

Application form

Environmental Protection Act 1994

Submission of a progressive rehabilitation and closure plan

This is the approved form for a progressive rehabilitation and closure plan (PRC plan) under section 126C of the Environmental Protection Act 1994 for a site-specific application for a mining activity relating to a mining lease.

Only use this application form if you are required to submit a PRC plan, where:

- You are applying for a new site-specific environmental authority for a mining activity relating to a mining lease.
OR
- The administering authority has included the requirement to submit a proposed PRC plan in an information request for a new site-specific environmental authority for a mining activity relating to a mining lease.
OR
- You completed a PRC plan as part of an EIS process and are submitting the PRC plan in the approved form as required under section 126C.
OR
- You have an existing site-specific environmental authority for a mining activity relating to a mining lease and have received a transition notice from the administering authority¹ in accordance with section 754 of the *Environmental Protection Act 1994* (EP Act).
OR
- Where none of the above apply: you have an existing site-specific environmental authority for a mining activity, you do not otherwise have a PRCP schedule approved yet one is required, and any of the following applies:
 - You have failed to comply with a transition notice;
 - You did not receive a transition notice as required under the legislation;
 - The administering authority has refused your proposed PRCP schedule.

Before completing this application form it is recommended that you:

- Read the [Statutory guideline - Progressive rehabilitation and closure plans \(ESR/2019/4964\)](#) which explains the information you are required to provide with this application.
- Have a pre-lodgement meeting. To request a pre-lodgement meeting, please fill out and lodge the form [Application for pre-lodgement services for an environmental authority \(ESR/2015/1664\)](#)

¹ The Department of the Environment, Tourism, Science and Innovation is the administering authority under the *Environmental Protection Act 1994*.



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If you require assistance in answering any part of this form, or have any questions about your application, please contact the relevant business centre. Contact details are at the end of this form (Section 10).

Privacy statement

The administering authority is collecting the information on this approved form to process your application for a PRC plan. The collection of information is authorised under Chapter 3 and Chapter 5 of the EP Act. Some of the information may be disclosed to the Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development, and Queensland Treasury for the purpose of processing this application or the Rehabilitation Commissioner in accordance with s444J of the EP Act the if accessing the information is necessary or convenient to be done in the performance of the Commissioner's functions.

Please note that the administering authority is required to keep this application on a register of documents open for inspection by members of the public under section 541 of the EP Act, and must permit a person to take extracts from the register pursuant to section 542 of the EP Act.

Your personal information will not be otherwise disclosed to any other parties unless authorised or required by law. For queries about privacy matters please email privacy@des.qld.gov.au or telephone 13 74 68.

Definitions of terms used in this form	
<i>(Where there is inconsistency between the definition of terms used here and the terms used in the EP Act, the terms in the EP Act apply)</i>	
Available for improvement	In relation to land in an improvement area for a non-use management area, means land in the improvement area that is not being mined, other than land to which any of the following applies— a) the land is being used for operating infrastructure or machinery for mining, including, for example, a dam or water storage facility; b) the land is identified in the PRCP schedule or the application for an environmental authority relating to the schedule as containing a probable or proved ore reserve that is to be mined within 10 years after the land would otherwise have become available for improvement; c) the land is required for the mining of a probable or proved reserve mentioned in paragraph (b).
Available for rehabilitation	For a rehabilitation area, means land in the area is not being mined, unless— a) the land is being used for operating infrastructure or machinery for mining, including, for example, a dam or water storage facility; or b) the land is identified in the PRCP schedule or the application for an environmental authority relating to the schedule as containing a probable or proved ore reserve, under section 126D(6) of the EP Act, that is to be mined within 10 years after the land would otherwise have become available for rehabilitation; or - ba) the land is required for the mining of a probable or proved reserve mentioned in paragraph (b); or c) the land contains permanent infrastructure identified in the proposed PRCP schedule as remaining on the land for a post-mining land use.
Land outcome document	For land, means the following documents relating to the land— a) an environmental authority for a resource activity on the land; b) a document made under a condition of an environmental authority

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	mentioned in paragraph (a), if– i. the document relates to the management of a void within the meaning of section 126D of the EP Act on the land, or the rehabilitation of the land; and ii. the document was received by the administering authority before the assent date; and iii. the administering authority has not, within 20 business days after the assent date, given notice to the environmental authority holder that the document is insufficient in a material particular relevant to a matter mentioned in subparagraph (i); and iv. before the assent date, the document has not been superseded; c) a document made under a condition of an environmental authority mentioned in paragraph (a), if– i. the document relates to the management of a void within the meaning of section 126D of the EP Act on the land, or the rehabilitation of the land; and ii. the environmental authority requires the document to be given to the administering authority on a stated day that is on or after the assent date, or does not state a day when the document must be given; and iii. the document is received by the administering authority within three years after the assent date; and iv. the administering authority does not, within 20 business days after receiving the document, give the environmental authority holder a notice that the document is insufficient in a material particular relevant to a matter in subparagraph (i); d) a report evaluating an EIS under the <i>State Development and Public Works Organisation Act 1971</i>, section 34D; e) an EIS assessment report; f) a written agreement between the holder of an environmental authority mentioned in paragraph (a) and the State that is in force on the assent date.
Improvement area	For a non-use management area, means an area of land in the non-use management area to which a management milestone relates.
Management milestone	For a non-use management area, means each significant event or step necessary to– a) achieve best practice management of the area; and b) minimise risks to the environment.
Non-use management area	Means 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.
Post-mining land use	For land the subject of a PRC plan, means the purpose for which the land will be used after all relevant activities for the PRC plan carried out on the land have ended.
PRC plan	For land the subject of a mining lease, means a progressive rehabilitation and closure plan for the land that consists of – a) the rehabilitation planning part of the PRC plan; and

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	b) the PRCP schedule for the PRC plan, including any conditions imposed on the schedule.
PRCP schedule	For a PRC plan, means a schedule of the plan that – a) complies with section 126D of the EP Act; and b) is approved under chapter 5, part 5, division 2 of the EP Act, with or without conditions.
Proposed PRC plan	For an application, a proposed PRC plan means a PRC plan proposed for land the subject of a mining lease that: (a) complies with Chapter 5, part 2, division 3; and (b) either – accompanies the application; or is submitted for the application after the application is made
Rehabilitation area	For land the subject of a post-mining land use, means an area of the land to which a rehabilitation milestone for the post-mining land use relates.
Rehabilitation milestone	For the rehabilitation of land, means each significant event or step necessary to rehabilitate the land to a stable condition.

The fields marked with an asterisk * are mandatory. If they are not completed then your application may be considered not properly made under section 128 of the EP Act.

Section 1 – Environmental authority details

Does this application relate to an <u>existing</u> environmental authority for a mining activity relating to a mining lease approved through a site-specific application?*	☐ No – Provide the reference number for your environmental authority application:	AR Insert.
	☒ Yes – Provide your environmental authority number:	P-EA-100114292

Section 2 – Applicant details

Details of the applicant are to be provided in this section.

If there is an agent acting on behalf of the applicant, details of the agent are to be provided. An agent could be a consultant or contractor for the environmental authority holder.

The person nominated as the application contact will receive correspondence relating to this application.

NAME / COMPANY NAME* MAGNETIC SOUTH PTY LTD	TRADING NAME (*IF AN ORGANISATION) Insert.
REGISTERED BUSINESS ADDRESS / RESIDENTIAL ADDRESS (NOT A POST OFFICE BOX) * SUITE 302, LEVEL 3, 102 ADELAIDE STREET BRISBANE QLD 4000	POSTAL ADDRESS (*WHERE DIFFERENT) Insert.
ABN / ACN (*IF AN ORGANISATION) 122 465 749	NAME OF APPLICATION CONTACT* DARYL KIDCAFF
EMAIL* daryl@magnetic-south.com.au	TELEPHONE* 0418775170

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- ☒ INDICATE IF YOU WANT TO RECEIVE CORRESPONDENCE VIA EMAIL
- ☐ INDICATE IF THIS FORM IS BEING COMPLETED BY AN AGENT FOR THE ENVIRONMENTAL AUTHORITY HOLDER*
- NOTE: If an agent is nominated, please provide evidence of appointment by the authority holder/s.**

Section 3 – Website address

If this application relates to an application for a new site-specific environmental authority for a mining activity, would you like to use the details on the environmental application form?	☒ No – Provide details below. ☐ Yes – Go to next section.	
Provide the website address for the application notice and application documents.	www.magnetic-south.com.au	
Provide details of the contact person if technical assistance is required.	NAME DARYL KIDCAFF	TELEPHONE 0418775170
	EMAIL DARYL@MAGNETIC-SOUTH.COM.AU	

Section 4 – Non-use management areas (new environmental authority applications only)

Does this application for a proposed PRC plan include a NUMA justified under section 126D(2)(b) of the EP Act? *	☒ No – Go to next section. ☐ Yes
Has a public interest evaluation been carried out by a qualified entity for the NUMA(s)? *	☐ No – Go to next section. ☐ Yes
Has the proposed NUMA(s) changed since the public interest evaluation was carried out in the EIS? *	☐ No – Go to next section. ☐ Yes – Provide details below.
How has the proposed NUMA(s) changed since the public interest evaluation was carried out?	Please provide details below. Insert.

Section 5 – PRC plan structure

The PRC plan must be prepared in accordance with the structure/format shown in Appendix 1 of this application form.

Requirement	Requirement met?
Include a cover page that complies with Appendix 1 of this application form.	☒ Yes
Include a table of contents that complies with Appendix 1 of this application form.	☒ Yes

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Section 6 – PRC plan Checklist *

The PRC plan must meet the information requirements stated in section 3 of the [Statutory guideline - Progressive rehabilitation and closure plans \(ESR/2019/4964\)](#), and sections 126C and 126D of the EP Act (note there is a limited exception for transitional PRC plans).

All PRC plan requirements are mandatory. For each requirement, insert a reference to the section of the PRC plan which satisfies the requirement. Justification must be provided for any requirement for which the response is Not Applicable (NA).

If more space is required, please attach a separate sheet.

PRC plan Requirement	Requirement met? (Yes / NA)	PRC Plan Section No.	Justification
Rehabilitation planning part of the PRC plan The rehabilitation planning part of the PRC plan must include the information required under section 126C the EP Act, including information requirements described in the Statutory guideline - Progressive rehabilitation and closure plans (ESR/2019/4964) in accordance with section 126C(1)(j) of the EP Act.			
Project description <i>Note: For existing mines transitioning to the PRC plan framework, pre-disturbance information collected as part of an EIS process or original environmental authority application should be included. If this information is unable to be provided, or cannot be developed because of the mine's life stage, this should be clearly explained in this section of the rehabilitation planning part of the PRC plan.</i>			
Describe the following:			
each resource tenure, including the area of each tenure, to which the application relates;	Yes	3.1.1	Description of ML 700056 and the tenure area of 6121 ha.
the relevant activities to which the application relates;	Yes	3.1.1	Description of project activities, including s 3.1.1.1 which outlines applicable ERAs.
the likely duration of the relevant activities	Yes	3.1.1.3	Provides stage plans outlining the progression of mining activities on site, including rehabilitation.

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Include a detailed description, including maps, of how and where the relevant activities are to be carried out.	Yes	3.1.1.3	Provides stage plans outlining the progression of mining activities on site, including rehabilitation.
Consultation			
Include details of the consultation undertaken by the applicant in developing the proposed PRC plan.	Yes	3.2	Provides a outline of previous community consultation and current stakeholder engagement plan.
Include details of how the applicant will undertake ongoing consultation in relation to the rehabilitation to be carried out under the plan.	Yes	3.2	Provides a outline of previous community consultation and current stakeholder engagement plan.
Post-mining land use			
State the extent to which each proposed post-mining land use identified in the proposed PRCP schedule for the plan is consistent with the outcome of consultation with the community in developing the PRC plan.	Yes	3.3.3	Outlines the justifications for the nominated post-mining land uses, including community consultation with underlying landholders and the surrounding community.
State the extent to which each proposed post-mining land use identified in the proposed PRCP schedule for the plan is consistent with any strategies or plans for the land of a local government, the State or the Commonwealth.	Yes	3.1.6, 3.3.2 & 3.3.3	Provides an in-depth assessment of the current regional planning schemes in the area and a justification of the PMLUs based on this assessment.
Non-use management area			
<i>Note for Transitional PRC plans: The holder is not required to comply with a requirements under section 126C(1)(g) or (h) or 126D(2) or (3) for the proposed PRCP schedule for the plan in relation to land if a land outcome document identifies the outcome for the land as the same, or substantially similar to, the outcome for the land if it were a non-use management area.</i>			
State the extent to which each proposed non-use management area identified in the PRCP schedule for the plan is consistent with the	NA	3.4	No NUMAs proposed.

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outcome of consultation with the community in developing the PRC plan.			
State the extent to which each non-use management area identified in the PRCP schedule for the plan is consistent with any strategies or plans for the land of a local government, the State or the Commonwealth.	NA	3.4	No NUMAs proposed
For each proposed non-use management area, state the reasons the applicant considers the area cannot be rehabilitated to a stable condition because of a matter mentioned in section 126D(2).	NA	3.4	No NUMAs proposed
For each matter mentioned in the requirement above, include copies of reports or other evidence relied on by the proponent for each proposed non-use management area.	NA	3.4	No NUMAs proposed
Rehabilitation and management methodology <i>Note: Section 3.6 of the Statutory guideline - Progressive rehabilitation and closure plans (ESR/2019/4964) outlines the range of information that must be included as appendices to the rehabilitation planning part of the PRC plan.</i>			
For each post-mining land use, state the applicant's 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.	Yes	3.5	Provides a detailed assessment of the rehabilitation areas, the nominated PMLU, the rehabilitation milestones and the general rehabilitation practices to achieve outcomes.
For each non-use management area, state the applicant's proposed methodology for achieving best practice management of the area to support the management milestones under the proposed PRCP schedule for the area.	NA	3.4	No NUMAs proposed
Risk assessment			

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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.	Yes	3.6	Provides a detailed risk assessment on the potential for rehabilitated land to not achieve the nominated PMLU.
PRCP Guideline			
Include any other information prescribed by the administering authority in the Statutory guideline - Progressive rehabilitation and closure plans (ESR/2019/4964) .	Yes	Various	The Table of Contents has been aligned with the Statutory Guideline such that headings are consistent between documents.
Include the spatial information required in the Statutory guideline - Progressive rehabilitation and closure plans (ESR/2019/4964) . See Attachment 1 of this form for details on how spatial information must be submitted.	Yes	N/A	Spatial information will be submitted separately through the information
Other information			
Include the other information the administering authority reasonably considers necessary to decide whether to approve the PRCP schedule.	Yes	Various	Insert.
PRCP Schedule			
The proposed PRCP schedule must comply with section 126D of the EP Act, and be written in accordance with the Statutory guideline - Progressive rehabilitation and closure plans (ESR/2019/4964) .			
The administering authority will assess the proposed PRCP schedule in conjunction with the rehabilitation planning part of the PRC plan and other application documents, and decide whether to approve the proposed PRCP schedule, with or without conditions, or refuse the proposed PRCP schedule.			
Include a PRCP schedule prepared using the PRCP schedule template (ESR/2019/5103)	Yes	Appendix A	Insert.
Include maps showing all of the land mentioned in the PRCP schedule, as it relates to being progressively rehabilitated.	Yes	3.1.1.3	Stage plans included.

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Section 7 – Non-use management areas (transitional applications only) ²	
Does this application for a proposed PRC plan include a NUMA? *	☒ No – Go to next section. ☐ Yes
Does the relevant environmental authority or any other land outcome document identify an outcome for the land that is the same, or substantially similar, to the outcome for the land if it were a NUMA under a PRCP schedule?	☒ No – Go to next section. ☐ Yes
Does the environmental authority or any other land outcome document state sufficient detail to identify either the location or the area of the land to which the outcome relates?	☐ No – Provide details below. ☒ Yes – Provide the document name(s) in Section 8.
If the area is not identified – how will the total area of the land to which the outcome relates be minimised? *	Insert.
If the location is not identified – how will the environmental authority holder ensure the location of the land to which the outcome relates minimises risks to the environment? *	Insert.

Section 8 – Transitional PRC plan requirements (transitional applications only) ²
In accordance with transitional provisions in the EP Act, an applicant with an existing environmental authority is able to transition aspects of the PRCP schedule from existing land outcome documents. Indicate below any information that is being transitioned from a land outcome document.

² Transitional applications mean the holder of an existing EA for an ineligible mining activity relating to a mining lease that has been issued a transition notice and is transitioning into the new PRC plan framework.

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PMLU/NUMA	Rehabilitation /Improvement area	Milestone Reference	Identify which of the below is being transitioned from a land outcome document		Land outcome document	Page No.
			Land outcome	Milestone criteria		
PMLU	RA1, RA2, RA5, RA8	GRAZING	☒	☐	P-EA-100114292	24
PMLU	RA3	FAUNA HABITAT	☒	☐	P-EA-100114292	24
PMLU	RA4	NATIVE ECOSYSTEM SUPPORT FAUNA HABITAT	☒	☐	P-EA-100114292	24
PMLU	RA6	GRAZING/NATIVE VEGETATION	☒	☐	P-EA-100114292	24
Insert.	Insert.	Insert.	☒	☐	Insert.	Insert.
Each land outcome document must be submitted with this approved form						
☒ All land outcome documents identified above have been attached to this approved form.						
Is the land outcome in the PRCP considered the same or substantially similar to the land outcome provided in the LOD?						
☒ Yes						
☐ No						
If no, please identify the land outcome:						

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As per section 755B of the EP Act, the notification stage under chapter 5, part 4 applies for the assessment process because the outcome for land under a land outcome document is different to the outcome for the land under the proposed PRCP schedule.

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Section 9 – Declaration*

Note: If you have not told the truth in this application you may be prosecuted.

