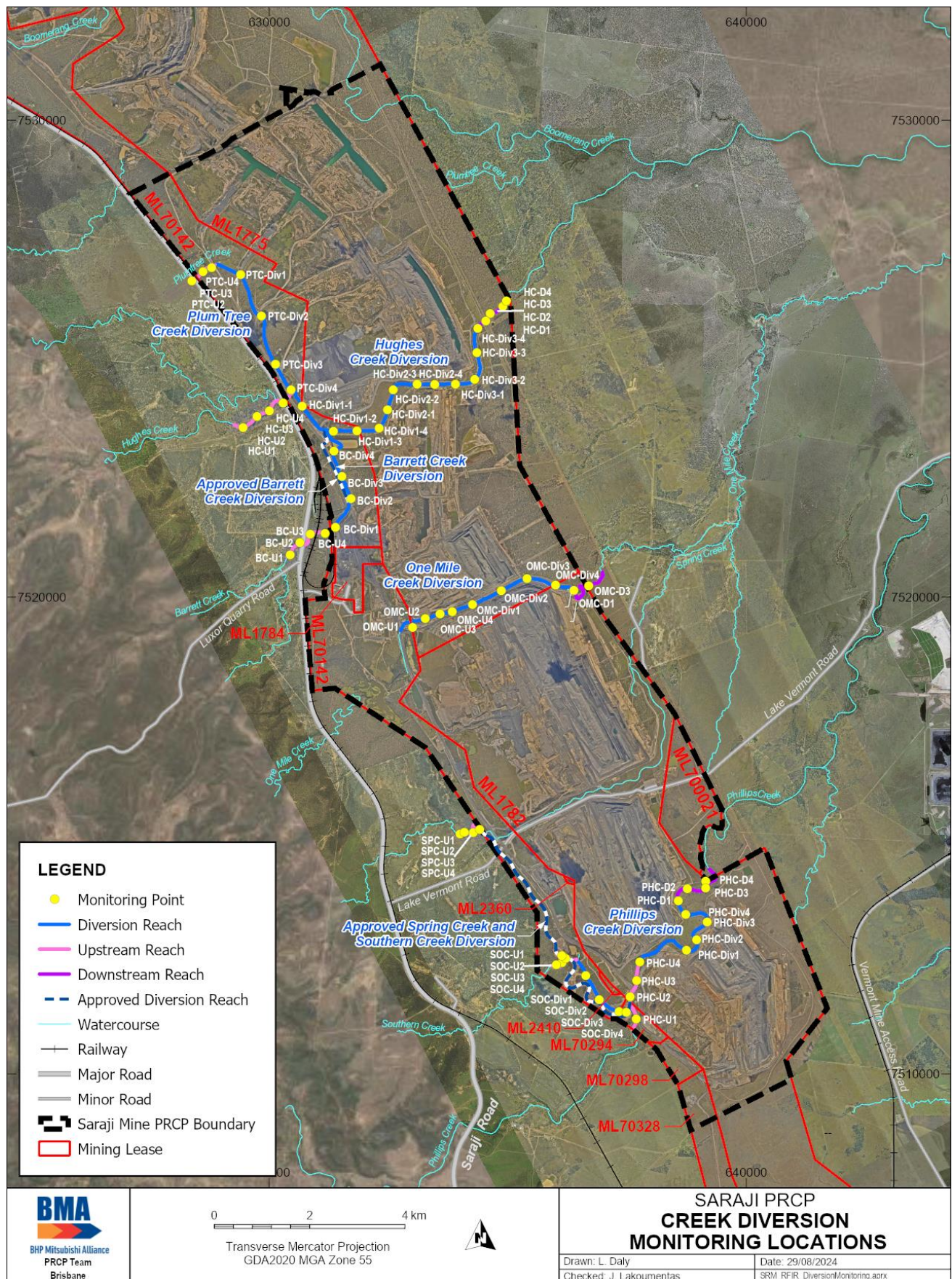


Figure 24: SRM watercourse creek diversion monitoring locations

8.5 Surface water monitoring

Surface water runoff monitoring will be undertaken for:

- Representative areas of rehabilitation as part of surface requirements (RM10, RM11, RM19) and to demonstrate achievement of PMLU to a stable condition (RM13, RM14, RM20) for rehabilitation commenced post approval of the transitional PRCP; and
- Watercourse locations included in the Table 69, commencing by 2050.

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

8.5.1 Surface water quality

The currently available surface water monitoring data has been collected for a variety of purposes, for which different sampling methodologies and data quality objectives were applied. Therefore, the currently available data is not suitable for the establishment of milestone criteria for closure to support monitoring of off tenure flows within the watercourses. Also, as per ANZG (2018), the default guideline values are for generic applications and may not be representative of local conditions and therefore these are also not suitable for use as water quality limits for a specific mine site. The execution of scopes for the collection of appropriate data sets to support the development of site-specific criteria have not formed part of the EA requirements.

Water quality limits should be site-specific and developed through appropriate sampling analytical and quality plans that include data quality objective processes aligned with the intended use of the data. BMA have requested the PRCP be conditioned to allow the appropriate development of site-specific water quality limits. As the watercourses at SRM are highly ephemeral and do not support baseflows, the establishment of the site-specific water quality limits will be based on the ANZECC guidance for temporary waters (Smith, et al., 2020).

Due to the variability and availability of the stream flows in the target ephemeral watercourses, there is uncertainty around the timing for completing the establishment of site-specific water quality limits. Site-specific closure water quality limits should be developed prior to commencement of closure focused downstream watercourse monitoring program.

8.5.2 Rehabilitation area surface water monitoring

Representative areas of rehabilitation will be selected by BMA to conduct surface water monitoring. Representative is defined in the EA as “a sample set that covers the variance in monitoring or other data due to either natural changes or operational phases of the mining activities”. A range of factors including: timing of rehabilitation; PMLU; slope; underlying material type; and surface treatment will be considered. The objective of the rehabilitation area surface water sampling is to demonstrate that a stable condition is being achieved. The selected rehabilitation areas will be designed and constructed to allow the capture of surface water flows for sampling from the rehabilitated area’s surface, without significant influence from surrounding operational areas. Depending on the nature of the rehabilitation area, the method of surface water collection may vary from area to area.

Samples from the selected rehabilitation areas will be collected and analysed for parameters transitioned from EA Table E1 (included in the EA prior to approval of the PRCP) and include pH, EC and turbidity, when suitable runoff occurs and when safe to do so. Rehabilitation area surface water runoff will be collected from rehabilitation areas designed and constructed post approval of the transitional PRCP (September 2024).

8.5.3 Receiving environment surface water monitoring

The collection and analysis of surface water samples from watercourses will commence by 2050. The objective of the watercourse samples is to facilitate relinquishment of the site through confirming the rehabilitated site is not causing environmental harm through surface water discharges and has generated a stable landform suitable to support the PMLUs.

Surface water quality will be monitored at locations in Table 69 (Figure 25), at least once per month when flows at the downstream gauging station record 1m³/second for Phillips Creek and Hughes Creek and 0.5m³/second

for One Mile Creek (when safe to collect samples). Due to the ephemeral nature of the watercourses that cross SRM, there are no baseflows to allow scheduled sample collection, and therefore sampling will be undertaken following rainfall events that generate suitable flows.

The water quality within the watercourses, within the five-year period immediately prior to surrender, will be assessed via the following process:

1. Downstream monitoring results will be compared the site-specific surface water quality limits (once developed). Where downstream monitoring results are below the surface quality limits, no further actions will be required.
2. Where exceedances of the surface water quality limits are identified at the downstream sample locations, the downstream results will be compared to the upstream results for that monitoring round. Where downstream results are equal to or less than the upstream results, no further actions will be required.
3. Where downstream results are above both the specified water quality limits and the upstream results, an AQP will be engaged to assess the risk to achieving a stable condition.
 - a) Where risks are determined to be low, no further action will be taken.
 - b) Where a risk greater than low is identified by the AQP, an assessment of potential environmental harm and any changes or rectification actions to rehabilitation activities will be assessed and implemented.
 - c) Where 3(b) is triggered more than three times over five consecutive years prior to surrender, the five-year monitoring period is reset. Where potential environmental harm is identified and/or rectification actions to rehabilitation activities are required, at least five years of further surface water monitoring will be undertaken.

The results of assessments completed by the AQP will be provided to the administering authority within six months of receiving the sampling results.

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 to measure progressive rehabilitation areas.