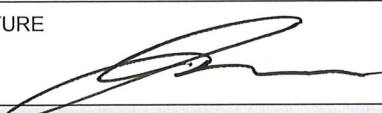
I declare that:

- I am the holder of the environmental authority, or authorised signatory for the holder of the environmental authority.
- The information I have provided is true and correct to the best of my knowledge.
- I understand that it is an offence under section 480 of the *Environmental Protection Act 1994* to give to the administering authority or an authorised person a document containing information that I know, or ought reasonably to know, is false or misleading in a material particular.
- I understand that under section 480A of the *Environmental Protection Act 1994* that, if I am required to give a document to the administering authority or an authorised person, it is an offence to give a document that I know or ought reasonably to know, contains incomplete information in a material particular.
- I understand that failure to provide sufficient information may result in the application being refused. I understand that an incomplete application may be invalid. Invalid applications will be returned without processing and will only be processed if resubmitted with all invalidating issues addressed.
- I understand that all information supplied on or with this application form may be disclosed publicly in accordance with the *Right to Information Act 2009* and the *Evidence Act 1977*.
- I will comply with all conditions and milestones of my approved PRCP schedule as well as any relevant provisions in the *Environmental Protection Act 1994*.
- I understand that I am responsible for managing the environmental impacts of these activities, and that approval of this application is not an endorsement by the administering authority of the effectiveness of management practices proposed or implemented.

Where an agreement is in place between all holders of the environmental authority, one holder can sign on behalf of the other joint holders. Please tick the checkbox below.

☒ I HAVE AUTHORITY TO SIGN THIS FORM ON BEHALF OF ALL THE JOINT HOLDERS OF THE ENVIRONMENTAL AUTHORITY.

Applicant's signature

APPLICANT'S NAME JAMES XU	POSITION Resource Development – Divisional Manager	COMPANY / ORGANISATION MAGNETIC SOUTH PTY LTD
APPLICANT'S SIGNATURE 	DATE 6/12/2024	
Joint holder(s) signature if applicable		
NAME, POSITION AND COMPANY NAME Insert.	SIGNATURE	DATE Select.
NAME, POSITION AND COMPANY NAME Insert.	SIGNATURE	DATE Select.

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OR ☐ I HAVE ATTACHED A DOCUMENT THAT PROVIDES THE REQUIRED INFORMATION FOR ALL JOINT HOLDERS.

Where the environmental authority holder is a company, this form must be signed by an authorised person for that company. Where there is more than one holder of the environmental authority, this declaration is to be signed by all holders, unless there is an agreement between all holders that one can sign on behalf of the other(s).

If you are signing on behalf of the environmental authority holder(s) you must provide a letter of authorisation.

Section 10 - Submission

Please submit your completed application form and supporting material to the Department of the Environment, Tourism, Science and Innovation office that services the industry applicable to your environmental authority.

A list of business centres can be found at www.des.qld.gov.au using the words 'business centres' as a search term.

Enquiries: Minerals Business Centre
PO Box 7230
Cairns QLD 4870
Phone: 07 4222 5352
Fax: 07 4222 5070
Email: ESCairns@des.qld.gov.au

Coal Business Centre
PO Box 3028
Emerald QLD 4720
Phone: 07 4987 9320
Email: CRMining@des.qld.gov.au

The latest version of this publication and other publications referenced in this document can be found at www.qld.gov.au using the relevant publication number (ESR/2019/4957 for this form) or title as a search term.

Appendix 1–PRC plan structure

Appendix 1 describes the formatting/structural requirements for a completed PRC plan. This includes the information required in a PRC plan cover page and table of contents, and the structure of a PRC plan.

A PRC plan must include the following sections in the order listed:

1. **Cover page:** This section must include the following information:
 - Title of the project
 - Document title
 - Version number
 - Document ID number
 - Date of submission
 - Tenure number(s)
 - Environmental authority holder name
 - Environmental authority holder contact details.
2. **Table of contents:** This section must include the following information:
 - Sections of PRC plan
 - Sub-sections of PRC plan
 - Figures, tables and maps (as applicable).
3. **Rehabilitation planning part**
 - 3.1. **Project planning:** This section will include baseline information, site location details, a description of the project and information on rehabilitation/improvement planning.
 - 3.2. **Community consultation:** This section will include information on stakeholder consultation including a community consultation register and community consultation plan. The community consultation register must include consultation dates, identification of each community member, description of consultation type (workshop, quarterly meetings, etc.), information provided to the community, issues raised/discussed by the community, how issues have been considered, decisions/outcomes of engagement, and commitments made by the applicant. The community consultation plan must include the objectives for community consultation, how the community will be engaged, proposed consultation frequency, what information will be released for community consultation, and how feedback/comments will be considered.
 - 3.3. **Post-mining land use:** This section will include the assessment of PMLU options, methodology for determining PMLU options, and details of each nominated PMLU. It must be 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.
 - 3.4. **Non-use management areas (if applicable):** This section will include the justification for the NUMA and details of each nominated NUMA. In providing justification for the NUMA, it 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.
 - The detail of each nominated NUMA must include information demonstrating that the proposed footprint of each NUMA is as small as practicable, an assessment of the NUMA location options, a description of the proposed location of each NUMA and the environmental values of the

surrounding environment, and evidence showing how the proposed location will prevent or minimise environmental harm.

- 3.5. Rehabilitation management methodology:** This section will include information describing how the proposed rehabilitation and management methodology have been developed and will be implemented. 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. This should include details of the general rehabilitation practices, tailings storage facilities, voids, underground mining and built infrastructure. For each proposed NUMA, 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.
- 3.6. Risk assessment:** This section will include a risk assessment that identifies the risk of a stable condition for land not being achieved and a risk treatment plan outlining how the applicant will manage or minimise the risk. All proposed NUMAs should also have a completed risk assessment. If rehabilitation trials are planned, this is also where relevant details must be given.
- 3.7. Monitoring and maintenance:** This section will include a monitoring and maintenance program that identifies and describes the monitoring systems that will be undertaken to demonstrate a milestone and milestone criteria have been achieved. It must include timing of when each rehabilitation or management milestone is to be achieved and be accompanied by maps outlining the relevant land.
- 4. Appendices and attachments:** The completed PRCP schedule and any relevant required reports/plans are to be included in this section. [PRCP schedule template \(ESR/2019/5103\)](#) should be included.

Attachment 1—Spatial data requirements for PRC plan

Attachment 1 provides guidance on the required content of spatial information (shapefiles) for the submission of a PRC plan. This attachment should be read in conjunction with the department's guideline: [Spatial information submission \(ESR/2018/4337\)](#). To obtain a copy of the guideline, the spreadsheet containing the schema (in Table 2) and a shapefile template for PCR plans are available on the Queensland Government's website at www.qld.gov.au, using the search term "submission of spatial information". The following sections provide information about the required fields and attributes for datasets.

Required files—Table 1

The applicant must submit shapefiles detailing the following:

- the location and maximum extent of disturbance footprint for the mine life
- the PMLU and NUMAs for the area within the resource tenure(s)
- the rehabilitation and improvement areas within the resource tenure(s)
- any sensitive receptors
- extent of a floodplain
- existing rehabilitation (if the PRC plan is for an existing environmental authority).

A minimum of one (1) shapefile must be submitted for a PRC plan, detailing the above-listed information, as outlined within Table 1. Each file must be named in accordance with the requirements outlined within the department's guideline: [Spatial information submission \(ESR/2018/4337\)](#).

Where the PRC plan relates to a site where a NUMA or floodplain are not present, this should be stated in the spatial information submission email to which the relevant spatial files are attached.

Table 1: Shapefile checklist

File	Spatial information requirement	Schema	Example file name (e.g. using submission date of 30 June 2020)
1	PRC plan – polygon	Table 2	EP00372556_PRC_PY_30062020

Where:

- PRCP = PRC plan
- PY = polygon (geometry)

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Table 2: Schema for PRC plan

Field Name	Type	Length	Definition	Domain Values ³	Domain Value Description	Mandatory/ Optional
PERMIT_REF	TEXT	50	The alpha-numeric environmental authority number relevant to the spatial information (if this PRC plan does not relate to an existing EA, please provide the relevant application number instead).			Mandatory
PROCESS	TEXT	4	The relevant process spatial data is being submitted for	PRCP	Progressive rehabilitation and closure plan	Mandatory
SITE_NAME	TEXT	254	Site name relating to the environmental authority.			Mandatory
SITE_ID	TEXT	20	This field contains a unique identifier for the spatial feature, which has been generated by the applicant.			Mandatory
FEATURE	TEXT	10	This field contains the land use feature on site which this polygon or point is describing. Select the relevant option of either post-mining land use, rehabilitation area, non-use management area, improvement area, maximum disturbance footprint, sensitive receptor, existing rehabilitation or floodplain using the codes specified.	PMLU	Post-mining land use	Mandatory
				REHAB_AREA	Rehabilitation area	Mandatory
				NUMA	Non-use management area	Mandatory if the PRC plan schedule proposes or changes a non-use management area
				IMPRV_AREA	Improvement area	Mandatory if the PRC plan schedule proposes or changes a non-use management area

³ If blank, populate based on Attribute type & definition

Application form

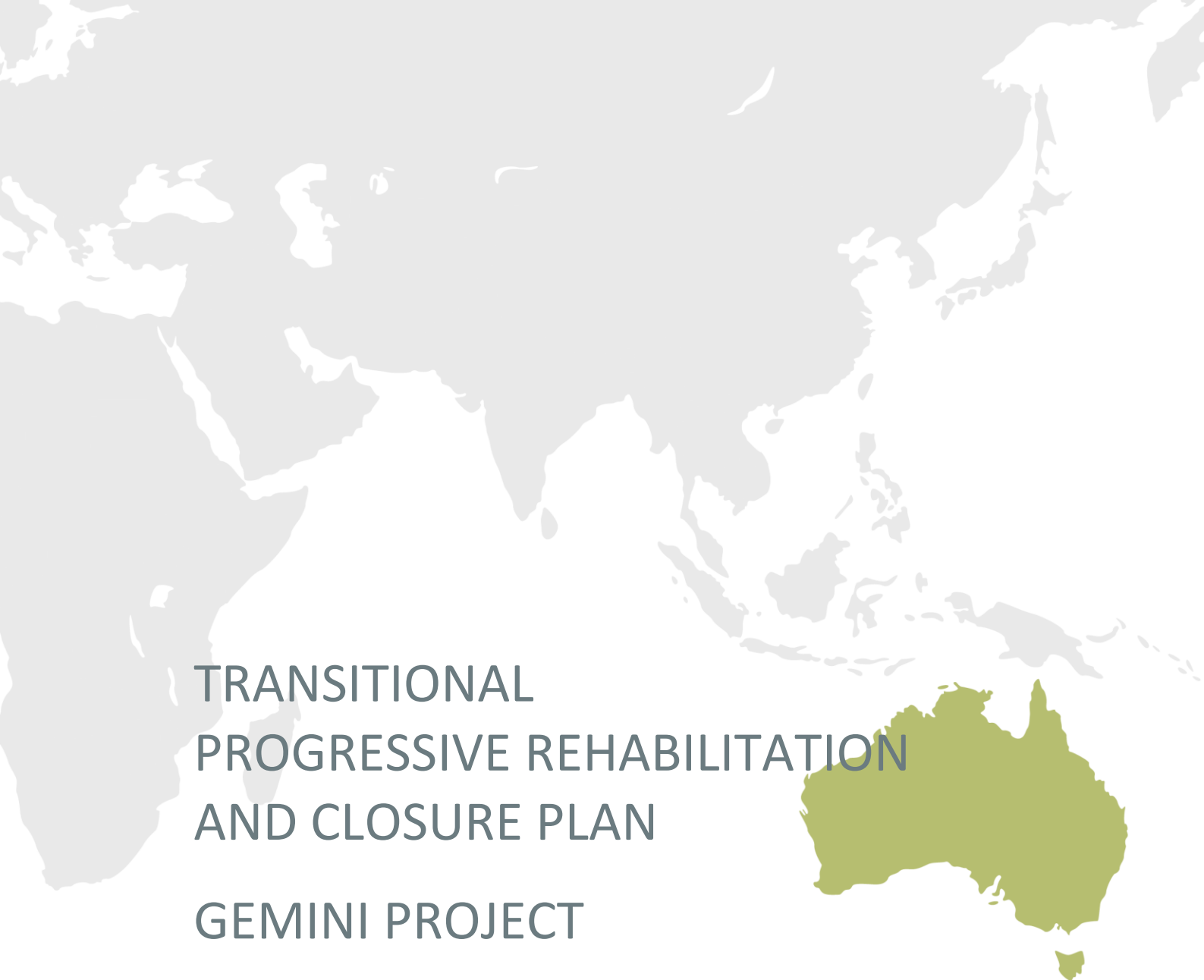
Submission of a progressive rehabilitation and closure plan

				FOOTPRINT	Maximum disturbance footprint over mine life	Mandatory
				SR	Sensitive receptor	Mandatory
				EX_REH	Existing rehabilitation	Mandatory if the application is for an existing EA and there is existing rehabilitation undertaken
				FLDP	Floodplain	Mandatory if there is a floodplain located within the EA boundary
FEAT_DESC	TEXT	254	Feature description		This field provides a description of the feature identified in 'FEATURE'.	Mandatory
PMLU_TYPE	TEXT	10	This field provides a description of the post mining land use type. If PMLU_TYPE is 'Other' additional information in the comments field is required.	GRAZ	Grazing	Mandatory for each PMLU.
				NAT_ECO	Native ecosystem	
				WTR_ST	Water storage	
				REC	Recreation	
				HB_ECS	Habitat and ecosystem services	
				AGRI	Agriculture	
				FOR	Forestry	
				CROP	Cropping	
				PERM_INFRA	Permanent infrastructure	
				IND	Industrial	
				LNDFL	Landfill	
				Oth	Other	
DATE_SUBMT	DATE	dd/mm/yyyy	Date of submission. This field identifies the date the spatial information was submitted.		Date of submission	Mandatory
SOURCE	TEXT	5	This field identifies the source of the spatial information and the capture	DIG	Digitising (Tracing over Ortho Imagery)	Mandatory

Application form

Submission of a progressive rehabilitation and closure plan

			methodology for the spatial information provided.	GPSD	GPS Differential Survey	
				GPSND	GPS Non Differential Survey	
				RTK	Real-Time Kinematic (RTK) Survey	
				UK	Unknown	
AREA_HA	DOUBLE	N/A	This field indicates the area in Hectares. (Polygon only)			Mandatory if GEOMETRY = polygon.
COMMENTS	TEXT	254	A free text field has been provided to include any additional information the proponent wishes to provide in relation to the data.			Mandatory if PMLU_TYPE = Oth



TRANSITIONAL PROGRESSIVE REHABILITATION AND CLOSURE PLAN GEMINI PROJECT

PREPARED FOR
MAGNETIC SOUTH PTY LTD

6 DECEMBER 2024

Cover Page

Project Name:	Gemini Project
Report Title:	Transitional Progressive Rehabilitation and Closure Plan
Client:	Magnetic South Pty Ltd
Project Manager:	Hollie Dick
Document ID/Ref.	Gemini Coal Mine PRCP v1
Date of Submission:	6 December 2024
Tenure Nos.:	ML700056
EA Reference:	P-EA-100114292
EA Holder Name:	Magnetic South Pty Ltd
EA Holder Contact Details:	Suite 302, Level 3, 102 Adelaide Street BRISBANE QLD 4000

Version	Comments	Author	Reviewer	Date
Draft issued for client review		MK	HD	5 December 2024
Final issued to client		MK	HD	6 December 2024

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Table of Abbreviations

AARC	AARC Environmental Solutions Pty Ltd
AEP	annual exceedance probability
AMD	acid mine drainage
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
ANZMEC	Australian and New Zealand Minerals and Energy Council
AQP	Appropriately Qualified Person
Biosecurity Act	Biosecurity Act 2014 (Qld)
BoM	Bureau of Meteorology
BOYD	John T. Boyd Company
CEC	cation exchange capacity
CH ₄	methane
CHPP	coal handling and preparation plant
CHRC	Central Highlands Regional Council
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAF	Department of Agriculture and Fisheries (Qld)
DES	Department of Environment and Science (Qld)
DME	former Department of Minerals and Energy (Qld)
DNRM	former Department of Natural Resources and Mines (Qld)
DNRME	Department of Natural Resources, Mines and Energy (Qld)
DoEE	Department of the Environment and Energy (Cth) DSITI former Department of Science, Information Technology and Innovation (Qld)
EA	Environmental Authority
EA Application	'Site-specific application for a new environmental authority for a resource activity
e.g.	'for example'
EC	electrical conductivity
EP Act	<i>Environmental Protection Act 1994</i>
EP Regulation	Environmental Protection Regulation 2019 (Qld)
EP	equivalent person
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
EPC	exploration permit for coal
ERA	Environmentally relevant activity

ESCP	Erosion and Sediment Control Plan
ESP	exchangeable sodium percentage
EV	environmental value
GDE	groundwater dependent ecosystem
GHG	greenhouse gas
HES	high ecological significance
i.e.	'in other words'
BT	JBT Consulting Pty Ltd
FOS	Factor of safety
LOD	Land outcome document
Magnetic South	Magnetic South Pty Ltd (the Proponent)
MAW	mine affected water
MIA	mine infrastructure area
ML	mining lease
MLA	mining lease application
ML / MLs	Mining Lease / Mining Leases
MSES	Matter(s) of State Environmental Significance
NATA	National Association of Testing Authorities
NC Act	Nature Conservation Act 1992 (Qld)
NUMA	Non-use management area
OC	of concern
PAF	potentially acid forming
PCI	pulverised coal injection
pH	'scale used to specify how acidic or basic a water-based solution is'
PMF	probable maximum flood
PMLU	Post-mining land use
PoO	Plan of Operations
PPE	personal protective equipment
PPV	peak particle velocity
PRCP	Progressive Rehabilitation and Closure Plan
PRCP Guideline	Progressive Rehabilitation and Closure Plan Guideline
RE	regional ecosystem

REMP	Receiving Environment Monitoring Program
RGS	RGS Environmental Pty Ltd
RIS	restricted invasive species
ROM	run-of-mine
RUSLE	Revised Universal Soil Loss Equation
SEP	Stakeholder Engagement Plan
SILO	Scientific Information for LandOwners
SMU	soil management unit
STP	sewage treatment plant
SWL	surface water level
SWMS	Site Water Management System
TDS	total dissolved solids
TEC	threatened ecological community
the Project	Gemini Project
TLO	train load out
TSP	total suspended particulate matter
TSSC	Threatened Species Scientific Committee
V	vulnerable
VC	vegetation community
VM Act	Vegetation Management Act 1999 (Qld)
Water Act	Water Act 2000 (Qld)
WoNS	weed(s) of national significance
WQO	water quality objective
WRM	WRM Water and Environment Pty Ltd

UNITS OF MEASUREMENT

%	percent
°	degree(s)
°C	degree(s) Celsius
cm	centimetre(s)
dS/m	deciSiemens per metre

ha	hectare(s)
kg/ha	kilogram(s) per hectare
kL	kilolitre(s)
km	kilometre(s)
km ²	square kilometre(s)
kV	kilovolt(s)
L	litre(s)
L/s	litre(s) per second
m	metre(s)
m/s	metre(s) per second
m ²	square metre(s)
m ³	cubic metre(s)
mAHD	metre(s) in Australian Height Datum
mbgl	metre(s) below ground level
meq/100g	milliequivalent per 100 grams
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per litre
ml	millilitre(s)
ML/a	megalitre(s) per annum
mm	millimetre(s)
Mt	million tonne(s)
Mtpa	million tonne(s) per annum
t	tonne(s)
μS/cm	microSiemens per centimetre

1 Introduction

AARC Environmental Solutions Pty Ltd (AARC) has been commissioned by Magnetic South Pty Ltd to develop a Progressive Rehabilitation and Closure Plan (PRCP) for the Gemini Project (the Project) in accordance with the requirements of the *Environmental Protection Act 1994* (EP Act).

The Gemini Project is a greenfield open cut metallurgical coal mine designed to produce pulverised coal injection (PCI) coal and coking coal for export to the international steel-making industry. The open cut mine will develop the coal seams in the Rangal Coal Measures.

An Environmental Authority (EA) (P-EA-100114292) for the Project was issued to Magnetic South Pty Ltd on 6 June 2024. The EA authorises the environmentally relevant activity (ERA) of Mining black coal under Schedule 3 of the Environmental Protection Regulation 2019. This PRCP is applicable to Mining Lease (ML) ML700056. The current version of the Environmental Authority (EA) P-EA-100114292 for the Project was issued on 29 October 2024.

A transition notice under s 754 of the EP Act was issued to Magnetic South on 6 June 2024, with the requirement to submit a proposed PRCP to the administering authority by 6 December 2024. This PRCP meets the legislative requirements under sections 126C, 126D and 754 of the EP Act as well as the Department of Environment, Tourism, Science and Innovation (DETSI) 'Progressive Rehabilitation and Closure Plan Guideline' (PRCP Guideline) (DESI 2024).

2 Scope and objective

The purpose of this PRCP is to describe how progressive rehabilitation will be carried out at the Project. The PRCP has been developed in accordance with the requirements of the PRCP Guideline, which states that the PRCP must include the following parts.

Rehabilitation Planning part:

The purpose of the rehabilitation planning part of the PRCP is to support and justify the development of the proposed PRCP schedule. This part must detail how progressive rehabilitation and closure will be carried out over the entire Project site. The critical components of the rehabilitation planning part for the Project are:

- community consultation information (refer to section 3.2);
- post-mining land use (PMLU) determination (refer to section 3.3);
- voids in floodplains (refer to section 3.1.8);
- rehabilitation and management methodology (refer to section 3.5);
- risk assessment (refer to section 3.6; and
- a monitoring and maintenance program (refer to section 3.7).

Rehabilitation Schedule part:

The Rehabilitation schedule is a required element of a PRCP. Once approved, the schedule becomes a legally binding and enforceable instrument with which the EA holder must comply. The schedule must include:

- nomination of either a PMLU or non-use management area (NUMA) for all land within the relevant resource tenures, including land uses for undisturbed land;
- identification of when land becomes available for rehabilitation or improvement;
- rehabilitation or management milestones to achieve the PMLU or NUMA outcomes;
- milestone criteria that demonstrate when each milestone has been completed;
- completion dates for each milestone to be achieved; and
- any conditions considered necessary or desirable.

Two deemed conditions are to be included in all PRCP schedules per section 206A of the EP Act. The first condition states that when carrying out a relevant activity under the PRCP schedule, the holder must comply with a requirement stated in the EA relevant to carrying out the activity. This condition applies even if the EA is suspended. The second condition states that the holder must comply with the following matters stated in the schedule:

- each rehabilitation milestone and management milestone; and
- when each rehabilitation milestone and management milestone is to be achieved.

The administering authority may impose a condition on a PRCP schedule if it considers the condition necessary or desirable (section 4.2 of the PRCP Guideline).

3 Project planning part

3.1 Project planning

3.1.1 Project description

The Project is situated within the Bowen Basin, approximately 110 km east of Emerald and 125 km southwest of Rockhampton, in central Queensland. The project location is shown in Figure 1. The Project is comprised of a single Mining Lease (ML 700056), which covers a total area of 6121 ha.

The Gemini open cut metallurgical coal mine will produce PCI coal and coking coal for export to the international steel-making industry. The Project targets a mining output of 1.9 Mtpa ROM and is scheduled to operate 24 hours a day, 7 days a week, during its operating life.

The open cut mining areas will be developed using a conventional truck and shovel mining method with excavators and haul trucks. The coal product will be transported via the Blackwater railway to the Port of Gladstone for export to international markets. The overall Project term is anticipated to be 37 years from the grant of the ML, including initial construction, mine operation, and rehabilitation activities. On Project commencement, mine construction activities are expected to take approximately six months to establish the necessary infrastructure for overburden removal, followed by an additional 18 months to initiate coal production.

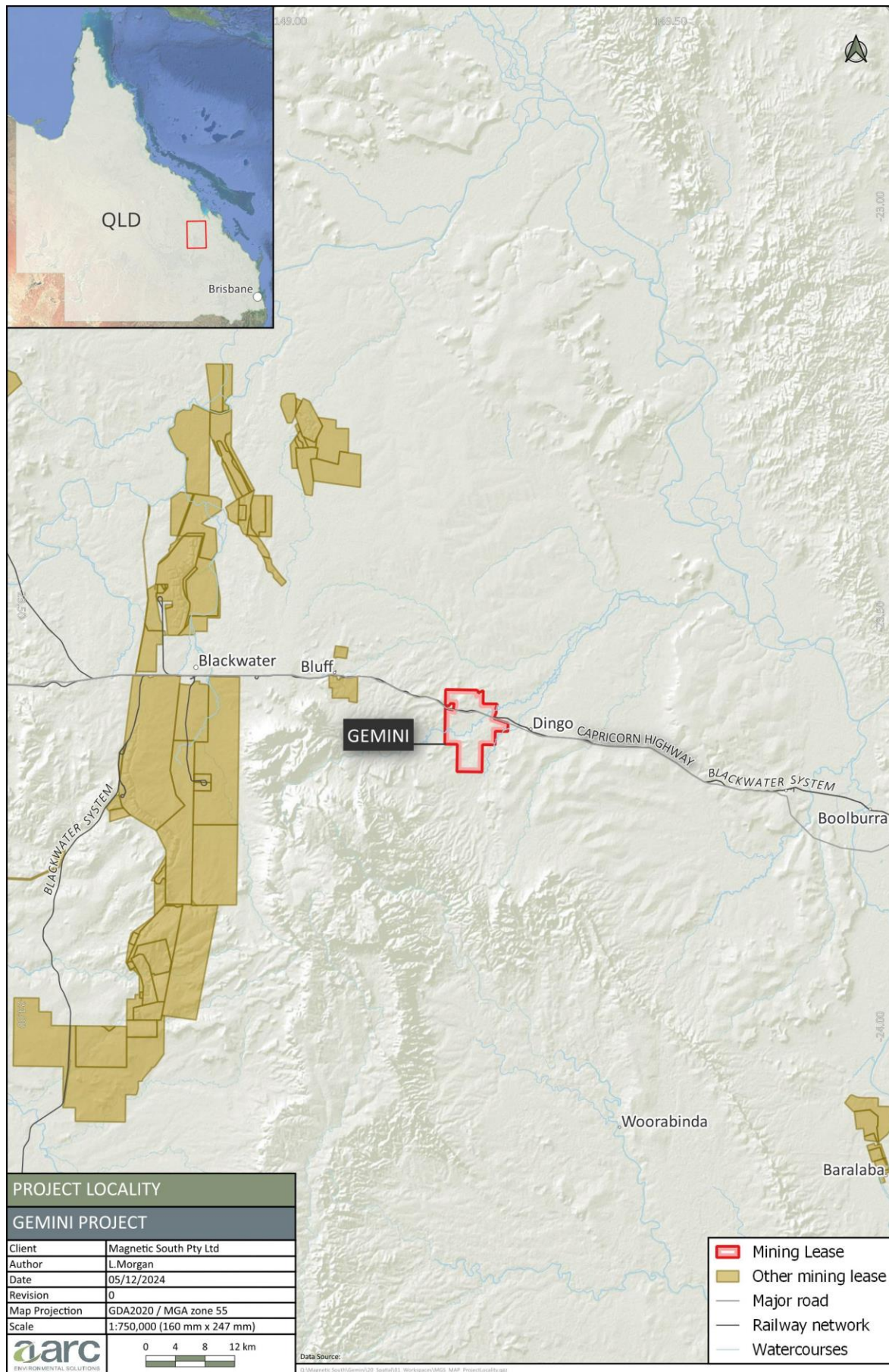


Figure 1: Project locality

3.1.1.1 Project activities

The Project will include the resource activity of ‘mining black coal’ as well as the ancillary activities outlined in Table 1, all of which are authorised under the EA. Notifiable activities relevant to the Project are identified in Table 2.

Table 1: Applicable ERAs for the Project

Environmentally Relevant Activity	Description
Schedule 3 (Resource Activity)	
13 Mining black coal	Mining black coal
Schedule 2 (Prescribed ERAs)	
8 (3) (iii) Chemical storage	Chemical storage (the relevant activity) consists of storing more than 500 m ³ of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c).
31 (2) (b) Mineral processing	Mineral processing (the relevant activity) processing, in a year, the following quantity of mineral products, other than coke — more than 100,000t
33 Crushing, milling, grinding or screening	Crushing, milling, grinding or screening (the relevant activity) consists of crushing, grinding, milling or screening more than 5,000 t of material in a year.
60 (2) subsection (1)(b)–(h) Waste disposal	Waste disposal (the relevant activity) consists of operating a facility for disposing of, in a year, more than 200,000t of waste.
63 (1)(b)(i) Sewage treatment	Sewage treatment (the relevant activity) consists of operating sewage treatment works, other than no-release works, with a total daily peak design capacity of more than 100 but not more than 1,500 EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme

Table 2: Notifiable activities applicable to the Project as per the EP Act 1994

Notifiable Activities	Description
Schedule 3	
1 Abrasive Blasting	Carrying out abrasive blast cleaning (other than cleaning carried out in fully enclosed booths) or disposing of abrasive blasting material.
7 Chemical Storage	Storing more than 10 t of chemicals (other than compressed or liquefied gases) that are dangerous goods under the dangerous goods code.
15 Explosives production or storage	Operating an explosives factory under the <i>Explosives Act 1999</i> .
24 Mine Wastes	- storing hazardous mine or exploration wastes, including, for example, tailing dams, overburden or waste rock dumps containing hazardous contaminants; or - exploring for, or mining or process, minerals in a way that exposes faces, or releases groundwater, containing hazardous contaminants.
29 Petroleum Product or Oil Storage	Storing petroleum products or oil: a) in underground tanks with more than 200 litre (L) capacity; or b) in above ground tanks with: a) for petroleum products or oil in class 3 in packaging groups 1 and 2 of the dangerous goods code – more than 2,500 L capacity; or b) for petroleum products or oil in class 3 in packaging groups 3 of the dangerous goods code – more than 5,000 L capacity; or c) for petroleum products that are combustible liquids in class C1 or C2 in <i>Australian Standard AS1940 The storage and handling of flammable and combustible liquids</i> published by Standards Australia – more than 25,000 L capacity.
37 Waste Storage, treatment or disposal	Storing, treating, reprocessing or disposing of waste prescribed under a regulation to be regulated waste for this item (other than at the place it is generated), including operating a nightsoil disposal site or sewage treatment plant where the site or plant has a design capacity that is more than the equivalent of 50,000 persons having sludge drying beds or on-site disposal facilities.

3.1.1.2 Resource tenements

The Project is located entirely within ML700056, which is underlain by an exploration permit for coal (EPC) 881, as shown in Figure 2. Both the surface rights within ML700056 and the exploration rights within EPC881 are held by Magnetic South, as described in Table 3 and Table 4, respectively.

The project area has no petroleum tenements overlapping or adjoining the ML. Other tenements proximal to the ML include EPC 960 and mineral development licence (MDL) 505 held by Walton Coal Pty Ltd (Figure 2). Those coal tenements that overlap or occur adjacent to the Project are listed in Table 4.

Table 3: Resource tenement details

Resource tenement	Grant date	Expiry date	Area (ha)
ML700056	29/10/2024	30 September 2049	6121

Table 4: Coal tenements

Authorised tenement	Tenement number	Location in relation to the Project
Exploration permit of coal		
Walton Coal Pty Ltd	EPC 960	Adjacent to Lot 1/RP904099
Magnetic South Pty Ltd	EPC 881	Overlapping Lot 4/RP801280
Mineral development licence		
Walton Coal Pty Ltd	MDL 505	Adjacent to 100SP325594

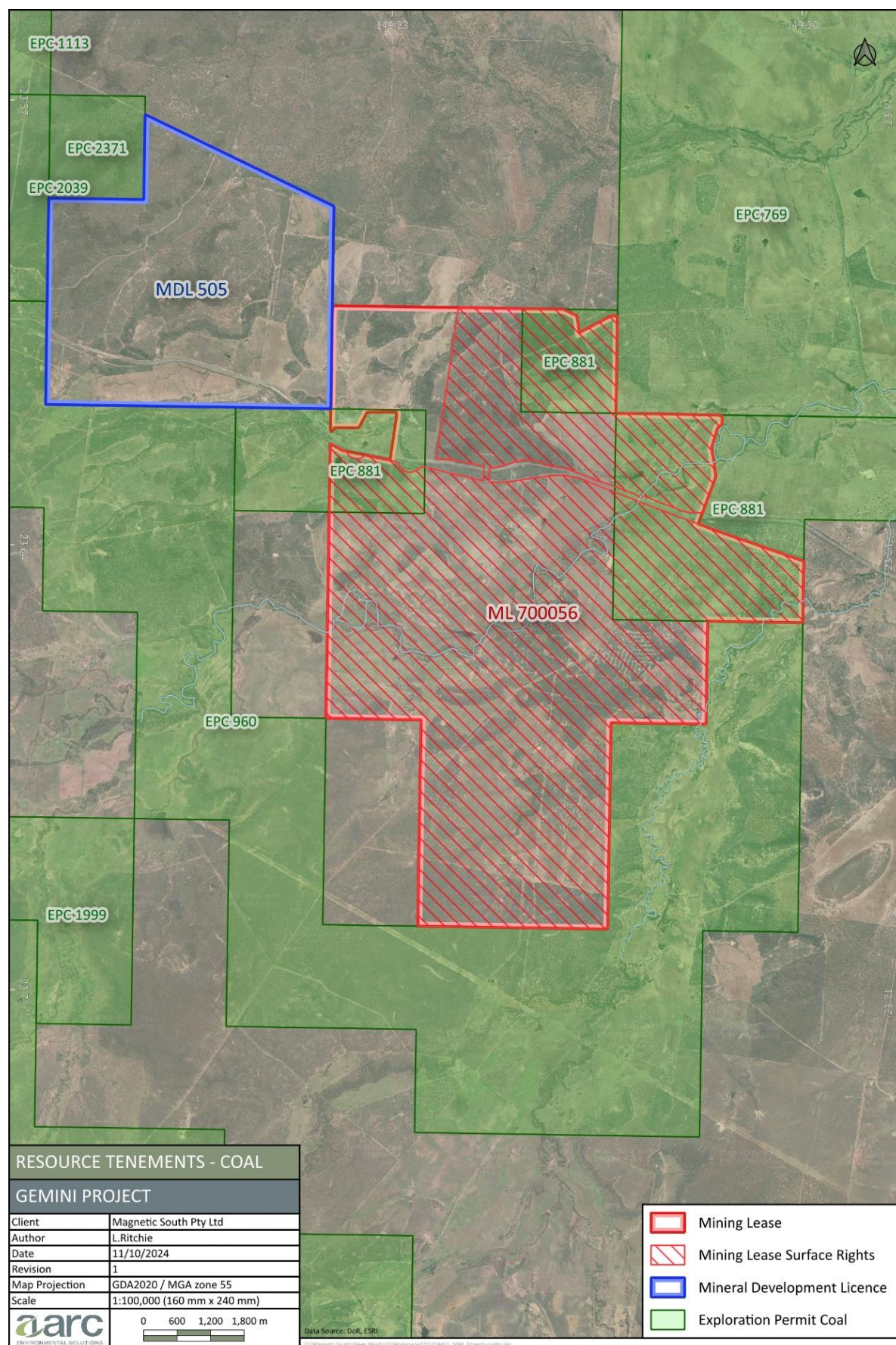


Figure 2: Resource tenements coal

3.1.1.3 Mining operations and site layout

The open cut mine will be developed using a conventional truck and shovel mining method with excavators and haul trucks. Coal will be handled, prepared, stockpiled on-site, and transferred via conveyor to a train load out (TLO) facility for transport. The coal product will then be transported via rail to the Port of Gladstone for export to international markets.