Table 69: Surface water monitoring locations

Monitoring point ID	Monitoring location description	Easting (MGA2020 Zone 55)	Northing (MGA2020 Zone 55)
Upstream monitoring locations			
MP1	Hughes Creek upstream adjacent to Dysart – Moranbah Road.	630290	7524051
MP2	One Mile Creek upstream adjacent to Dysart – Moranbah Road.	631096	7516901
MP3	Phillips Creek upstream adjacent to Dysart – Moranbah Road.	634068	7508901
MP4	Spring Creek upstream.	634503	7515043
Downstream monitoring locations			
MP5b	Hughes Creek downstream adjacent to lease boundary.	635008	7526316

Monitoring point ID	Monitoring location description	Easting (MGA2020 Zone 55)	Northing (MGA2020 Zone 55)
MP6	One Mile Creek downstream adjacent to lease boundary and existing creek crossing.	636583	7520215
MP7b	Phillips Creek downstream adjacent to lease boundary.	639579	7515541

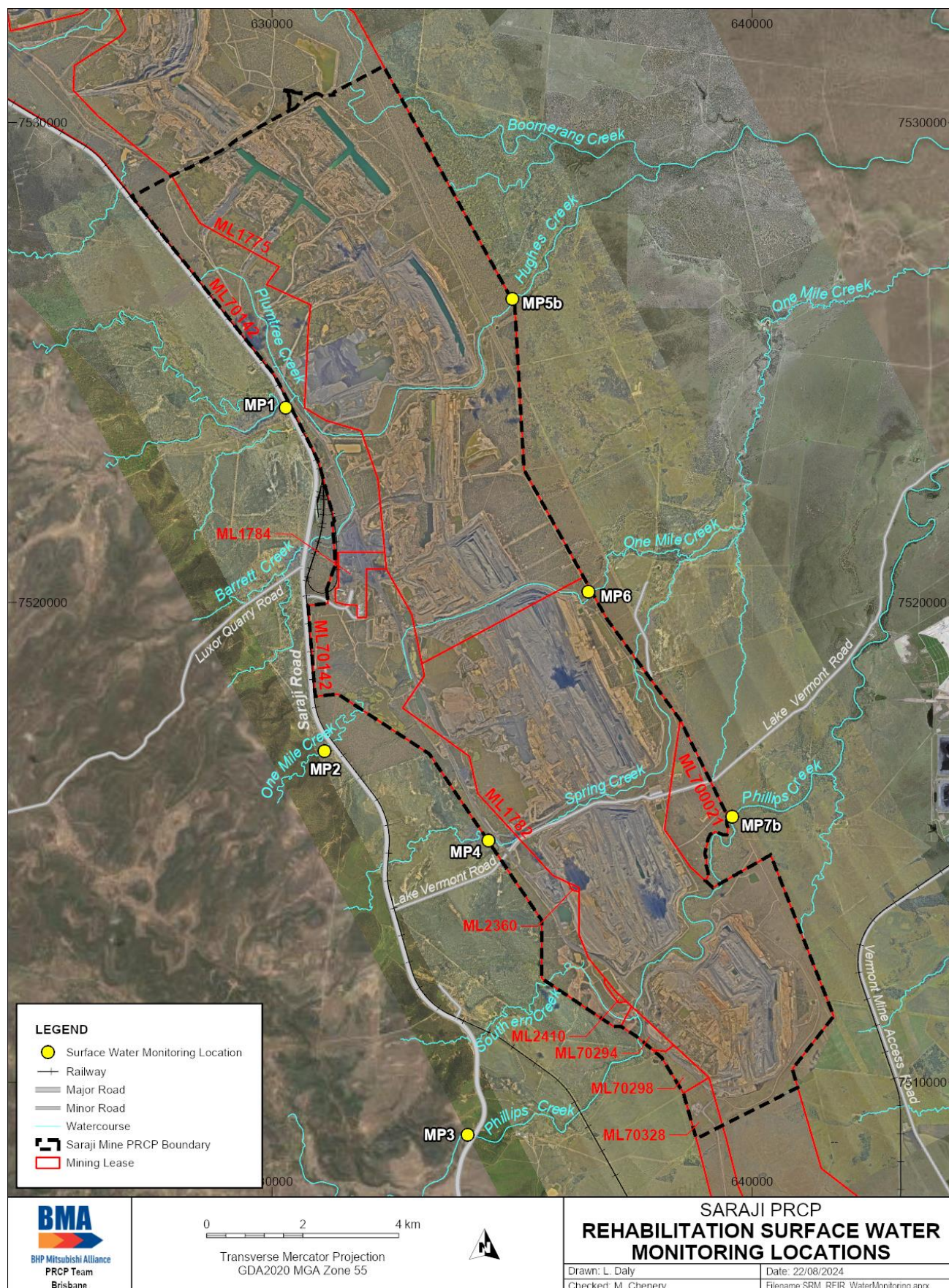


Figure 25: SRM rehabilitation surface water monitoring locations

8.6 Groundwater monitoring

In line with the *Guideline progressive certification for resource activities*, deep drainage water quality will be “addressed holistically for a site at surrender” (DES, 2022e). 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.

8.6.1 Groundwater quality

The groundwater monitoring data currently held for the site has been collected for a variety of purposes, for which different sampling methodologies and data quality objectives were applied, therefore, this data is not suitable for the development of site-specific closure criteria. Also, as per ANZG (2018), the default guideline values are for generic applications and may not be representative of local conditions, therefore these are also not suitable for use as water quality limits. The execution of scopes for the installation of monitoring infrastructure and collection of appropriate data sets to support the development of site-specific criteria have not formed part of the EA requirements.

Water quality limits should be site-specific and developed through appropriate sampling analytical and quality plans that include data quality objective processes aligned with the intended use of the data. BMA have requested the PRCP is conditioned to allow the appropriate development of site-specific water quality limits.

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

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 with the data incorporated into the predictive numerical groundwater models. The numerical groundwater models will be used to confirm the residual voids are progressing to a stabilised state, where they will act as on-going sinks for the Permian hosted groundwater and thus minimising the potential for an unacceptable risk of environmental harm off-tenure.

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. The groundwater model and water balance model will be recalibrated and predictions rerun at least every five-years commencing from 2050. These updates will incorporate up to date information and confirm the predictions for the residual voids.

8.6.3 Groundwater monitoring schedule

During operations, groundwater monitoring will continue as per the applicable EA conditions.

Following installation of monitoring bores by 2050, groundwater quality will be monitored six monthly and compared against the developed site-specific groundwater quality limits.

8.6.4 Groundwater monitoring locations

Groundwater monitoring to support the assessment of closure conditions will be undertaken on bores that provide a geographical distribution across SRM and coverage of the key hydrogeological units. The groundwater monitoring bore network to assess closure conditions 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 network to be utilised for assessment of rehabilitation are provided in Table 70 and illustrated on Figure 26.

The rehabilitation groundwater monitoring bore network may require maintenance or adjustment throughout the monitoring period. Where bores become inoperable or are not producing the required data due to damage to bores, changes in water levels, changes to the catchment or other site-specific circumstances, replacement bores or additional bores may be installed as required.

Table 70: Groundwater monitoring locations

Hydro-geologic unit	Monitoring location ID	Monitoring location description	Easting (MGA2020 Zone 55)	Northing (MGA2020 Zone 55)
Alluvium	MB32	Philips Creek upstream - existing bore	637596	7510717
	MB38/ SRMMB19_01A	Philips Creek downstream – existing bore	640033	7515861
Tertiary and Quaternary sediments and weathered material	PZ02A	Undifferentiated weathered material. North of the Jacaranda/Bauhinia Void – existing bore	632134	7530857
	PZ00C	Tertiary sediments. Immediately to the east of the Jacaranda/Bauhinia Void – existing bore	632986	7529936
	SRMMB12_01	Undifferentiated weathered material. East of Coolabah/Dogwood Void – proposed new bore	637219	7522753
	MB40/ MB19SRM 02T	Tertiary sediments. Adjacent to Philips Creek downstream of SRM – existing bore	640027	7515868
Permian Coal Measures	PZ02C	North-eastern corner, to the north-east of Jacaranda/Bauhinia	632128	7530854
	MB31	West of Jacaranda/Bauhinia and Coolabah/Dogwood voids – existing bore	625943	7522561
	MB20SRM 03P	East of Jacaranda/Bauhinia Void – existing bore	636021	7527857
	SRMMB12_03	East of Coolabah/Dogwood Void – proposed new bore	637241	7522760
	MB19SRM 04P	West of Hakea Void – existing bore	637169	7511225
	MB33	West of Ebony/Grevillea	636755	7520381
	MB34	West of Ebony/Grevillea	638041	7518451
	MB37	West of Ebony/Grevillea	632504	7515753
	MB39/ MB19SRM 03P	East of Ebony/Grevillea and Hakea voids and immediately north of Phillips Creek – existing bore	640019	7515877

Hydro-geologic unit	Monitoring location ID	Monitoring location description	Easting (MGA2020 Zone 55)	Northing (MGA2020 Zone 55)
	MB20SRM 07P	South of Hakea Void – existing bore	641475	7508140
	New Bore 1	East of Bauhinia Pit – new proposed bore	635005	7526450
	New Bore 2	East of Hakea Void – new proposed bore	641354	7513125

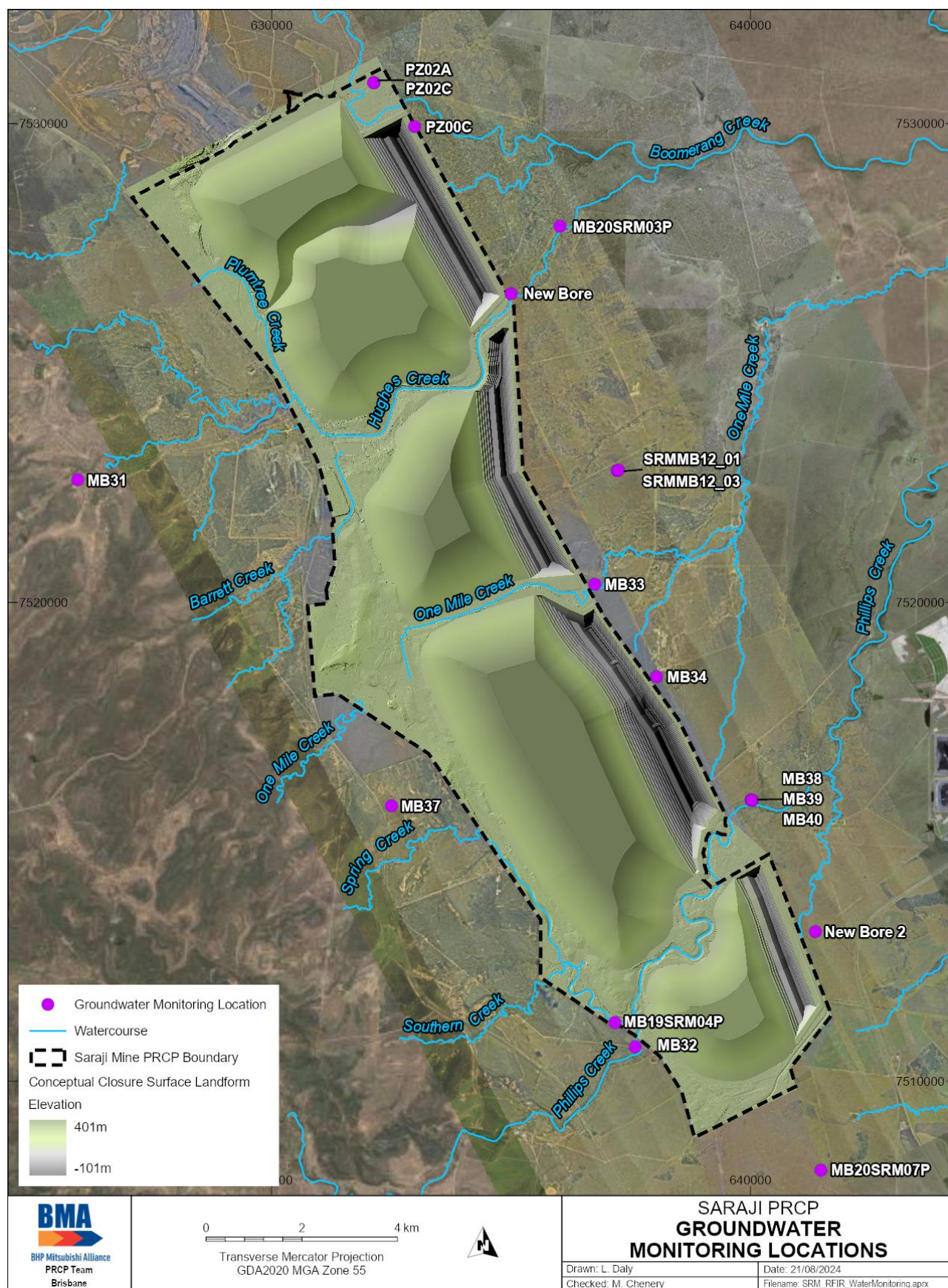


Figure 26: SRM rehabilitation groundwater monitoring locations

8.7 NUMA milestone monitoring

Management milestone monitoring will be undertaken at SRM by an AQP (as per condition A5 of the EA) to demonstrate achievement of the MMs as they relate to achieving sufficient improvement of the NUMA extents.

The MMs and associated milestone criteria for SRM are detailed in Section 1.4.3 and Section 10.5. A combination of monitoring, reporting and data analysis approaches will be used to demonstrate the achievement of the MMs prior to site relinquishment as detailed in Table 71.

Table 71: Management milestones with relevant reporting requirements

Milestone reference	Management milestone	Reporting requirements
MM1	Achievement of structural stability	- Final groundwater model and assessment - Final flood model and assessment - Final geotechnical assessment - Final void design - Survey/LiDAR of landform - Analysis of final landform against design
MM2	Achievement of surface requirements	Document visual inspections of safety bund, fencing and signage
MM3	Achievement of sufficient improvement	- Groundwater monitoring (Section 8.6) - Residual voids water quality and level monitoring (Section 6.3.5) - AQP certification that residual voids: - Are safe to humans and livestock - Are immune from flooding - Highwall landforms are constructed to final design - Safety infrastructure is installed as per design - Will not present an unacceptable risk of environmental harm outside of the tenure - Will not impact on the stability of any adjacent rehabilitation areas, or their ability to sustain their PMLU - Document visual inspections of safety bund, fencing and signage

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, grassland, woodland habitat and watercourse PMLUs are listed in Table 72. These timeframes have regard to the risks presented in Section 7.

Achievement of surface requirements for cattle grazing (RM10) and grassland (RM19) is scheduled 10-years from revegetation and a further five-years for achievement of PMLU to a stable condition for cattle grazing

(RM13 and RM17) and grassland (RM20). There are a number of factors which can influence the successful establishment of grasses 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 scheduled 10-years from revegetation. A further 10-year timeframe is allowed for initial establishment and successional processes and natural recruitment to occur, prior to achievement of the PMLUs to a stable condition (RM14, RM15 and RM18).

Table 72: Time for achievement of surface requirements and PMLUs rehabilitation milestones

Milestone reference	Rehabilitation milestone	Milestone achievement time after revegetation (in PRCP schedule)
RM10	Achievement of surface requirements (cattle grazing)	10-years
RM11	Achievement of surface requirements (woodland habitat)	10-years
RM12	Achievement of surface requirements (watercourse)	10-years
RM19	Achievement of surface requirements (grassland)	10-years
RM13	Achievement of post-mining land use to a stable condition (cattle grazing – RA3)	Up to 15-years
RM14	Achievement of post-mining land use to a stable condition (woodland habitat – RA1, RA4)	Up to 20-years
RM15	Achievement of post-mining land use to a stable condition (watercourse – RA2)	Up to 20-years
RM17	Achievement of post-mining land use to a stable condition (cattle grazing - existing rehabilitation – RA7)	Up to 15-years
RM18	Achievement of post-mining land use to a stable condition (woodland habitat – RA10)	Up to 20-years
RM20	Achievement of post-mining land use to a stable condition (grassland – RA9)	Up to 15-years

8.8.2 NUMAs

The timing of the management milestones specific to achievement of sufficient improvement (MM3) is listed in Table 73.

Table 73: Time for achievement of sufficient improvement for NUMA management milestones

Milestone reference	Management milestone	Milestone achievement time (in PRCP schedule)
MM3	Achievement of sufficient improvement	Aligned with achievement of neighbouring PMLUs (RM13, RM14 or RM15) to ensure maximum monitoring period to demonstrate minimising environmental harm

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 included in rehabilitation budgets for completion. Records of maintenance activities will be retained by BMA.

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.