The main activities associated with the Project include:

- ongoing exploration activities to support mine planning;
- development of a mine infrastructure area (MIA) including mine offices, bathhouse, crib rooms, warehouse/stores, workshop, fuel storage, refuelling facilities, wash bay, laydown area, sewage, effluent and liquid waste storage, and a helipad;
- construction and operation of a coal handling and preparation plant (CHPP) and coal handling facilities adjacent to the MIA, including run-of-mine (ROM) coal and product coal stockpiles and rejects bin/overflow (coarse and fine rejects);
- construction and operation of a surface conveyor from the product stockpiles to a TLO facility and rail loop connecting to the Blackwater Railway to transport product coal to coal terminals at Gladstone for export;
- construction of an accommodation facility, sewage treatment plant and effluent irrigation area within the northwest bounds of the MLA;
- construction of access roads from the Capricorn Highway to the MIA and from the Capricorn Highway to the TLO facility;
- installation of a raw water supply pipeline to connect to the Blackwater Pipeline network;
- construction of a 66 kV transmission line and switching/substation to connect to the existing regional network;
- other associated minor infrastructure, plant, equipment and activities;
- development of mine areas (open cut pits) and out-of-pit waste rock emplacements;
- drilling and blasting of competent waste material;
- mine operations using conventional surface mining equipment (excavators, front-end loaders, rear dump trucks, dozers);
- mining up to 1.9 Mtpa ROM coal (average of 1.8 Mtpa) for a construction/production period of approximately 20 years;
- progressive placement of waste rock in:
 - emplacements adjacent to and near the open cut voids; and
 - mine voids, behind the advancing open cut mining operations;
- progressive rehabilitation of waste rock emplacement areas and mined voids;
- progressive establishment of soil stockpiles, laydown area and borrow pits (for road base and civil works; material will be sourced from local quarries where required);
- disposal of CHPP rejects (coarse and fine rejects) in out-of-pit waste rock dumps and in-pit behind the mining void;
- progressive development of internal roads and haul roads, including a causeway over Charlevue Creek to enable coal haulage and pit access; and
- development of water storage and sediment dams and the installation of pumps, pipelines, and other water management equipment and structures, including temporary levees, diversions and drains.

Existing local and regional infrastructure, facilities and services would be used to support Project activities. These include the Sunwater water distribution network, the Aurizon rail network, Ergon's electricity network, the Capricorn Highway, and the Gladstone export coal terminals.

The conceptual mine layout showing mine infrastructure and the authorised disturbance footprint is provided in Figure 3. The conceptual Project layout represents the total area to be disturbed by mine operations only and does not equate to the disturbance footprint at any one point in time.

The total disturbance footprint for the Project is 1,968.0 ha, which incorporates all mining and infrastructure components as described in Table 5.

Open cut mining areas will be progressively rehabilitated over the life of the mine. A key component of the rehabilitation methodology is the progressive backfilling of open cut pits with the excavated overburden or waste rock material. The proposed staging for the progressive rehabilitation of the Project's disturbance areas is demonstrated through Figure 4 to Figure 13.

Future exploration drilling will be performed and rehabilitated in accordance with the EA and standard conditions contained in the *Eligibility criteria and standard conditions for exploration and mineral development projects—ESR/2016/1985 (formerly EM586)*.

Table 5: Total disturbance area at end of operational mine life

Proposed Disturbance	Approximate Area (ha)
In-pit and out-of-pit waste emplacements, including dry rejects disposal areas	720.7
Temporary waste emplacements	17.5
Residual void lakes	76.3
Residual void high walls	132.8
Residual void low walls	186.9
Rehabilitated dams	35.8
Retained dams	34.0
Diversion drains	14.3
Mine infrastructure areas	735.9
Retained infrastructure	13.8
Total	1,968.0

*Infrastructure disturbance includes a nominal 100m buffer around the perimeter of the disturbance footprint.