8.11 Quality assurance and quality control

The quality assurance and quality control (QA/QC) process to be followed as part of SRM ongoing rehabilitation monitoring is illustrated in Figure 27. 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 27: 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 SRM final site design is provided in Figure 28.

10.2 Reference map

The SRM reference map is provided in Figure 29.

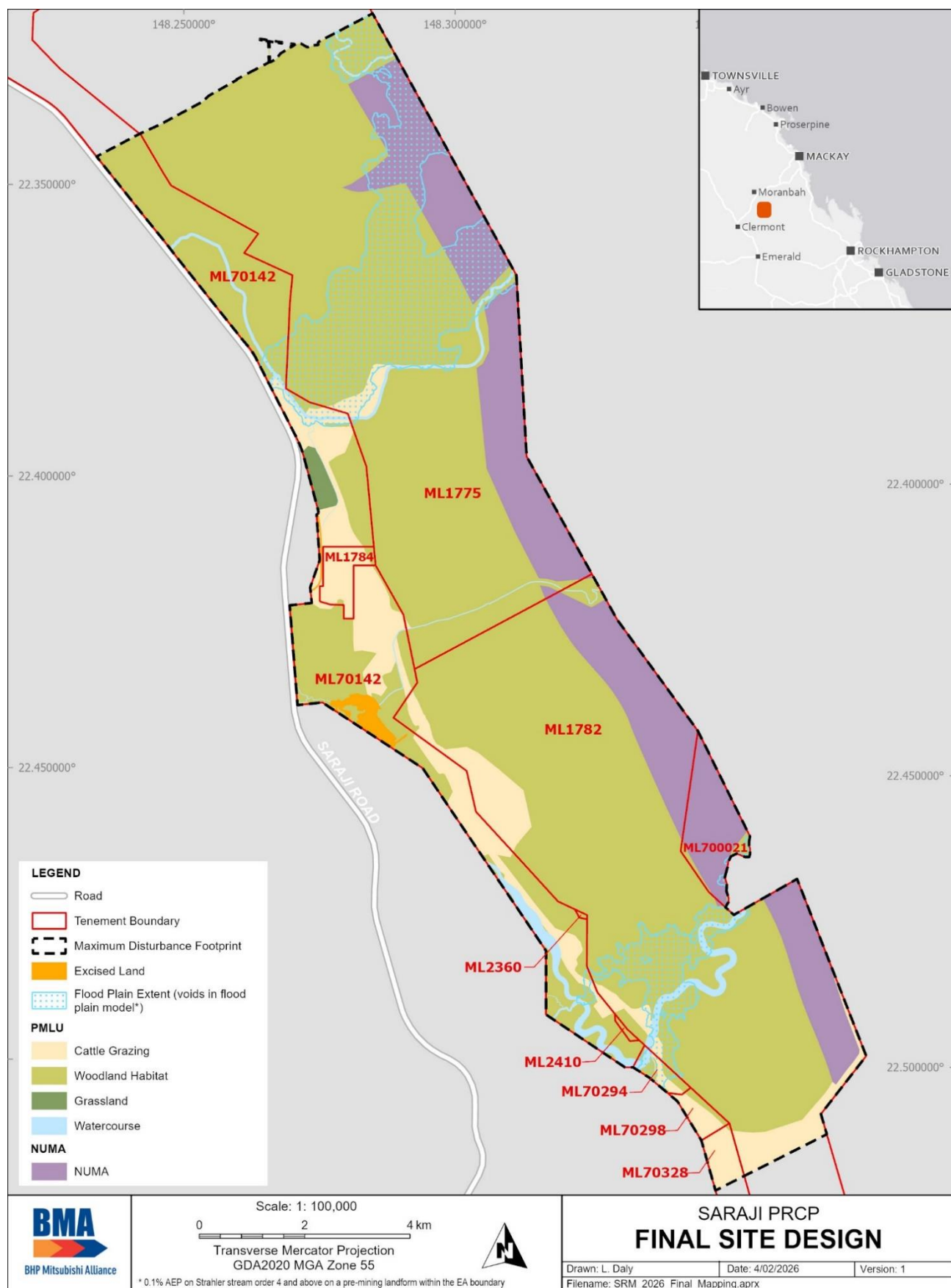


Figure 28: SRM final site design

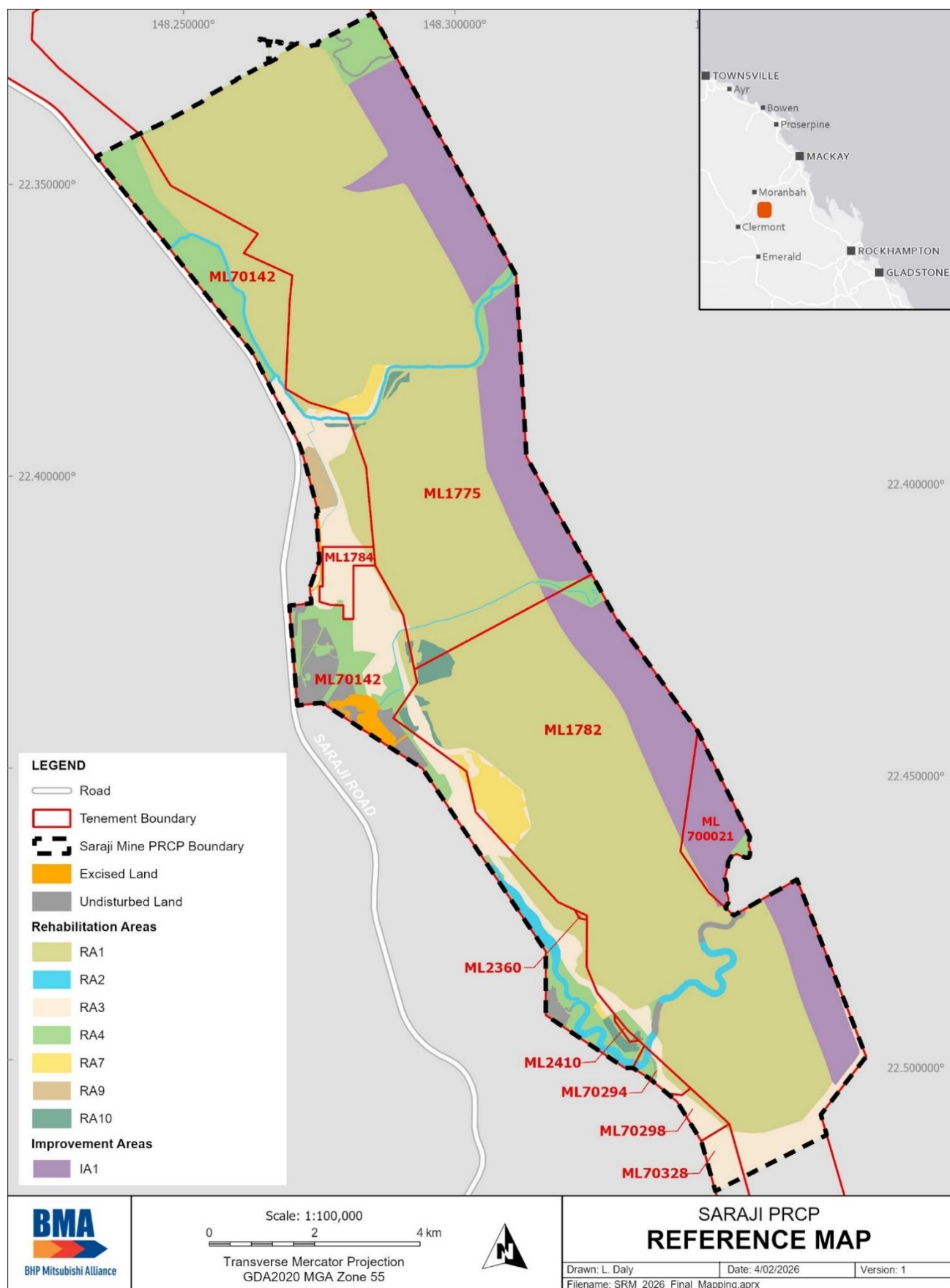


Figure 29: SRM reference map

10.3 Schedule Conditions

Refer to the SRM PRCP schedule for conditions (Section A - Conditions of PRCP schedule).

10.4 Rehabilitation milestones

The RMs and milestone criteria for SRM are shown in Table 74.