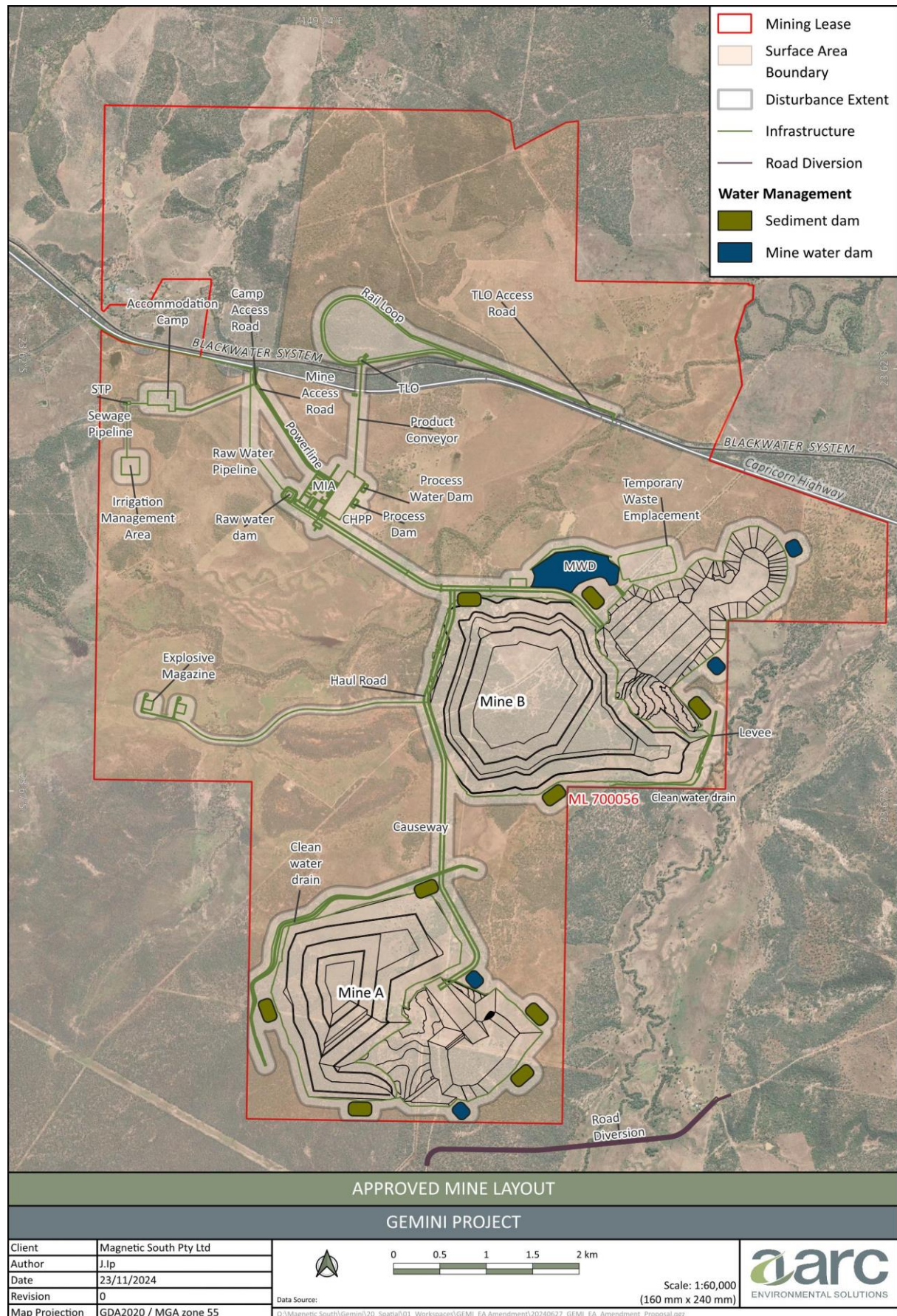


Figure 3: Conceptual Project layout – Gemini Project

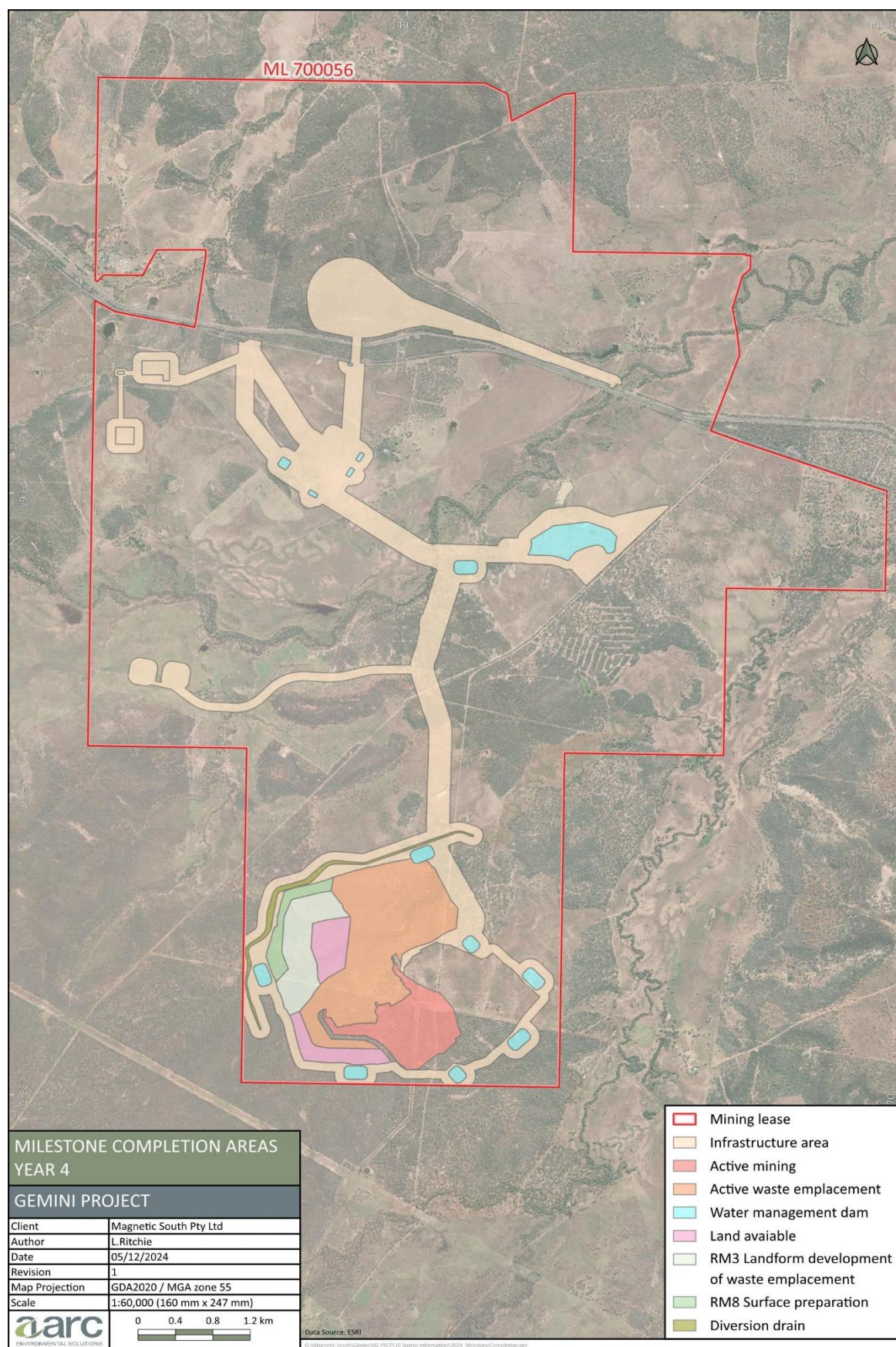


Figure 4: Mine progress – Year 4

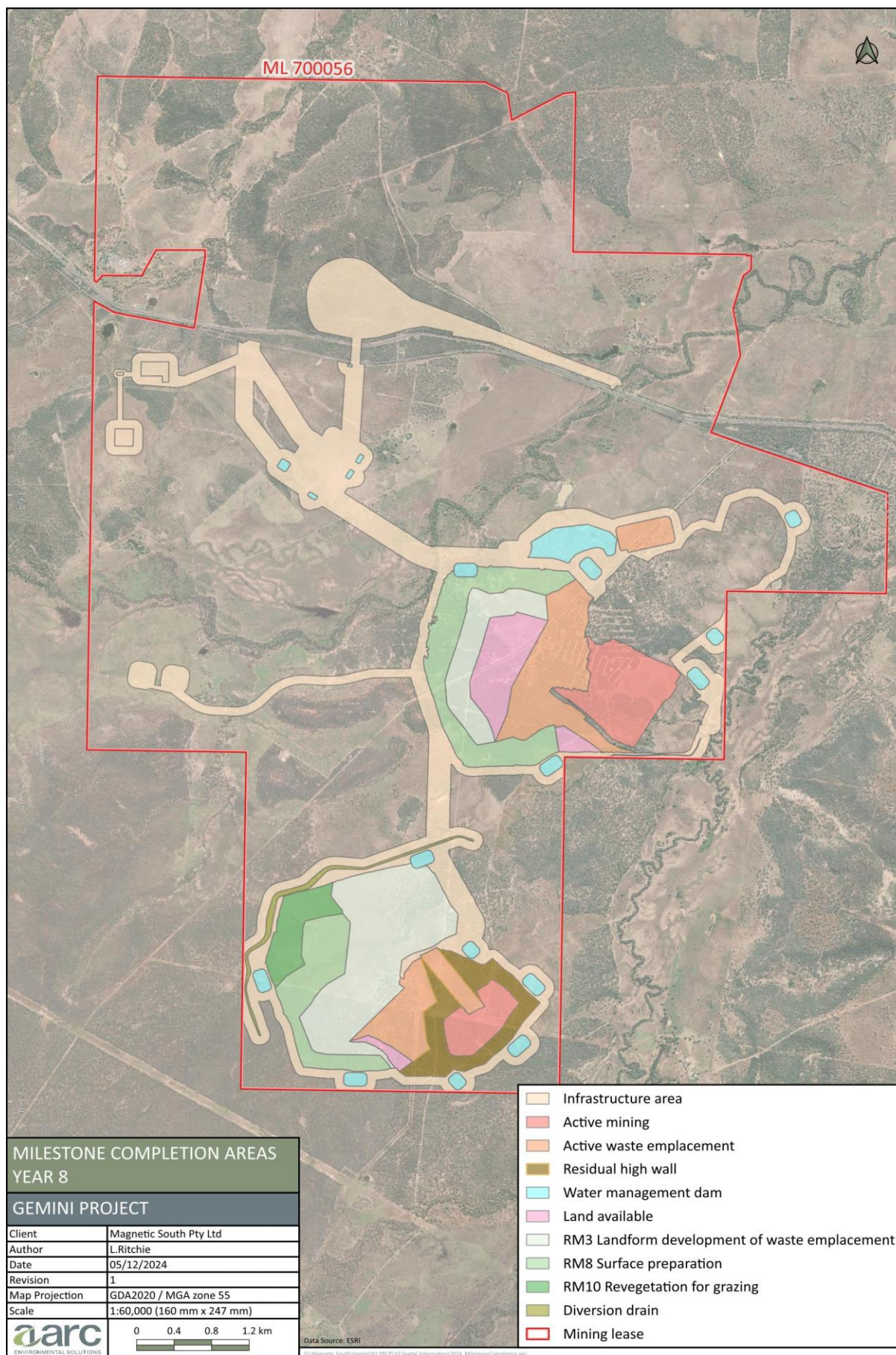


Figure 5: Mine progress – Year 8

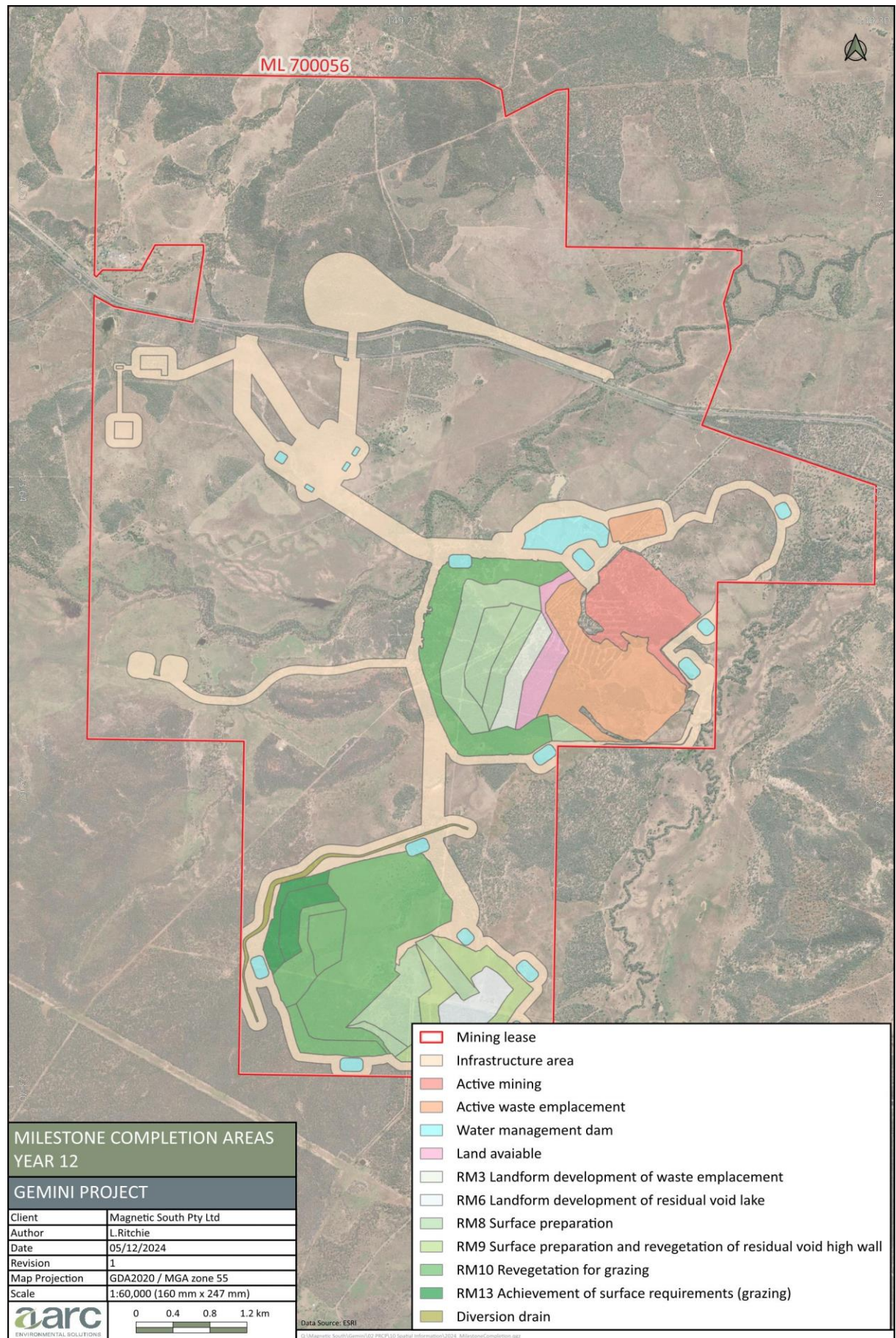


Figure 6: Mine progress – Year 12

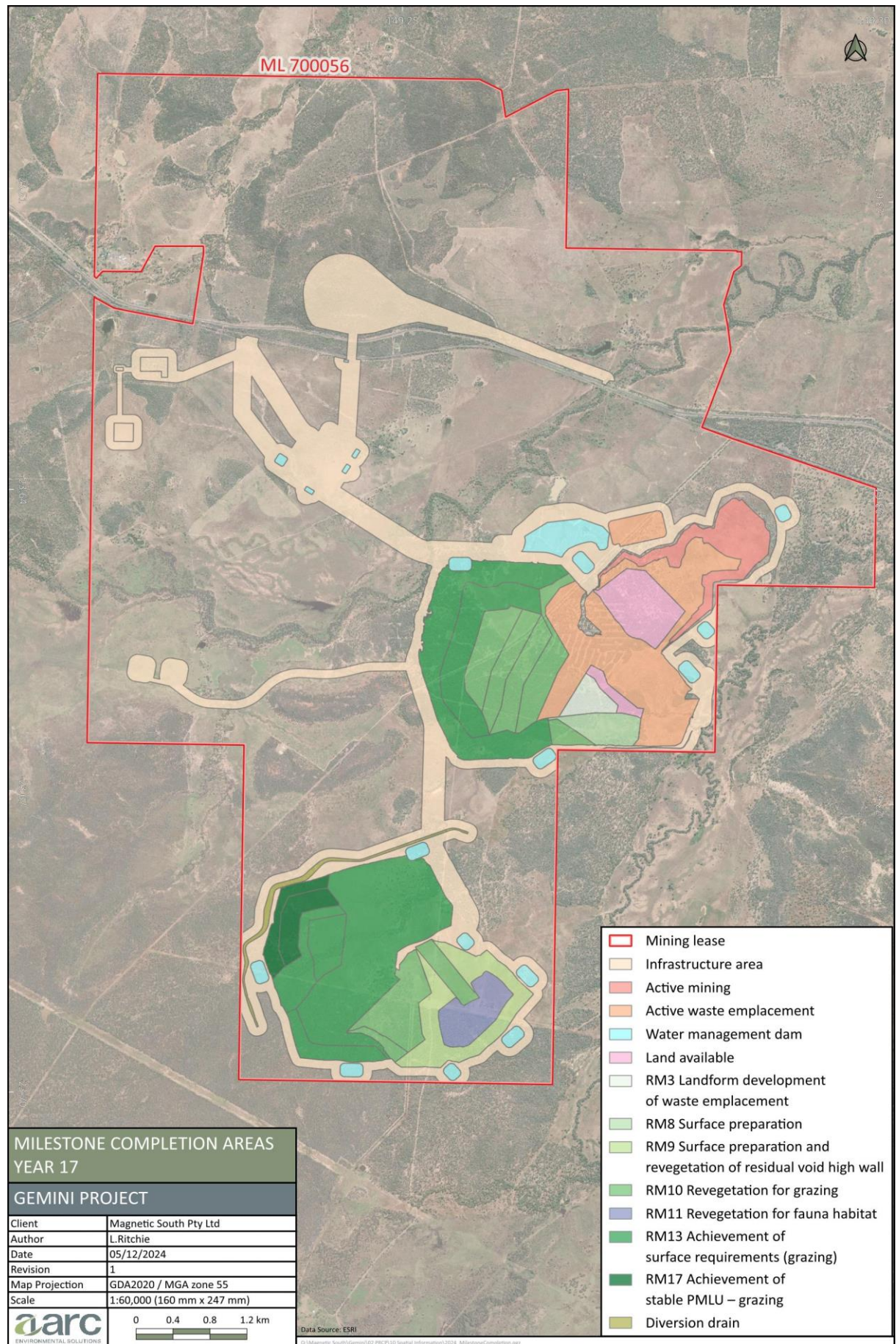


Figure 7: Mine progress – Year 17

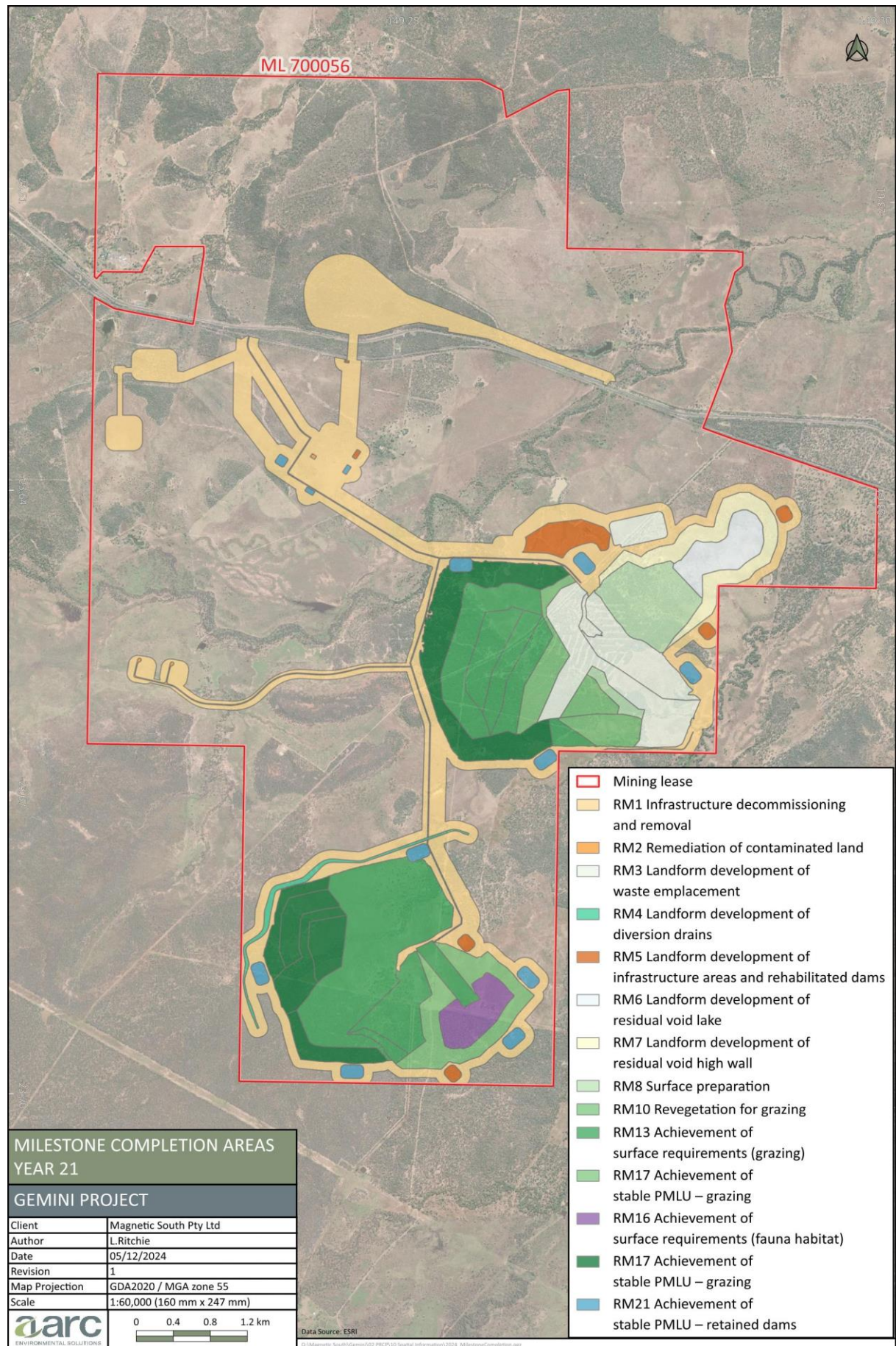


Figure 8: Mine progress – Year 21

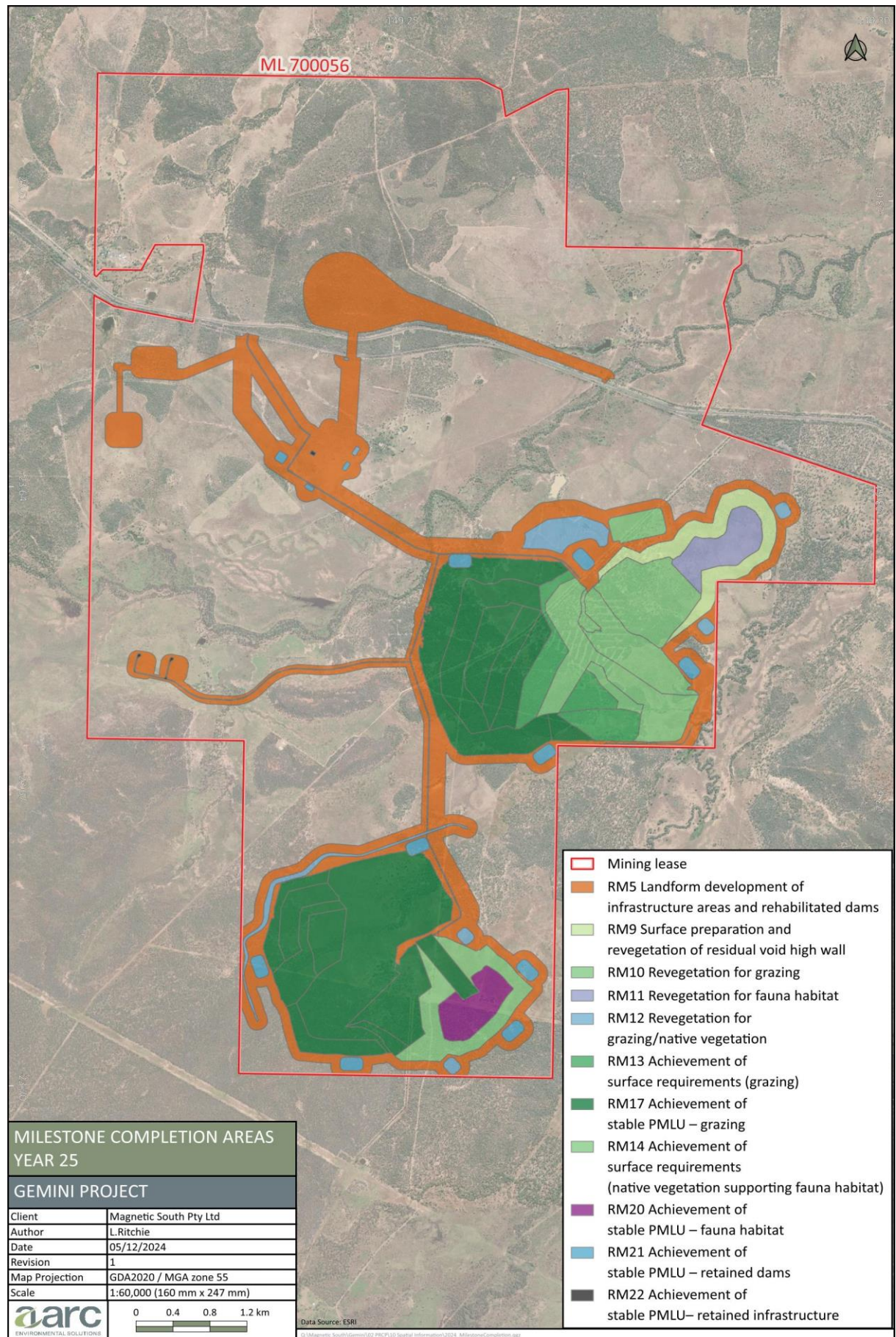


Figure 9: Mine progress – Year 25

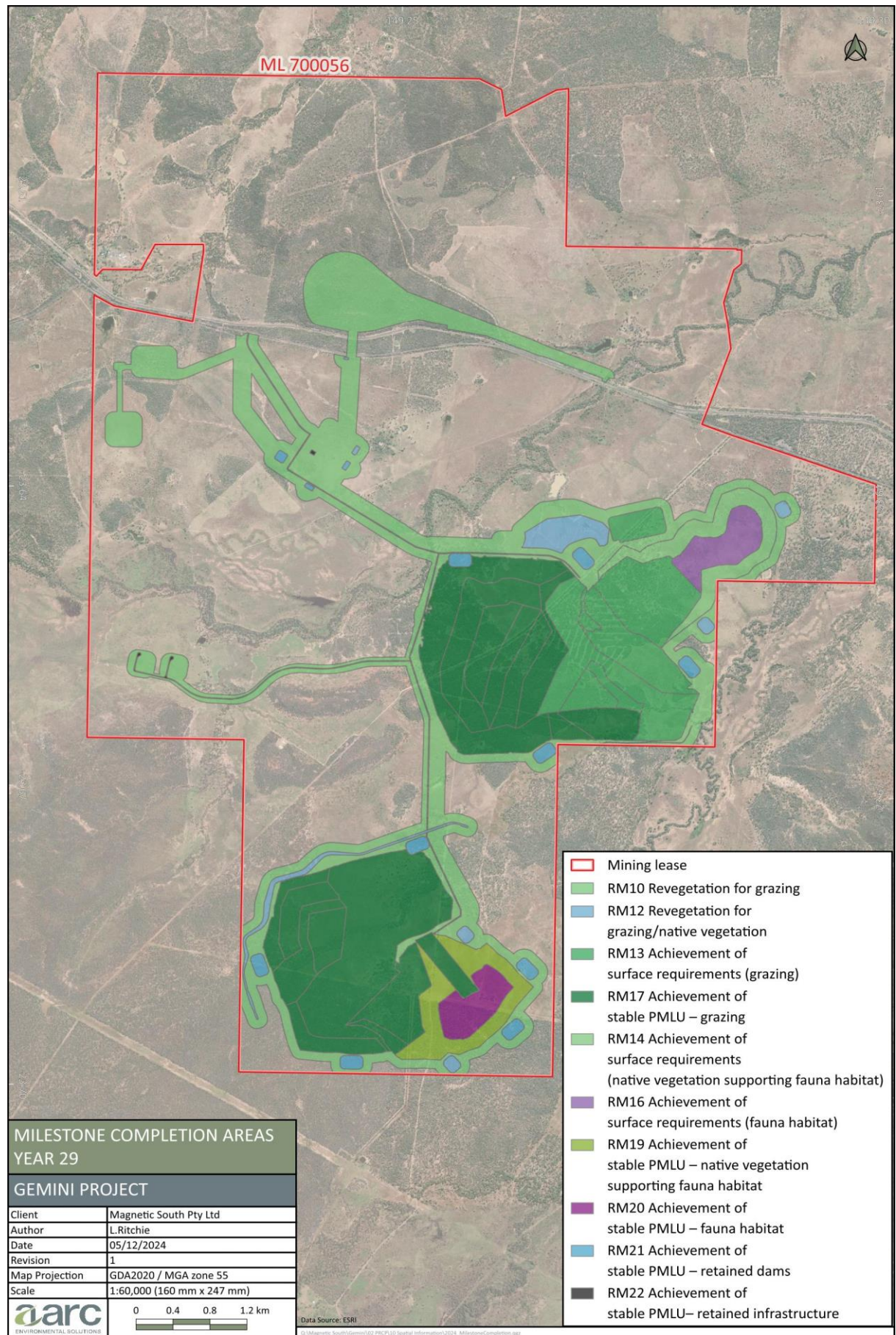


Figure 10: Mine progress – Year 29

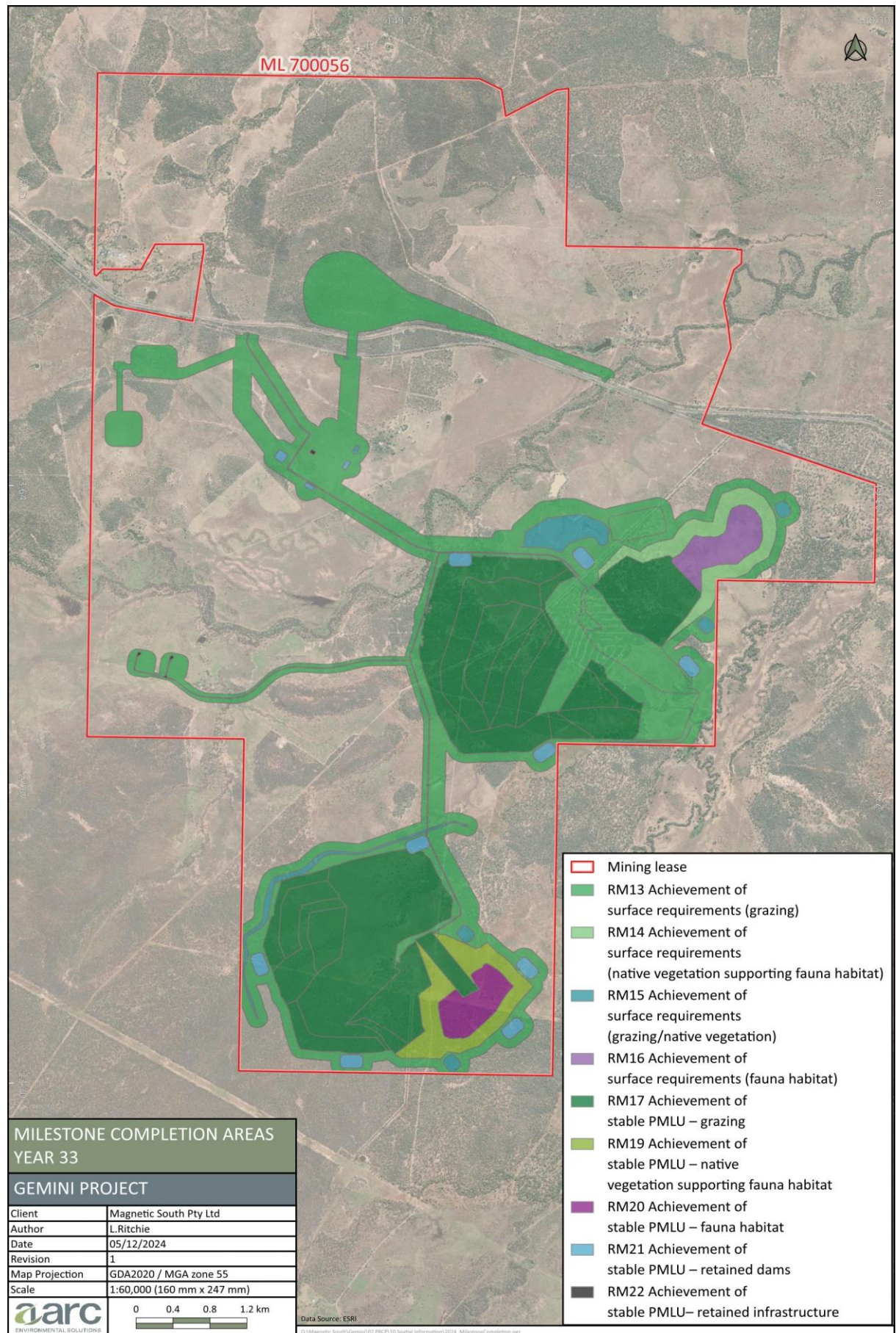


Figure 11: Mine progress – Year 33

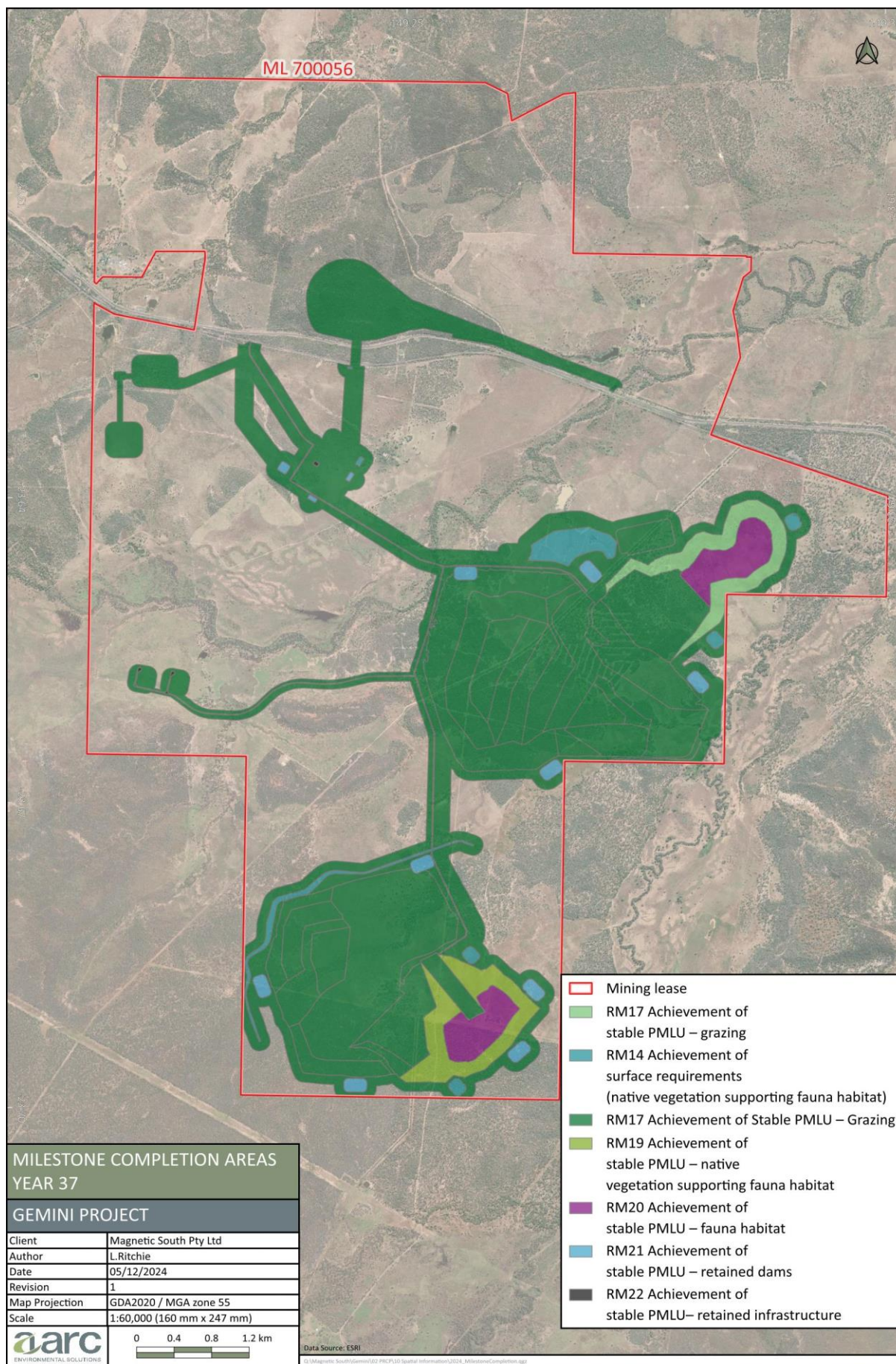


Figure 12: Mine progress – Year 37

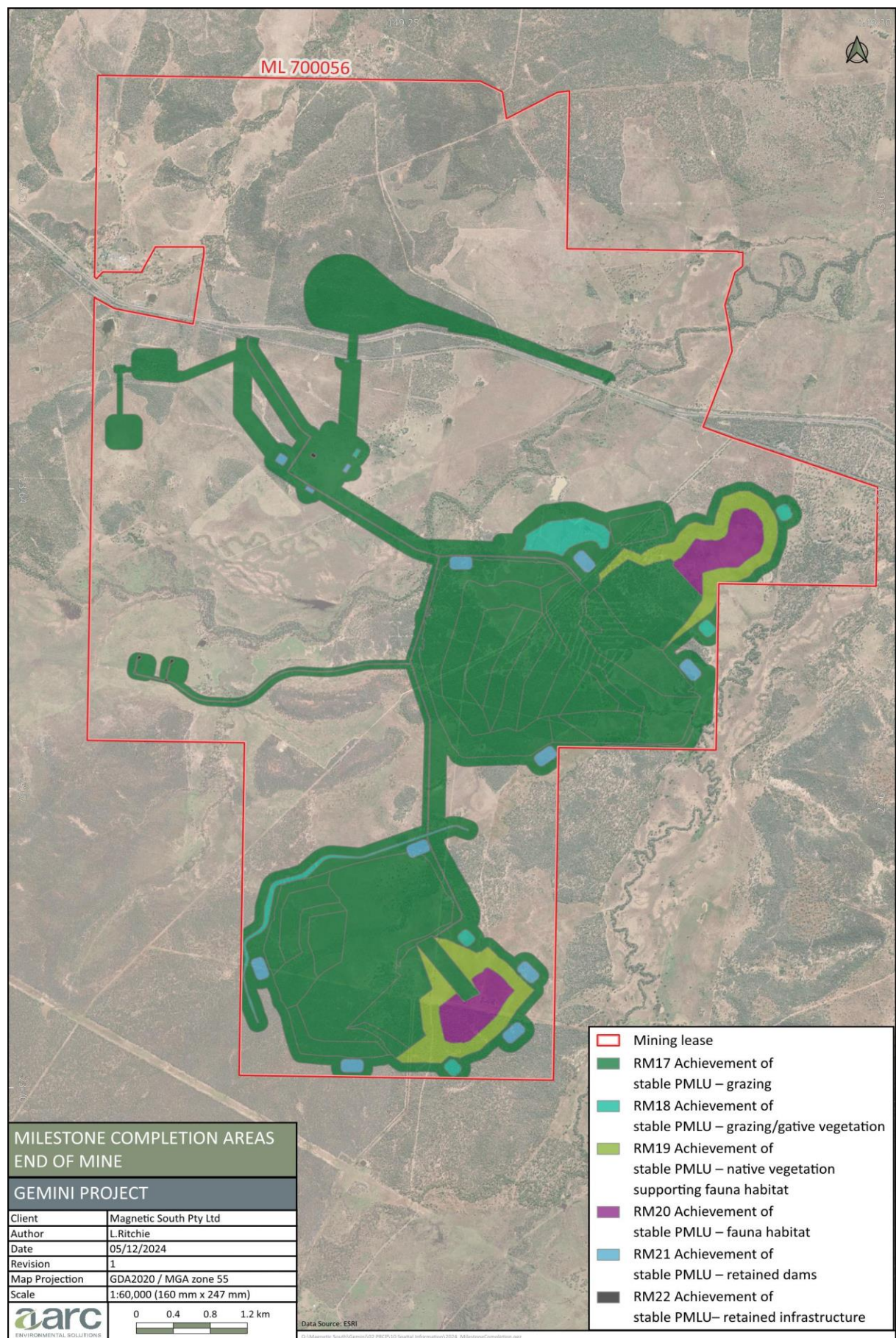


Figure 13: End of mine rehabilitation completion

3.1.2 Climate

According to the Bureau of Meteorology’s (BoM) modified Köppen climate classification system, the Project area has a climate classification of ‘subtropical’ (moderately dry winter). The local region experiences a subtropical climate characterised by high seasonal rainfall variability subject to cyclic wet summer and dry winter seasons, with variable temperature and evaporation. Wind blows predominantly from the southeast and east in the region.

Local meteorological conditions have been compiled using data from the Scientific Information for Landowners (SILO) Data Drill from the year 1990 to 2024 (35 years). The Data Drill accesses grids of climate data from surrounding BoM point observations and then creates interpolated climate values for the requested location. The SILO climate data was obtained for coordinates that correspond to the approximate centre of the Gemini Project ML, referred to here-in as the Gemini Grid. Moreover, rainfall and temperature data has been sourced from the nearest BoM station to the Project location.

3.1.2.1 Rainfall