Table 74: SRM rehabilitation milestones and milestone criteria

Milestone Reference	Rehabilitation milestone	Milestone criteria
RM1	Infrastructure decommissioning and removal	1.1 All infrastructure to be retained onsite must be safe, stable and not cause environmental harm. 1.2 All infrastructure and services to be retained onsite must have a signed landholder statement, declaring that they will accept responsibility for the infrastructure (except for those items in 1.3). 1.3 Below-ground infrastructure, services and waste (as per the Environmental Authority (EPML00862313) waste schedule) deeper than 0.5m in relation to the final landform surface can be retained provided it can meet the following: a) All pipelines have been drained; and b) All below-ground infrastructure (installed after the approval date of the transitional PRCP (4 September 2024)) to be retained must be mapped; and c) The intended PMLU is not compromised. 1.4 With the exception of 1.2 and 1.3 above, the following are complete: a) All services disconnected, terminated and removed b) All buildings and associated infrastructure dismantled and removed c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate) removed d) All pipelines drained and removed e) All waste, not authorised under the Environmental Authority (EPML00862313) waste schedule, removed f) All surface water drainage infrastructure removed g) All drillholes, bores, sediment ponds and sumps decommissioned h) All machinery and equipment not required for rehabilitation works removed from site i) Mine water dams are decommissioned j) Watercourse crossings and culverts removed. 1.5 Assessment of mine water dams to be retained post closure is completed by an AQP¹ and identified sediment and water management actions to ensure the dams are safe and stable for post mine use are completed. ¹Appropriately qualified person (AQP) means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice

Milestone Reference	Rehabilitation milestone	Milestone criteria
		<i>and analysis on performance relating to the subject matter using the relevant protocols, standards, methods or literature.</i>
RM2	Remediation and/or management of contaminated land	2.1 Contaminated Land Investigation Document completed in accordance with the <i>Environmental Protection Act 1994</i>, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 The Contaminated Land Investigation Document confirms the area within the mining leases (ML1775, ML1782, ML1784, ML2360, ML2410, ML70142, ML70294, ML70298, ML70328, ML700021) does not present an unacceptable risk to the post-mining land use. 2.3 Despite 2.1 and 2.2, where contaminated land investigations are undertaken for individual areas of progressive rehabilitation that do not cover an entire Lot on Plan, the investigations will be undertaken by a Suitably Qualified Person to a standard, that at the time of investigation, would be suitable to form part of a future <i>Environmental Protection Act 1994</i> compliant Contaminated Land Investigation Document for that property, and does not need to achieve all requirements for a contaminated land submission to the administering authority.
RM3	Landform development and reshaping	<u>All rehabilitation areas</u> 3.1 Erosion and sediment control systems are designed by an AQP¹, installed, and fit for purpose. 3.2 Appropriate mitigative measures in place for outer landform slopes that interact with flood waters up to a 0.1% AEP, as modelled on the closure landform, and designed by an AQP¹ to minimise potential instability of the landforms from interaction with floodwaters. 3.3 The reshaped landforms are geotechnically stable with RA1 and RA9 achieving FoS ≥ 1.5. <u>Woodland Habitat (RA1, RA4)</u> 3.4 Landforms reshaped with: a) RA1: $\leq 30\%$ slopes, with $>15\%$ slopes covered with minimum 0.5m rock b) RA1: Runoff to be restricted from the top of the landform onto the batter slopes if required using appropriate measures of erosion control as advised and designed by an AQP¹ c) RA1: Rejects to be covered with at least 2m of competent benign spoil, unless alternative depth is justified by an AQP¹ d) RA4: $\leq 15\%$ slopes. <u>Watercourses (RA2)</u> 3.5 Disturbed natural watercourse bed and banks returned to a profile similar to the pre-disturbance condition.

Milestone Reference	Rehabilitation milestone	Milestone criteria
		<u>Cattle Grazing (RA3)</u> 3.6 RA3 landforms are reshaped with slopes: $\leq 12\%$. <u>Grassland (RA9) - Installation of cover</u> 3.7 An AQP¹ to determine appropriate cover which at minimum achieves the following: a) Tailings to be capped with at least 2m of competent benign spoil; b) Reduces risk of upward movement of contaminants into the topsoil layer above the cover and reduce risk of environmental harm from contaminated seepage; c) Landforms are reshaped with slopes $\leq 30\%$; d) $>15\%$ slopes to be covered with minimum 0.5m rock, unless an alternative is justified by an AQP; and e) Landform surface to be free draining. 3.8 An independent AQP¹ to endorse installation of the cover system as per 3.7. <u>Retained water structure</u> 3.9 Water storages are safe for stock access and have vegetated banks.
RM4	Surface preparation (cattle grazing, grassland)	4.1 Topsoil placed at minimum depth of 150mm in areas where topsoil has previously been removed. 4.2 Assessment of growth media characteristics is completed by an AQP¹: a) To target land suitability class ≤ 3 as per Table 24: Regional land suitability framework for beef cattle grazing PMLU rehabilitation in the Bowen Basin (RA3), and b) For target vegetation establishment suitable for designated PMLU (RA9). 4.3 Ameliorant and physical treatments are applied as identified in criteria 4.2. 4.4 Rip at least 300mm into soil/subsoil profile along contour of slopes.
RM5	Surface preparation (woodland habitat)	5.1 Topsoil placed at minimum depth of 100mm, or alternative growth media at minimum depth of 300mm, in areas where topsoil has previously been removed. 5.2 Assessment of growth media characteristics is completed by an AQP¹ for target vegetation establishment suitable for designed PMLU. 5.3 Ameliorant and physical treatments are applied as identified in criteria 5.2. 5.4 Rip at least 300mm into soil/subsoil profile along contour of slopes.
RM6	Surface preparation (watercourse)	6.1 Topsoil placed at minimum depth of 150mm in areas where topsoil has previously been removed.

Milestone Reference	Rehabilitation milestone	Milestone criteria
		6.2 Assessment of growth media characteristics is completed by an AQP¹ for target vegetation establishment suitable for designed PMLU. 6.3 Ameliorant and physical treatments s are applied as identified in criteria 6.2. 6.4 Rip at least 300mm into soil/subsoil profile along contour of slopes.
RM7	Revegetation (cattle grazing, grassland)	7.1 Completed seeding in accordance with Table 36: Recommended species list and seeding rates for cattle grazing and grassland PMLU. 7.2 For cattle grazing PMLU, at least 4 species of 3P pasture species and two legumes from Table 36: Recommended species list and seeding rates for cattle grazing and grassland PMLU.
RM8	Revegetation (woodland habitat)	8.1 Completed seeding in accordance with Table 38: Recommended species list and seeding rates for woodland habitat PMLU (RA1)², or as recommended by an AQP¹ where vegetation is targeting a specific regional ecosystem (RA4)³. ²If recommended species are not available, substitute with species from RE 11.5.3, RE 11.5.9, RE 11.10.1 or RE 11.10.3. ³Seed application may not be required in all RA4 areas.
RM9	Revegetation (watercourse)	9.1 Completed seeding in accordance with Table 39: Recommended species list and seeding rates for watercourse PMLU – upper and mid banks and Table 40: Recommended species list and seeding rates for watercourse PMLU – lower banks.
RM10	Achievement of surface requirements (cattle grazing)	10.1 >50% vegetation groundcover (RA7), of which ≥50% of dry matter yield is 3P pasture species as listed in Table 36: Recommended species list and seeding rates for cattle grazing and grassland PMLU (RA3). 10.2 Surface water runoff has been collected across representative areas of rehabilitation when surface flows occur and it is safe to do so, and the results are not significantly different to upstream values for pH, EC and turbidity (RA3). 10.3 With respect to erosion in rehabilitated landforms: a) All erosion inclusive of tunnel erosion as per Table 59: Erosion type and severity is assessed by an AQP¹ and repaired if assessed as requiring intervention to ensure the stable PMLU is achieved, and evidence that it is repaired as per AQP¹ advice; and b) Mass movement is absent.
RM11	Achievement of surface requirements (woodland habitat)	11.1 Groundcover⁴: a) >15% slopes must achieve ≥80% groundcover, or b) ≤15% slopes must achieve ≥50% groundcover. 11.2 Vegetation meets the following: a) BioCondition score of ≥18/60 based on the averaged benchmarks for the representative regional ecosystems as listed in Table 64: BioCondition benchmarks and scoring of site-based attributes for representative regional