The mean annual rainfall for the Project region is approximately 677.26 mm. Rainfall in the Project region is highly seasonal, with November to March generally accepted as the ‘wet season’ and rainfall during this time accounting for approximately 68% of the region’s total yearly rainfall. The ‘dry season’ usually occurs from April through to October with monthly rainfall totals below 45 mm consistently throughout this period. The rainfall data for this region is consistent with the Köppen classification of ‘subtropical’ (moderately dry winter).

Mean monthly rainfall records from 1990-2024 for the Project region are derived from the BOM database – Dingo Post Office (035025) (BOM 2024) and are shown in Figure 14.

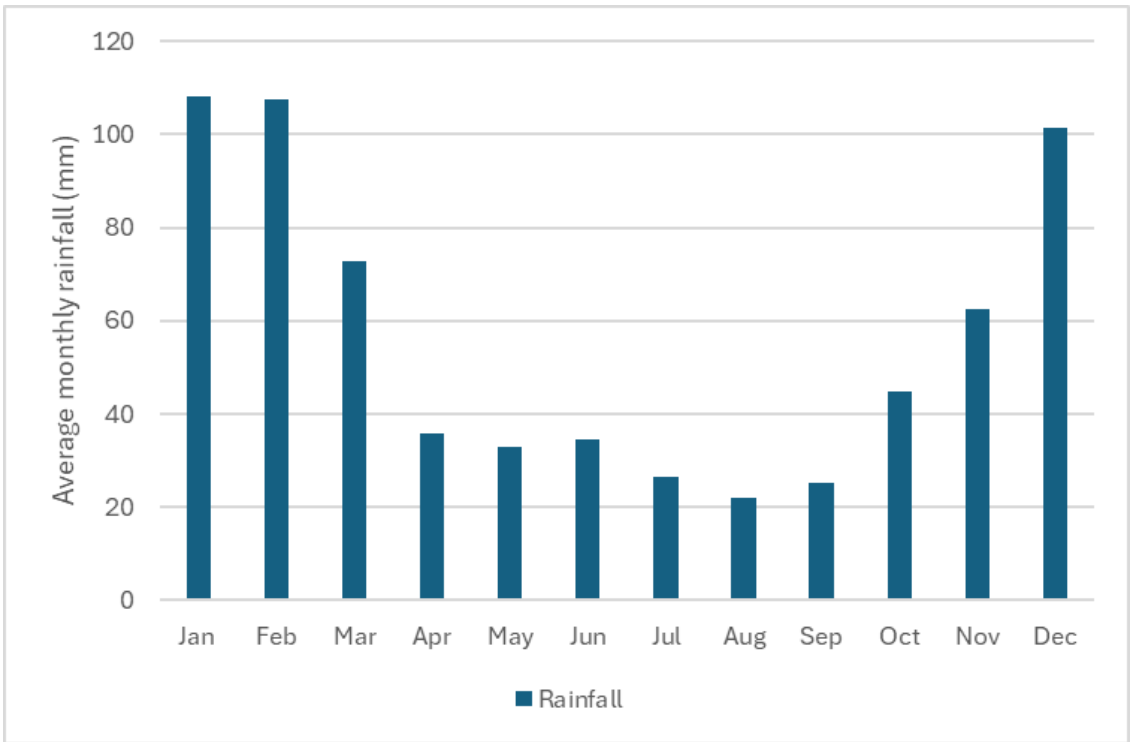


Figure 14: Mean monthly rainfall at Dingo Post Office (Source: BoM 2024)

3.1.2.2 Evaporation

The average annual (pan) evaporation estimated from the Gemini Grid is 2,018.94 mm, more than three times higher than the average annual rainfall (677.26 mm). Mean monthly evaporation exceeds mean monthly rainfall during every month from 1990-2024 as shown in Figure 15.

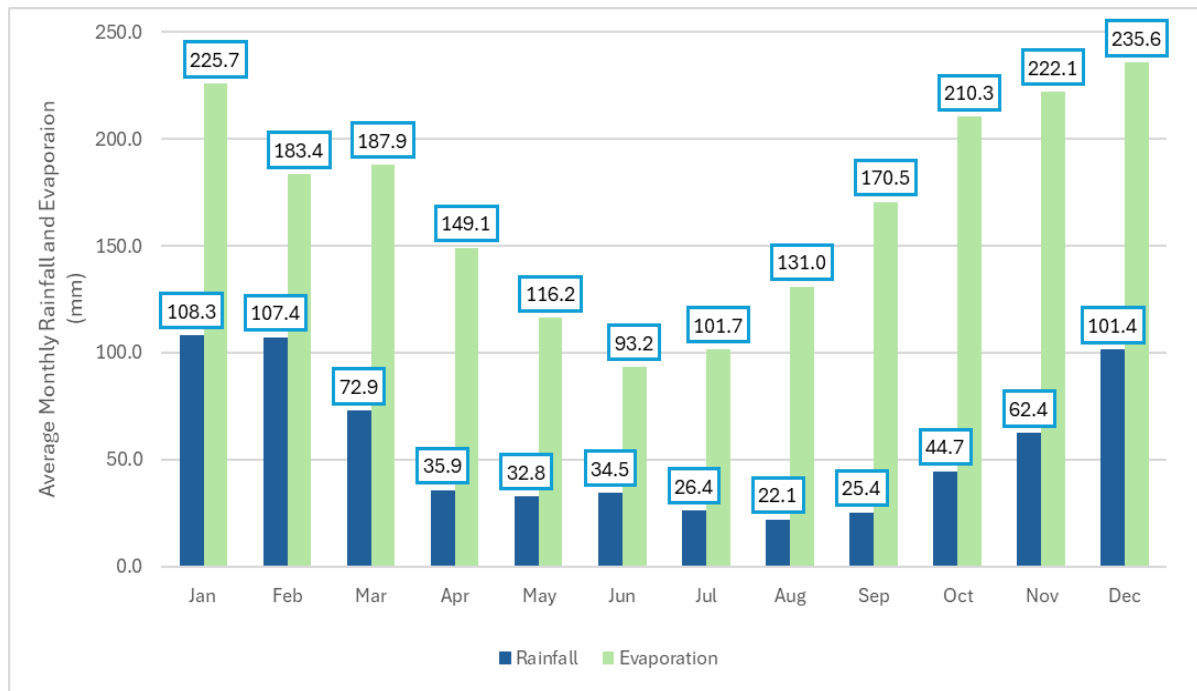


Figure 15: Mean monthly rainfall and evaporation at Dingo Post Office (Source: SILO 2024)

3.1.2.3 Temperature

Daily temperature records are available from the BoM Blackwater Airport Station (035134), which is located 40 km from the Project area, and interpolated monthly temperature data for the Gemini Grid has been obtained from the SILO database.

As per (BOM 2024) for the period May 2013 to July 2024, mean monthly temperatures were recorded in the range of 9.4 °C (min.) to 34.4 °C (max.) at Blackwater Airport (Figure 16).

While for the period between 1997 and 2024, the SILO database interpolates mean temperatures of 8.7 °C (min.) to 34.8 °C (max.) for the Project Grid.

To demonstrate the mean monthly minimum and maximum temperatures of the study area and the surrounding areas, temperature data obtained from the BoM Blackwater Airport Station (035134) has been compared to the SILO Gemini grid data as shown in Figure 16 (Source BoM 2024 and SILO).

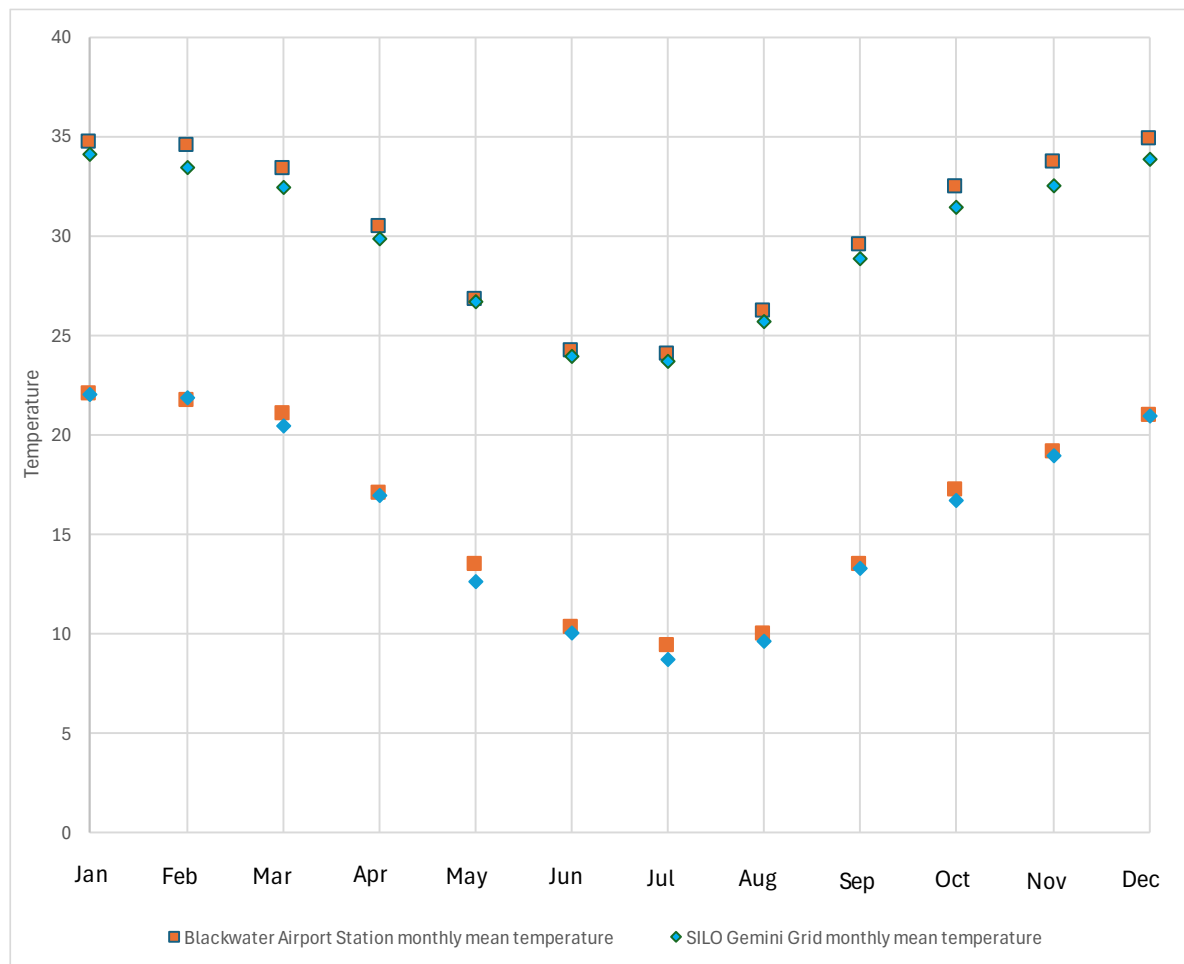


Figure 16: Mean monthly maximum and minimum temperatures in the Project region

3.1.2.4 Climate change

In Australia, climate change is generally expected to result in a shift towards more arid conditions, warmer temperatures, and reduced rainfall. According to the Queensland Government (2019), rainfall in central Queensland is predicted to decrease due to climate change. By 2050, median annual rainfall is projected to decrease by:

- 2% under a lower emissions scenario (with emissions reduced from 'business as usual'); and
- 8% under a high emission, or 'business as usual' scenario.

Long-term climate projections predict that conditions will become warmer, with hotter and more frequent hot days. Rainfall events are predicted to become more intense, and tropical cyclones are predicted to become less frequent but more intense.

3.1.3 Geological setting

The Gemini Project coal deposit is hosted within the Permian Rangel Coal Measures and the Yarrabee Structural Zone. Seven seams or seam groups have been identified at the site, which belong to either the Rangel Coal Measures or the underlying Burngrove Formation (BOYD 2019). In descending stratigraphic order, the seams include the Aries, Castor, Pollux, Orion, Pisces, Virgo and Leo seams. The seams contain several individual plies that have been identified for mining at the site; the main coal seams that are encountered at the site and their typical thickness are described in Table 6 below.

Surface geology at the site predominantly comprises sediments of the Tertiary Duaringa Formation and Quaternary alluvium associated with ephemeral creeks, including Charlevue Creek and Springton Creek. The surface geology of the Project area is shown in Figure 17. and Figure 18 shows the project location in relation to the underlying Bowen Basin solid geology (i.e. the surficial unconsolidated Quaternary and Tertiary units have been removed, revealing the relationship between the underlying Triassic and Permian sediments and the prevalence of regional-scale faults). The two mining areas (Mine A and Mine B) occur where folding has brought the coal seams close to the surface at depths that can be economically mined.

Table 6: Summary of local stratigraphy

Geological Age	Unit	Coal Seams	Description	Typical thickness (m)
Quaternary	Alluvium		Unconsolidated soil, silt clay, sand and gravel associated with current surface drainage systems, e.g. Charlevue Creek and Springton Creek	1.5
Tertiary	Duaringa Formation		Mudstone, sandstone, conglomerate, siltstone	15 - 30
	Basalt		Minor basalt at one location path of Mine A	20
Triassic	Rewan Group		Lithic sandstone, piney lithic sandstone green to volcanilithic brown mudstone and minor conglomerate at the base	0-50
Permian	Rangal Coal Measures	Aries Upper	Feldspathic and Lithic sandstone, carbonaceous mudstone, siltstone, tuff and coal seams.	2.1
		Aries Lower		4
		Castor Upper		1.6
		Castor Lower		2
		Pollux Upper	Includes the Aries, Castor and Pollux Coal Seam, which are the target coal seam for mining at the Gemini Project	1.9
		Pollux Lower Upper		2.9
		Pollux Lower Lower		3.5
		Orion		6.1
		Pisces Upper		1.7
		Yarrabee Tuff		0.9
		Pisces Lower		0.7
	Burngrove Formation	Virgo		2.8
		Leo	Mudstone, siltstone, sandstone, coal, tuff	4.4
	Gyranda Formation		Siltstone and shale with minor tuff and volcanilithic sandstone and rare coal	0 to 100+

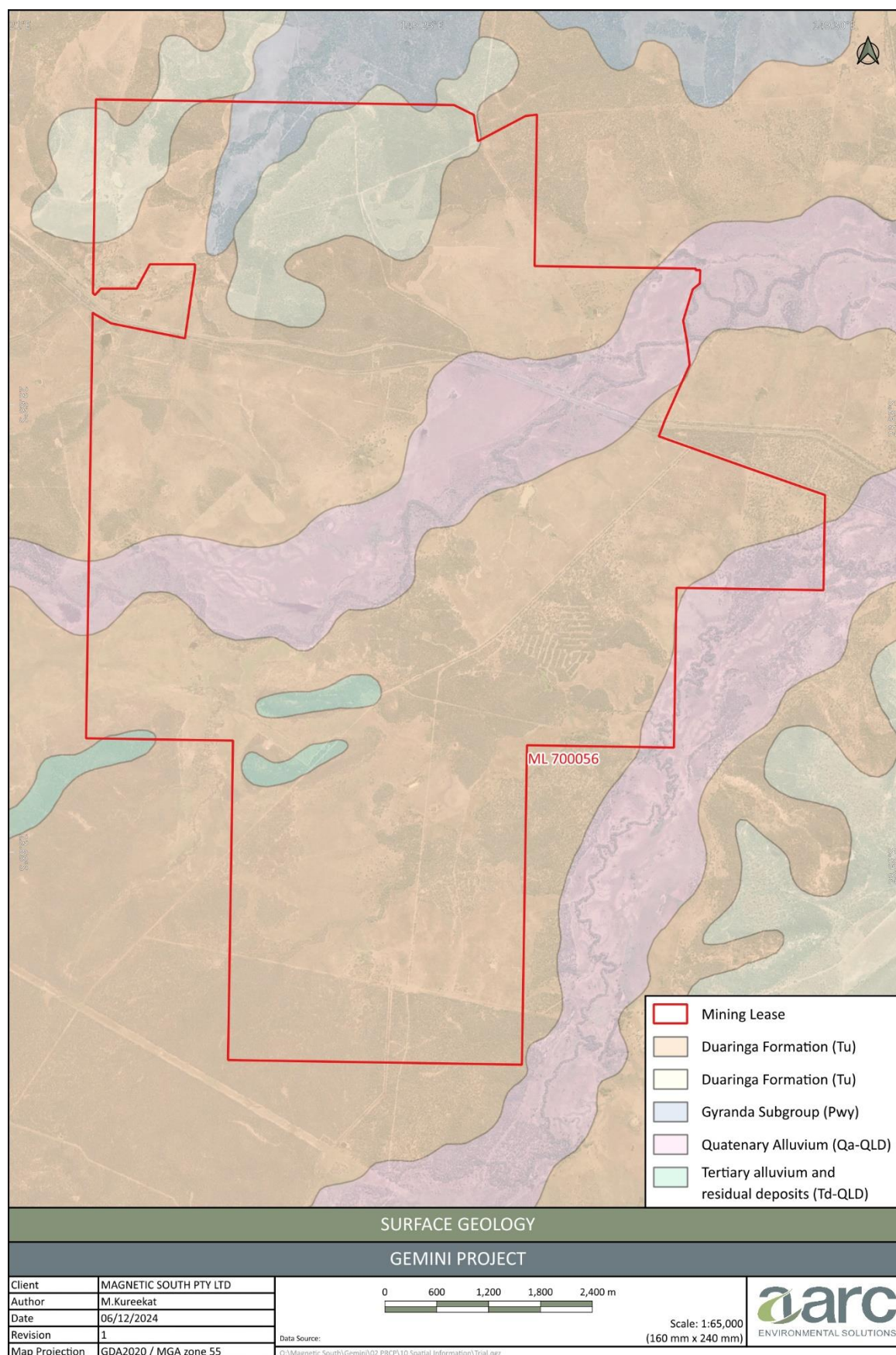


Figure 17: Surface geology of the Project

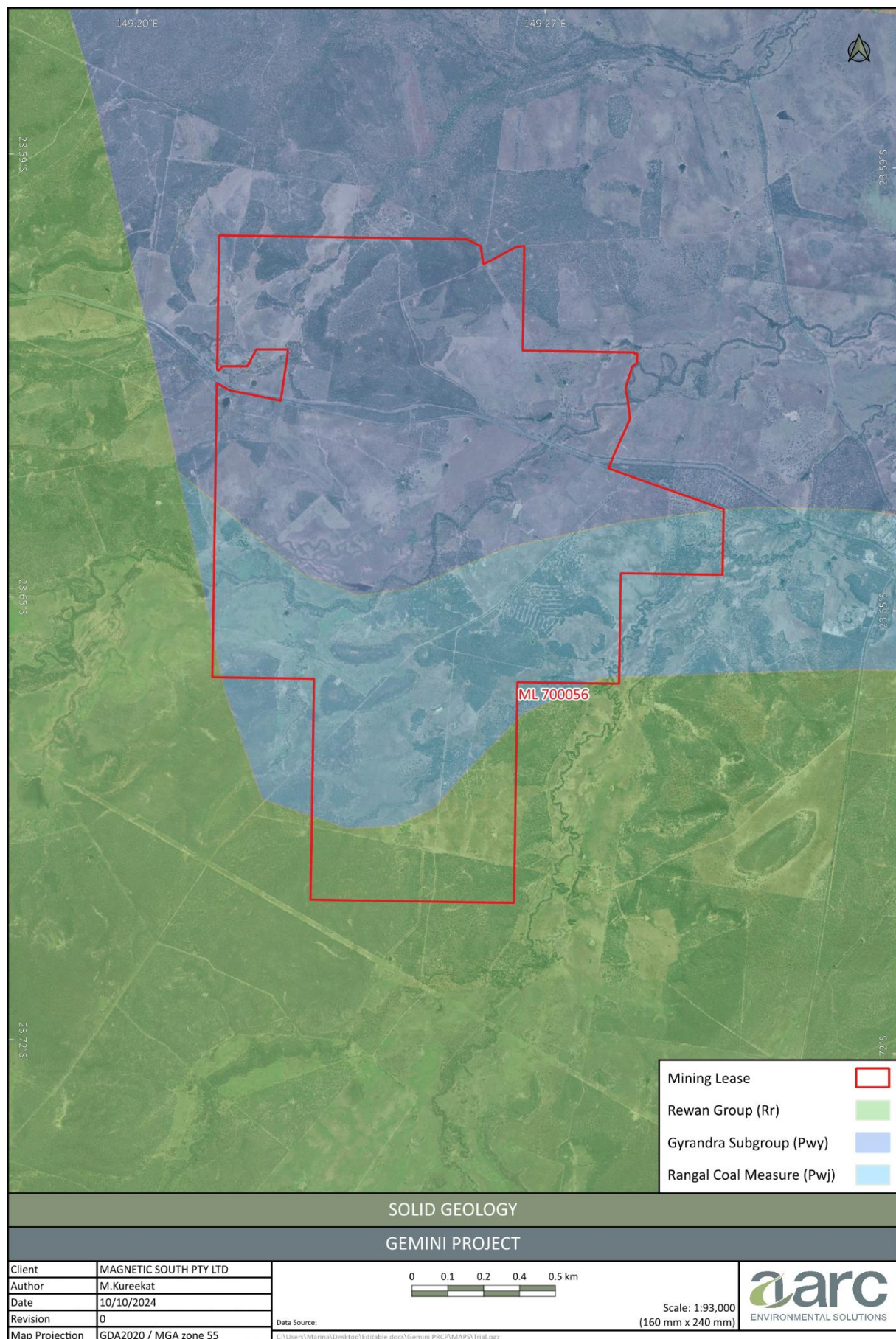


Figure 18: Solid geology of the Project

3.1.4 Topography and surface hydrology

The Project area is described as gently undulating with elevations between 120-150 mAH. The physiography of the area is characterised by a dissected tableland having a general relief variation of about 80 m. The topography of the Project is representative of the surrounding region. The viewshed, some 15-18 km distant to the southwest and west is to the Blackdown Tableland National Park and Arthurs Bluff State Forest, which rise approximately 450 m above the elevation of the Project site. There is little relief to the north and east, with the land falling gently toward the Mackenzie River valley.

The Project lies within the Mackenzie River sub-catchment, which covers a total area of 12,985 km², and is situated in the centre of the Fitzroy River Basin. The major water body associated with the Project site is Charlevue Creek. This creek begins within the boundaries of Blackdown Tablelands National Park, flowing to the northeast before joining Springton Creek (Figure 19). Springton Creek flows to the Fitzroy River, eventually reaching the Pacific Ocean approximately 46 km north of Gladstone.

The Project landscape is influenced by the presence of Charlevue Creek, which bisects the ML from west to east, and Springton Creek, which flows alongside the southeast boundary of the ML (Figure 19). The associated floodplains of these two watercourses result in localised lower elevations within the surrounding landscape. A significantly smaller tributary, Stanley Creek crosses the northwest corner of the ML boundary eventually converging with Springton Creek downstream of the ML. Minor associated tributaries, dams and drainage features also exist across the site (Figure 19). The land system is characterised by fluvial plains surrounding these waterways. It is mostly composed of stable flood plains traversed by a branching pattern of drainage floors.

3.1.4.1 Surface water quality

A baseline water quality monitoring program has been implemented for the Project, which includes field monitoring and automated flow gauges that monitor a variety of physical water parameters.

The baseline water quality at Gemini has been compared to the relevant water quality objectives (WQO) outlined in the Environmental Protection (Water and Wetland Biodiversity) Policy 2019. Of note, Gemini is located within the Mackenzie River Sub-basin for the purposes of Schedule 1 of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019. The key WQO are described in Table 7.

Table 7: Mackenzie River Sub-basin Water Quality Objectives

Quality characteristics (units)	Limit
pH	pH 6.5-8.5
Conductivity (EC) baseflow (µS/cm)	720
Turbidity (NTU)	< 50
Sulphate (mg/L)	25
Aluminium – dissolved (µg/L)	55
Cobalt – dissolved (µg/L)	1.4
Chromium – dissolved (µg/L)	1900
Copper – dissolved (µg/L)	34
Manganese – dissolved (µg/L)	11
Molybdenum – dissolved (µg/L)	5
Nickel – dissolved (µg/L)	8

Quality characteristics (units)	Limit
Selenium – dissolved (µg/L)	20
Zinc – dissolved (µg/L)	100
Total recoverable hydrocarbons (C6-C9) (µg/L)	20
Total recoverable hydrocarbons (C10-C36) (µg/L)	100
Major ions (mg/L) Calcium, chloride, potassium, magnesium, sodium, bicarbonate, carbonate	For interpretation purposes only
Hardness (mg/L)	For interpretation purposes only

Field monitoring of surface water quality was first undertaken as part of the Gemini EA Application and consisted of two monitoring events at Charlevue Creek and Springton Creek in late February 2018 and mid-April 2019. Water quality monitoring has continued since then, with samples taken every year during the wet season, following a flow event. Water quality field monitoring was last undertaken at Gemini on 8 April 2024.

Automated flow gauging stations were installed at downstream locations within Springton Creek and Charlevue Creek by ALS in December 2020. In addition to flow rates, the gauges also monitor a number of physical parameters, including salinity, turbidity and pH. Water quality monitoring via flow gauges has been continuously undertaken since their establishment. The average water quality results of field and flow gauge monitoring are outlined in Table 8.