Milestone Reference	Rehabilitation milestone	Milestone criteria
		ecosystems and as assessed by an AQP¹ using the modified 'BioCondition Assessment Manual' (version 2.2) methodology (RA1, RA4), or b) Species richness of ≥ 2 native trees, ≥ 3 native shrubs and ≥ 4 ground species (exotic or native) (RA10). 11.3 Surface water runoff has been collected across representative areas of rehabilitation when surface flows occur and it is safe to do so, and the results are not significantly different to upstream values for pH, EC and turbidity (RA1, RA4). 11.4 With respect to erosion in rehabilitated landforms: a) All erosion inclusive of tunnel erosion as per Table 59: Erosion type and severity is assessed by an AQP¹ and repaired if assessed as requiring intervention to ensure the stable PMLU is achieved, and evidence that it is repaired as per AQP¹ advice; and b) Mass movement is absent. ⁴ Groundcover: anything in contact with the soil surface, for example, live cover, standing dry cover, organic litter (including leaves, hay, woody debris) or rocks
RM12	Achievement of surface requirements (watercourse)	12.1 Landform slopes must achieve $\geq 50\%$ groundcover⁴. 12.2 Geomorphic index score: greater than or equal to upstream or downstream values (Index of Diversion Condition method⁵). 12.3 Vegetation meets the following: a) Species richness: ≥ 2 native trees; ≥ 2 native shrubs representative of RE 11.3.25; and ≥ 2 grasses (exotic or native). 12.4 With respect to erosion in rehabilitated landforms: a) All erosion inclusive of tunnel erosion as per Table 59: Erosion type and severity if assessed as requiring intervention to ensure the stable PMLU is achieved, and evidence that it is repaired as per AQP¹ advice; and b) Mass movement is absent. ⁵For watercourse rehabilitation not within a diversion (i.e. crossings/culverts), a modified IDC method with a reduced number of monitoring points within each reach will be used.
RM13	Achievement of post-mining land use to a stable condition (cattle grazing – RA3)	13.1 Hazard assessment completed by an AQP¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 13.2 Groundcover: $>50\%$ vegetation groundcover, with $\geq 50\%$ of dry matter yield is 3P grasses as listed in Table 36: Recommended species list and seeding rates for cattle grazing and grassland PMLUs: 13.3 Achievement of land suitability class ≤ 3 as per Table 24: Regional land suitability framework for beef cattle grazing PMLU rehabilitation in the Bowen Basin or ≥ 4 if not different from pre-mining class. 13.4 With respect to erosion in rehabilitated landforms:

Milestone Reference	Rehabilitation milestone	Milestone criteria
		a) No evidence of erosion classified as moderate or severe as defined by Table 59: Erosion type and severity ; and b) Mass movement is absent; and c) An AQP¹ determines that any erosion present, including tunnel erosion, will not compromise the achievement of a PMLU to a stable condition. 13.5 Surface water runoff has been collected across representative areas of rehabilitation when surface flows occur and it is safe to do so, and the results are not significantly different to upstream values for pH, EC and turbidity.. 13.6 <i>Leucaena leucocephala</i> plants >2m high do not exceed stem density of 250 stems per hectare (1 per 40m²) mean of total area. 13.7 Restricted invasive plants (as defined in the <i>Biosecurity Act 2014</i>) comprise ≤5% of vegetation groundcover, with the exception of <i>Parthenium hysterophorus</i> which must not exceed 10% vegetation groundcover and assessed by an AQP¹ as appropriately managed. 13.8 Final landform survey confirms no built infrastructure remains other than those that form part of landholder agreement and meets exception as per 1.3. Retained infrastructure/ Water storage 13.9 Infrastructure to be transitioned to a future landholder is deemed fit for purpose, safe and stable by AQP and accepted, by signed agreement with the future landholder. 13.10 All retained dams are safe, stable for native animals and stock access and have vegetated banks. 13.11 Water storages monitored for water quality annually must meet ANZECC 2000 stock water guideline values, for a minimum of 5 consecutive years.
RM14	Achievement of post-mining land use to a stable condition (woodland habitat – RA1, RA4)	14.1 Hazard assessment completed by an AQP¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 14.2 Rehabilitation is assessed as geotechnically stable by an AQP¹ with FoS ≥1.5 (RA1). 14.3 With respect to erosion in rehabilitated landforms: a) No evidence of erosion classified as moderate or severe as defined by Table 59: Erosion type and severity ; and b) Mass movement is absent; and c) An AQP¹ determines that any erosion present, including tunnel erosion, will not compromise the achievement of a PMLU to a stable condition 14.4 Groundcover⁴: a) >15% slopes must achieve ≥80% groundcover, or b) ≤15% slopes must achieve ≥50% groundcover. 14.5 Vegetation meets the following: BioCondition score of ≥35/60 based on the averaged benchmarks for the representative regional ecosystems as listed in Table 64: BioCondition benchmarks and

Milestone Reference	Rehabilitation milestone	Milestone criteria
		scoring of site-based attributes for representative regional ecosystems and as assessed by an AQP¹ using the modified 'BioCondition Assessment Manual' (version 2.2) methodology 14.6 Restricted invasive plants (as defined in the <i>Biosecurity Act 2014</i>) comprise ≤5% of vegetation groundcover, with the exception of <i>Parthenium hysterophorus</i> which must not exceed 10% vegetation groundcover and assessed by an AQP¹ as appropriately managed. 14.7 Surface water runoff has been collected across representative areas of rehabilitation when surface flows occur and it is safe to do so, and the results are not significantly different to upstream values for pH, EC and turbidity. 14.8 Final landform survey confirms no built infrastructure remains other than those that form part of landholder agreement and meets exception as per 1.3.
RM15	Achievement of post-mining land use to a stable condition (watercourse – RA2)	15.1 Hazard assessment completed by an AQP¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 15.2 With respect to erosion in rehabilitated landforms: a) No evidence of erosion classified as moderate or severe as defined by Table 59: Erosion type and severity ; and b) Mass movement is absent; and c) An AQP determines that any erosion present, including tunnel erosion, will not compromise the achievement of the PMLU to a stable condition. 15.3 Geomorphic index score: greater than or equal to upstream or downstream values (Index of Diversion Condition method⁵). 15.4 Watercourse vegetation meets the following: a) Riparian vegetation index score: greater than or equal to upstream or downstream values (Index of Diversion Condition method⁵) b) Species richness: I. ≥2 native trees; II. ≥2 native shrubs; III. ≥2 grasses (native or exotic) c) Tree canopy cover ≥13%. 15.5 Restricted invasive plants (as defined in the <i>Biosecurity Act 2014</i>) comprise ≤5% of vegetation groundcover, with the exception of <i>Parthenium hysterophorus</i> which must not exceed 10% vegetation groundcover and assessed by an AQP¹ as appropriately managed. 15.6 Diversion has an IDC score >10 as defined in 'Criteria for functioning river landscape units in mining and post-mining landscapes' (ACARP Project number C20017). 15.7 AQP¹ must consider the following in closure design determination for diversions being retained in the landform: a) Incorporate natural features (including geomorphic and vegetation) present at the location of the diversion;

Milestone Reference	Rehabilitation milestone	Milestone criteria
		b) Maintain the pre-existing hydrologic characteristics of surface water for the area in which the watercourse diversion is located; c) Maintain the hydraulic characteristics of the local watercourses without requiring on-going maintenance; d) Maintain sediment transport and water quality regimes that allow the diversion to be self-sustaining, while minimising any impacts to upstream and downstream water quality, geomorphology, or vegetation; e) Maintain equilibrium and functionality in all substrate conditions at the location of the diversion; and f) Geotechnically and erosionally stable. 15.8 Final landform survey confirms no built infrastructure remains other than those that form part of a landholder agreement and meets exception as per 1.3.
RM17	Achievement of post-mining land use to a stable condition (cattle grazing - existing rehabilitation – RA7)	17.1 Hazard assessment completed by an AQP¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 17.2 With respect to erosion in rehabilitated landforms: a) No evidence of erosion classified as moderate or severe as defined by Table 59: Erosion type and severity ; and b) Mass movement is absent; and c) An AQP¹ determines that any erosion present, including tunnel erosion, will not compromise the achievement of the PMLU to a stable condition. 17.3 Final landform survey confirms no built infrastructure remains other than those that form part of a landholder agreement and meets exception as per 1.3. 17.4 Groundcover: >50% vegetation groundcover, of which ≥50% of dry matter yield is 3P pasture species. 17.5 Land condition: assessed as Good (A) or Fair (B) condition using Table 62: Grazing Land Management ABCD Land Condition Framework . 17.6 <i>Leucaena leucocephala</i> plants >2m high do not exceed stem density of 250 stems per hectare (1 per 40m²) mean of total area. 17.7 Restricted invasive plants (as defined in the <i>Biosecurity Act 2014</i>) comprise ≤5% of vegetation groundcover, with the exception of <i>Parthenium hysterophorus</i> which must not exceed 10% vegetation groundcover and assessed by an AQP¹ as appropriately managed.
RM18	Achievement of post-mining land use to a stable condition (woodland habitat - existing rehabilitation –RA10)	18.1 Hazard assessment completed by AQP¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use 18.2 Groundcover⁴: a) >15% slopes must achieve ≥80% groundcover, or b) ≤15% slopes must achieve ≥50% groundcover. 18.3 Vegetation meets the following:

Milestone Reference	Rehabilitation milestone	Milestone criteria
		a) Species richness: i. ≥ 2 native trees, ii. ≥ 3 native shrubs, and iii. ≥ 4 grasses (exotic or native) b) Tree canopy cover $\geq 16\%$. 18.4 Restricted invasive plants (as defined in the <i>Biosecurity Act 2014</i>) comprise $\leq 5\%$ of vegetation groundcover, with the exception of <i>Parthenium hysterophorus</i> which must not exceed 10% vegetation groundcover and assessed by an AQP¹ as appropriately managed. 18.5 With respect to erosion in rehabilitated landforms: a) No evidence of erosion classified as moderate or severe as defined by Table 59: Erosion type and severity ; and b) Mass movement is absent; and c) An AQP¹ determines that any erosion present, including tunnel erosion, will not compromise the achievement of the PMLU to a stable condition.
RM19	Achievement of surface requirements (grassland)	19.1 Groundcover⁴: a) $>15\%$ slopes: $\geq 80\%$ groundcover, b) $\leq 15\%$ slopes: $\geq 50\%$ groundcover, c) $\leq 5\%$ slopes: $\geq 50\%$ groundcover, consisting of at least 50% vegetation groundcover. 19.2 With respect to erosion in rehabilitated landforms: a) All erosion as per Table 59: Erosion type and severity is assessed by an AQP¹ and repaired if assessed as requiring intervention to ensure a stable PMLU is achieved, and evidence that it is repaired as per AQP¹ advice; and b) Mass movement and tunnel erosion are absent. 19.3 Surface water runoff has been collected across representative areas of rehabilitation when surface flows occur and it is safe to do so, and the results are not significantly different to upstream values for pH, EC and turbidity.
RM20	Achievement of post-mining land use to a stable condition (grassland – RA9)	20.1 Hazard assessment completed by an AQP¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 20.2 Rehabilitation is assessed as geotechnically stable by an AQP¹ with FoS ≥ 1.5. 20.3 With respect to erosion in rehabilitated landforms: a) No evidence of erosion classified as moderate or severe as defined by Table 59: Erosion type and severity ; and b) Mass movement and tunnel erosion are absent; and c) An AQP¹ determines that any erosion present will not compromise the achievement of the PMLU to a stable condition. 20.4 Vegetation: ≥ 2 grass species (native or exotic). 20.5 Groundcover⁴:

Milestone Reference	Rehabilitation milestone	Milestone criteria
		a) >15% slopes: ≥80% groundcover, b) ≤15% slopes: ≥50% groundcover, c) ≤5% slopes: ≥50% groundcover, consisting of at least 50% vegetation groundcover. 20.6 Surface water runoff has been collected across representative areas of rehabilitation when surface flows occur and it is safe to do so, and the results are not significantly different to upstream values for pH, EC and turbidity. 20.7 Restricted invasive plants (as defined in the <i>Biosecurity Act 2014</i>) comprise ≤5% of vegetation groundcover, with the exception of <i>Parthenium hysterophorus</i> which must not exceed 10% vegetation groundcover and assessed by an AQP¹ as appropriately managed.

10.5 Management milestones

The MMs and milestone criteria for SRM are shown in Table 75.

Table 75: SRM management milestones and milestone criteria

Milestone Reference	Management milestone	Milestone criteria
MM1	Achievement of structural stability	1.1 Highwall landforms must: a) Prevent surface flow of floodwater into the void b) Be geotechnically stable when floodwater is against the watercourse-side batter c) Prevent seepage flow of floodwater into the void d) Not be constructed with dispersive material e) Have maximum 30% slopes with rock for scour protection. f) Minimum height to include appropriate freeboard for flood heights and materials. 1.2 The final design for highwall landform must be completed by an AQP¹ based on the latest flood modelling and materials data prior to construction. 1.3 Final residual voids are not subject to inundation from floodwaters up to and including the 0.1% AEP. 1.4 The high-wall, end-wall and low-wall achieve a FoS ≥1.5 within the NUMA extents as determined by an AQP¹. 1.5 A minimum distance of 50m is to be designed between the residual void crest and the toe of the safety bund, where against an external perimeter mining lease (ML1775, ML1782, ML1784, ML2360, ML2410, ML70142, ML70294, ML70298, ML70328, ML700021) boundary or a watercourse. 1.6 The location of the voids and associated safety bunds does not cause instability or degradation to the land outside of the mining

Milestone Reference	Management milestone	Milestone criteria
		lease (ML1775, ML1782, ML1784, ML2360, ML2410, ML70142, ML70294, ML70298, ML70328, ML700021) boundary. 1.7 Low-walls are free-draining into the void lake with a maximum 37 degree slopes. 1.8 Residual voids must not overtop. 1.9 Flood mitigation as per 1.3 have appropriate scour protection to sustain flood velocities. 1.10 Residual voids collectively act as groundwater sinks within the relevant mining lease (ML1775, ML1782, ML1784, ML2360, ML2410, ML70142, ML70294, ML70298, ML70328, ML700021) boundary post closure as demonstrated by groundwater modelling defined in condition PRCP12.
MM2	Achievement of surface requirements	2.1 Competent safety bund or equivalent landform in place around the perimeter of the residual void to prevent access to the residual void, at the geotechnical set-back distance. 2.2 Fencing erected, where required to prevent access to the residual void, around the perimeter of the safety bund. 2.3 Warning signage placed along the fence line (nominally one sign every 100m). 2.4 A minimum distance of 25m is to be designed between the residual void low-wall crest within the NUMA and the safety bund or equivalent landform in 2.1. 2.5 An area of 60ha of unmined land is retained between Grevillea residual void and the eastern boundary of mining lease ML700021. 2.6 Despite 2.5, the safety bund can be positioned within the 60ha area and located as close to the high wall as necessary to enable the eastern side of the bund wall to retain its current land use.
MM3	Achievement of sufficient improvement	3.1 Certification from an AQP¹ that: a) The residual void is safe to humans and livestock b) Residual voids are monitored for water level annually, in accordance with condition PRCPXX, and are shown to be on a trajectory to the establishment of a residual void sink at surrender c) The water level and quality in the void will not cause environmental harm to the surrounding environment, as demonstrated by residual void water level, groundwater level, quality monitoring and modelling d) Voids retain flood immunity, supported by flood modelling re-run at end of life and calibrated against the final landform e) The highwall landform has been constructed in accordance with the final design as per 1.2 f) Erosion and sediment control measures have been installed and are operating as per design g) Appropriate safety infrastructure at the geotechnical set-back distance has been installed to prevent access to the NUMA

Milestone Reference	Management milestone	Milestone criteria
		h) The residual void will not present an unacceptable risk of environmental harm outside of the relevant external perimeter mining lease (ML1775, ML1782, ML1784, ML2360, ML2410, ML70142, ML70294, ML70298, ML70328, ML700021) boundary i) Erosion of the landform within the NUMA area will not negatively impact on the stability of any adjacent rehabilitation areas, or their ability to sustain their PMLU. 3.2 Monitoring and maintenance of exclusion fences and bunds to be carried out to ensure they remain effective.

10.6 Schedule

The SRM PRCP schedule is provided below.

Post-mining land uses (PMLU)											
Rehabilitation area				RA1							
Relevant activities				Spoil Dumps							
Total rehabilitation area size (ha)				6775							
Commencement of first milestone: RM2				10-Dec-23							
PMLU				Woodland Habitat							
Date area is available	10/12/2023	10/12/2028	10/12/2033	10/12/2038	10/12/2043	10/12/2048	10/12/2053	10/12/2058	10/12/2063	10/12/2068	10/12/2073
Cumulative area available (ha)	51	193	431	582	794	1030	1303	1703	2343	2743	3143
Milestone completed by	10/12/2028	10/12/2033	10/12/2038	10/12/2043	10/12/2048	10/12/2053	10/12/2058	10/12/2063	10/12/2068	10/12/2073	10/12/2078
Milestone Reference	Cumulative area achieved (ha)										
RM2	51	193	431	582	794	1030	1303	1703	2343	2743	3143
RM3		51	193	431	582	794	1030	1303	1703	2343	2743
RM5		51	193	431	582	794	1030	1303	1703	2343	2743
RM8		51	193	431	582	794	1030	1303	1703	2343	2743
RM11				51	193	431	582	794	1030	1303	1703
RM14						51	193	431	582	794	1030

Date area is available	10/12/2078	10/12/2083	10/12/2088	10/12/2093	10/12/2098						
Cumulative area available (ha)	3663	4722	5161	5461	6775						
Milestone completed by	10/12/2083	10/12/2088	10/12/2093	10/12/2098	10/12/2103	10/12/2108	10/12/2113	10/12/2118	10/12/2123	10/12/2128	10/12/2133
Milestone Reference	Cumulative area achieved (ha)										
RM2	3663	4722	5161	5461	6775						
RM3	3143	3663	4722	5161	5461	6123	6775				
RM5	3143	3663	4722	5161	5461	6123	6775				
RM8	3143	3663	4722	5161	5461	6123	6775				
RM11	2343	2743	3143	3663	4722	5161	5461	6123	6775		
RM14	1303	1703	2343	2743	3143	3663	4722	5161	5461	6123	6775

Post-mining land uses (PMLU)													
Rehabilitation area	RA2												
Relevant activities	Creek diversions and crossings												
Total rehabilitation area size (ha)	211												
Commencement of first milestone: RM1	10-Dec-42												
PMLU	Watercourse												
Date area is available	10/12/2042	10/12/2052	10/12/2062	10/12/2065	10/12/2079	10/12/2082	10/12/2085	10/12/2099	11/12/2104				
Cumulative area available (ha)	41	89	128		176		176		211				
Milestone completed by	10/12/2045	10/12/2055	10/12/2065	10/12/2075	10/12/2082	10/12/2085	10/12/2092	10/12/2102	10/12/2107	10/12/2112	10/12/2117	10/12/2122	10/12/2127
Milestone Reference	Cumulative area achieved (ha)												
RM1	41	89	128		176			178	211				
RM3	41	89	128		176			178	211				
RM6	41	89	128		176			178	211				
RM9	41	89	128		176			178	211				
RM12		41	89	128			176			178	211		
RM15			41	89		128		176				178	211

Post-mining land uses (PMLU)													
Rehabilitation area	RA3												
Relevant activities	Infrastructure Areas - MIA, workshop, dams, coal stockpiles, roads, general infrastructure												
Total rehabilitation area size (ha)	906												
Commencement of first milestone: RM1	10-Dec-99												
PMLU	Cattle Grazing												
Date area is available	10/12/2099	10/12/2104											
Cumulative area available (ha)	693	906											
Milestone completed by	10/12/2102	10/12/2107	10/12/2112	10/12/2114	10/12/2117	10/12/2119	10/12/2122	10/12/2124	10/12/2127	10/12/2129	10/12/2134	10/12/2139	10/12/2144
Milestone Reference	Cumulative area achieved (ha)												
RM1	693	906											
RM2			665		860		888		906				
RM3				665		860		888		906			
RM4				665		860		888		906			
RM7				665		860		888		906			
RM10								665		860	888	906	
RM13										665	860	888	906

Post-mining land uses (PMLU)												
Rehabilitation area	RA4											
Relevant activities	Roads, creek corridor areas, exploration and general infrastructure											
Total rehabilitation area size (ha)	707											
Commencement of first milestone: RM1	10-Dec-26											
PMLU	Woodland Habitat											
Date area is available	10/12/2026	10/12/2028	10/12/2031	10/12/2041	10/12/2099	10/12/2101	10/12/2104					
Cumulative area available (ha)	105				448		707					
Milestone completed by	10/12/2028	10/12/2031	10/12/2041	10/12/2051	10/12/2101	10/12/2104	10/12/2106	10/12/2109	10/12/2114	10/12/2119	10/12/2124	10/12/2129
Milestone Reference	Cumulative area achieved (ha)											
RM1	105				448		707					
RM3		105				448		707				
RM5		105				448		707				
RM8		105				448		707				
RM11			105						448	707		
RM14				105							448	707

Post-mining land uses (PMLU)										
Rehabilitation area				RA7						
Relevant activities				Existing Rehabilitation						
Total rehabilitation area size (ha)				161						
Commencement of first milestone: RM10				10-Dec-23						
PMLU				Cattle Grazing						
Date area is available	10/12/2023									
Cumulative area available (ha)	161									
Milestone completed by	10/12/2033	10/12/2038								
Milestone Reference	Cumulative area achieved (ha)									
RM10	161									
RM17		161								

Post-mining land uses (PMLU)										
Rehabilitation area				RA9						
Relevant activities				TSF3						
Total rehabilitation area size (ha)				41						
Commencement of first milestone: RM1				10-Dec-23						
PMLU				Grassland						
Date area is available	10/12/2023	10/12/2033	10/12/2036	10/12/2046	10/12/2104					
Cumulative area available (ha)	24				41					
Milestone completed by	10/12/2033	10/12/2036	10/12/2046	10/12/2056	10/12/2106	10/12/2116	10/12/2119	10/12/2129	10/12/2139	
Milestone Reference	Cumulative area achieved (ha)									
RM1	24				41					
RM2	24					41				
RM3		24					41			
RM4		24					41			
RM7		24					41			
RM19			24					41		
RM20				24					41	

Post-mining land uses (PMLU)										
Rehabilitation area				RA10						
Relevant activities				Existing Rehabilitation						
Total rehabilitation area size (ha)				96						
Commencement of first milestone: RM8				10-Dec-23						
PMLU				Woodland Habitat						
Date area is available	10/12/2023									
Cumulative area available (ha)	96									
Milestone completed by	10/12/2023	10/12/2025	10/12/2033	10/12/2035	10/12/2038	10/12/2043	10/12/2045			
Milestone Reference	Cumulative area achieved (ha)									
RM8	54	96								
RM11	49		54	96						
RM18					49	54	96			

Non-use management area (NUMA)										
Rehabilitation area				IA1						
Relevant activities				Void and set-backs						
Total rehabilitation area size (ha)				1838						
Commencement of first milestone: MM1				10-Dec-85						
PMLU				NUMA						
Date area is available	10/12/2085	10/12/2087	10/12/2098	10/12/2105						
Cumulative area available (ha)	624	1080	1335	1838						
Milestone completed by	10/12/2087	10/12/2089	10/12/2100	10/12/2107	10/12/2144					
Milestone Reference	Cumulative area achieved (ha)									
MM1	624	1080	1335	1838						
MM2	624	1080	1335	1838						
MM3					1838					

C: APPENDICES

Appendix A: Saraji Mine Environment Authority (EPML00862313) (28 May 2025)

Appendix B: SLR (2023) - Saraji Mine Transitional PRC Plan Hydrogeology

Appendix C: Landloch (2022a) - Saraji Mine (SRM) - Material Characterisation Study

**Appendix D: BHP (2023a) - Saraji Mine Community Consultation Plan and
Community Consultation Register**

**Appendix E: SLR (2022) - Saraji Mine Transitional PRCP Voids in Floodplain
Assessment**

Appendix F: WMS (2023) - Saraji Mine PRCP Rehabilitation Flood Modelling

**Appendix G: BHP (2023b) – Saraji Mine PRCP Environmental Geochemical
Characterisation and Risk Assessment of Mineral Waste**

**Appendix H: Landloch (2024) - Erosion and Landform Evolution Simulations to
Support Waste Landform Design: Saraji Mine**

Appendix I: Engeny (2023a) - PRCP Concept Design Report – Hughes Creek

Appendix J: Engeny (2023b) - PRCP Concept Design Report – Barrett Creek

Appendix K: Engeny (2023c) - PRCP Concept Design Report – One Mile Creek

**Appendix L: WSP/Golder (2022) - PRCP Tailings Storage Facility Description –
Saraji Mine**

Appendix M: WSP/Golder (2024) - Saraji Mine Void Closure Plan

Appendix N: Saraji Mine PRCP Risk Assessment