Table 8: Baseline mean water quality monitoring results

Site	Method	DO (%)	EC (µS/cm)	TDS (mg/L)
Springton Creek	Field	58.9	162.5	72.9
	Flow Gauge	nil	397.8	nil
Charlevue Creek	Field	76.4	150	72.0
	Flow Gauge	nil	330.2	nil

The surface water quality of these waterways was generally found to be moderate to low, with DO and turbidity not meeting the WQO. Low DO levels were recorded at field and flow gauge monitoring locations within the Springton and Charlevue Creeks. Given the ephemeral nature of these systems, such exceedances are unreliable indicators of long-term system health. During the short periods in which these two creeks are flowing, the DO levels are expected to be higher; however, this cannot be confirmed.

Exceedances of the turbidity WQO were observed across all sites, likely due to the ephemeral nature of the creeks. Of note, flow gauge monitoring reported higher average turbidity than field monitoring by 450 to 700 NTU, depending on the creek. Charlevue Creek has lower turbidity than Springton Creek; however, both exceed the relevant WQO. Increased turbidity can affect the rate of photosynthesis and, therefore, the growth of plants or algae in the creeks. Therefore, high turbidity values indicate poor stream health and reduced biodiversity in aquatic fauna and flora, which remains consistent with the ephemeral nature of the creeks.

In addition to field parameters, surface water samples also underwent laboratory analysis, including measuring dissolved metals. Comparing dissolved metal concentrations against the WQO, both Springton and Charlevue Creeks recorded the aquatic ecosystem limit exceedances for turbidity and aluminium levels, while only Springton Creek recorded high levels of Manganese. These exceedances were observed in monitoring sites from 2021 to 2024.

Table 9 baseline mean surface water monitoring data (2019-2024)

Parameters	WQO trigger levels	Baseline monitoring data	
		Charlevue Creek	Springton Creek
pH	pH 6.5-8.5	7	6
Conductivity (EC) baseflow (µS/cm)	720	145	164
Turbidity (NTU)	< 50	961	407
Aluminium – dissolved (µg/L)	55	99	61
Cobalt – dissolved (µg/L)	1.4	0	1
Chromium – dissolved (µg/L)	1900	0	1
Copper – dissolved (µg/L)	34	3	3
Manganese – dissolved (µg/L)	11	2	42
Molybdenum – dissolved (µg/L)	5	0	0
Nickel – dissolved (µg/L)	8	2	3
Selenium – dissolved (µg/L)	20	0	0
Zinc – dissolved (µg/L)	100	1	3

Overall, the baseline surface water quality of Springton and Charlevue Creek was generally found to be moderate to low based on field and lab results and flow gauge monitoring. Physical parameters such as pH and TDS remained within the aquatic ecosystem WQO; however, exceedances were recorded for all other monitoring water quality parameters collected as part of field and flow gauge monitoring.

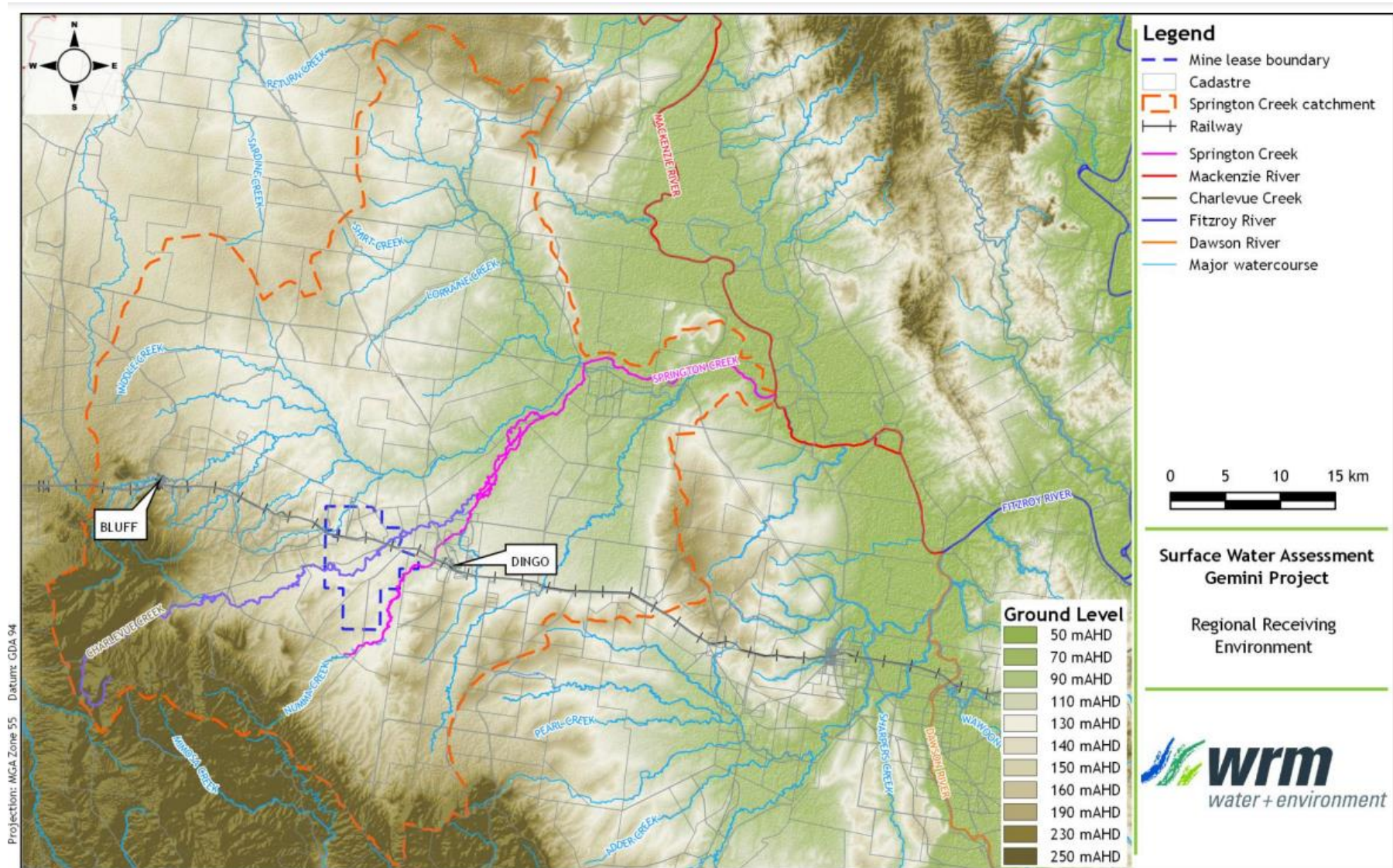


Figure 19: Watercourses and catchments of the Project region

3.1.5 Groundwater

Groundwater of the Project site has been characterised as three main groundwater units, including:

- Quaternary alluvium aquifers
- Tertiary sediments of the Duaringa Formation; and
- Permian Rangal Coal Measures.

3.1.5.1 Quaternary alluvium

Quaternary-age alluvial deposits are associated with the major drainage features of Charlevue and Springton Creek, which occur to the west and east of the proposed mining area, respectively. Alluvium recharge is via direct rainfall recharge and occurs at a low rate. This is consistent with the observation of elevated salinity in the shallow sediments, likely due to the low rate of recharge and high residence times for groundwater.

3.1.5.2 Tertiary sediments

The Tertiary sediments of the Duaringa formation are variably saturated, with the elevation of the base of the Tertiary being a control on the occurrence of water within the sediments. Observation from both exploration records and groundwater modelling suggests the presence of dry bores within the Tertiary, as well as a variation in water level between the topographically elevated base of the Tertiary and the topographically lower base of the Tertiary, suggesting that a continuous water surface does not exist in the Tertiary sediments and that the elevation of the base of Tertiary will be a control on the presence of groundwater within the sediments. The Tertiary sediments exhibit recharge and salinity characteristics similar to those of the Quaternary alluvium.

3.1.5.3 Permian Rangal Coal measures

Groundwater in the Permian sediments occurs preferentially in the coal seams due to the open nature of the cleats, providing a conduit for infiltrating rainfall. Within the Permian coal measures the coal seams are the primary conduits for groundwater flow with no significant trend for upward or downward movement of groundwater between the coal seams.

However, a trend occurs for groundwater movement through the coal seams from the southwest to the northeast, and also from the northwest to the southeast, towards a depression that is centred on the area where Mine B is proposed to be developed. The coal seams are recharged in subcrop areas where the coal seams directly underlay Tertiary and/or Quaternary sediments. The extremely high salinity of groundwater within the coal measures supports an interpretation of a low rate of recharge to these units.

A minor occurrence of Tertiary basalt has been identified from geological drilling to the north of Mine A. The basalt area is approximately 600 m long, 200 m wide and 20 m thick and has been interpreted as a localised basalt paleochannel (JBT 2019) (Appendix E). One groundwater monitoring bore was located within the basalt (bore DW7105W1); the bore was 23 m deep and was found to be dry. The basalt flow is considered dry (as it lies above the regional groundwater level) and of limited extent. It is, therefore, not considered an important groundwater feature within the project area. Extensive geological drilling across the project area has shown no other evidence of basaltic flows or intrusions (JBT 2019) (Appendix E).

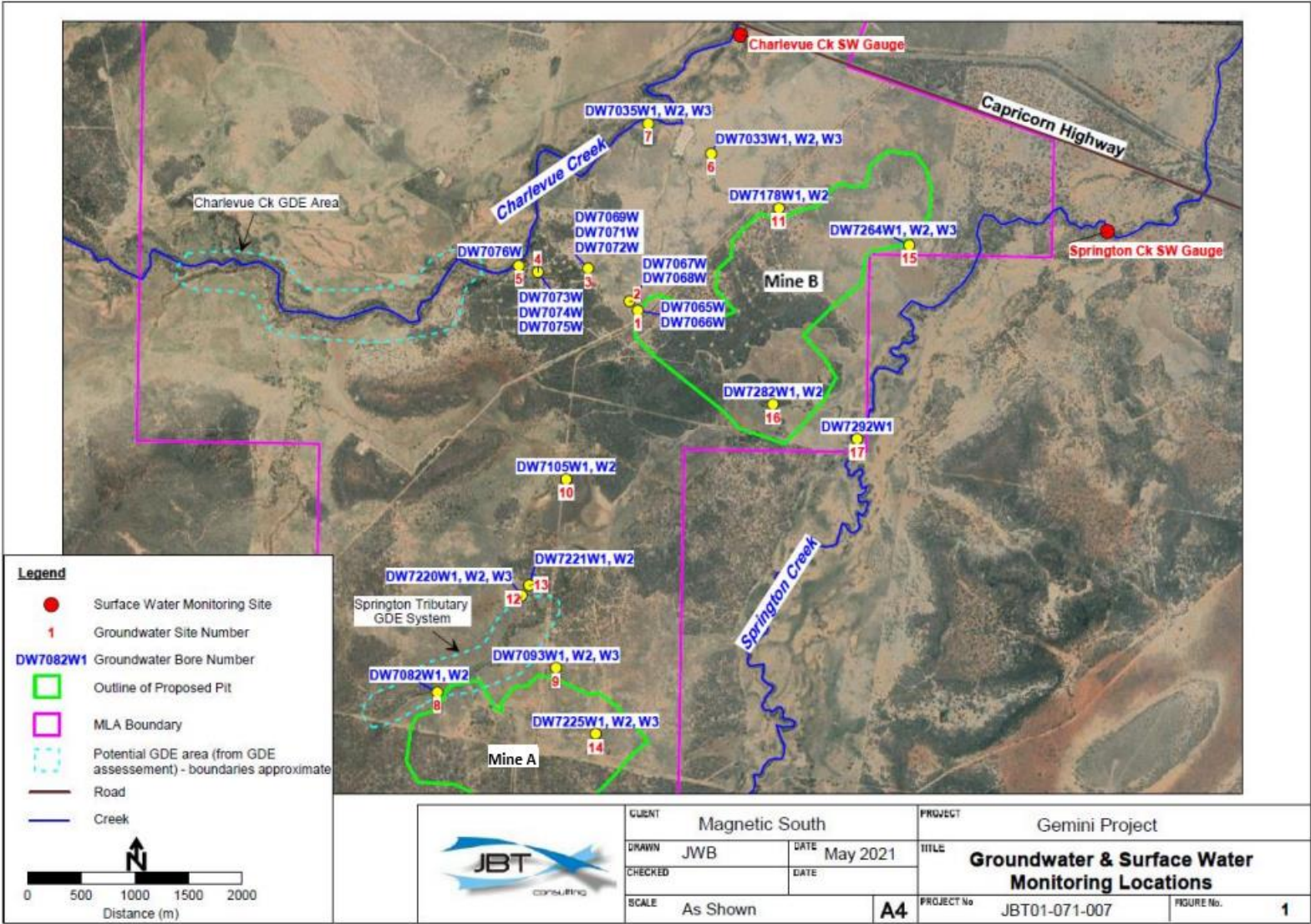


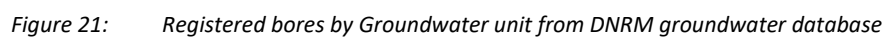
Figure 20: Groundwater and surface water monitoring locations

3.1.5.4 Regional Groundwater Use

Data from the Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development (DNRMMRRD) Groundwater Database was reviewed for the Project and the surrounding area (within 10 km) as part of the Groundwater Impact Assessment (JBT 2019) (refer to Appendix E). The available groundwater bore data are illustrated in Figure 21 and Figure 22, respectively.

The findings of the database review are summarised as follows:

- There are 48 registered bores within 10km of the Project; the majority were listed as existing, while five bores were listed as abandoned but usable.
- The majority of bores are screened within Tertiary units (26 bores) or Permian coal measures (15 bores).
- Several considerations were identified with respect to assessing baseline EC, namely:
 - Six (6) monitoring bores recorded an EC of <1000 $\mu\text{S}/\text{cm}$. These bores consisted of four sites in Tertiary sediments located outside of ML 700056 (Figure 22);
 - Fourteen (14) bores that record an EC between 1,000 and 6,000 $\mu\text{S}/\text{cm}$. A limit of 6,000 $\mu\text{S}/\text{cm}$ was assessed as this EC equates to 4,000 mg/L, which is the ANZG (2018) livestock drinking limit for beef cattle (assessed to the most likely stock use for the area); and
 - Twelve (12) bores that record an EC >6,000 $\mu\text{S}/\text{cm}$ (assessed to be of limited or no use for stock watering).



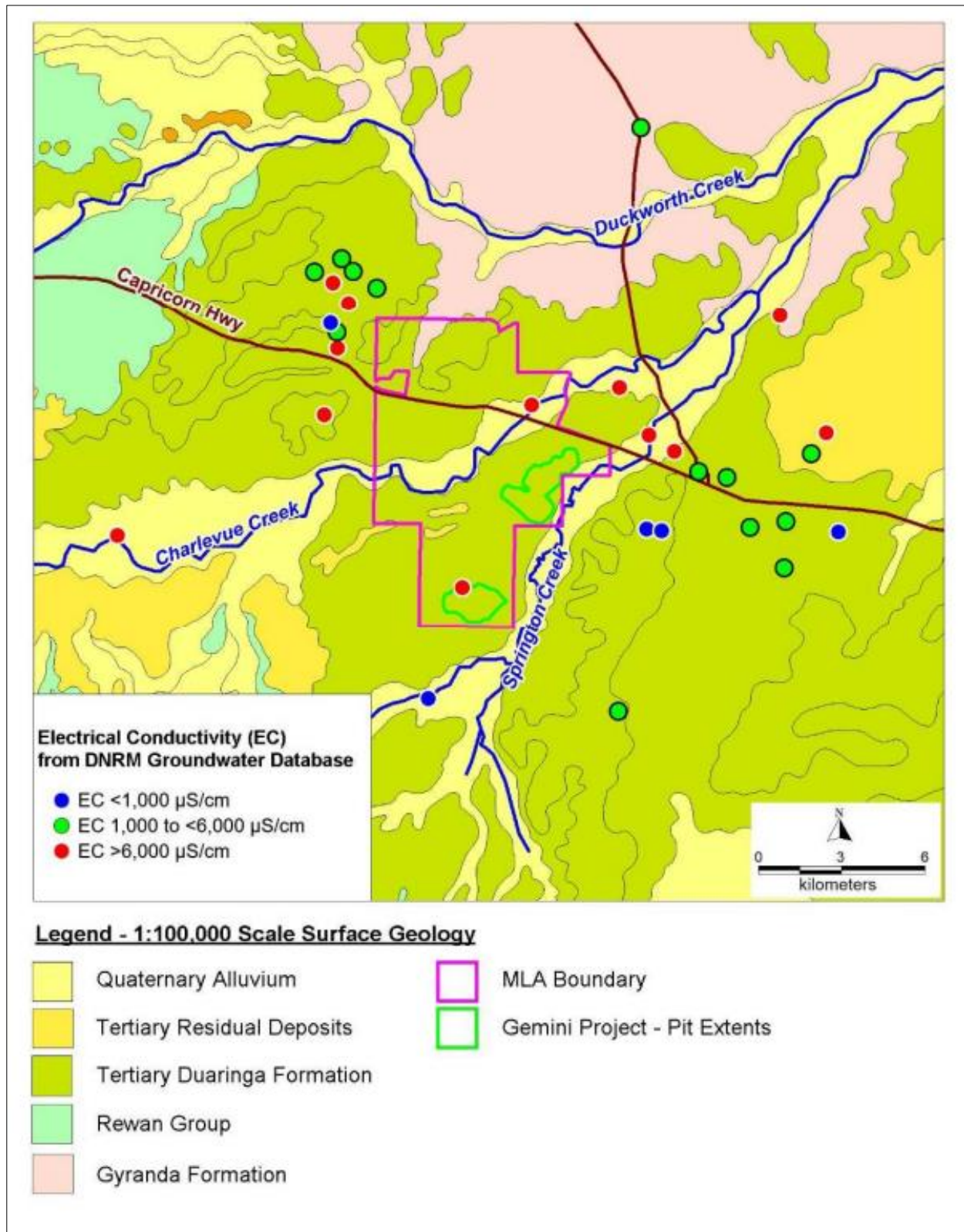


Figure 22: Registered bores by Electrical conductivity (EC) from DNRM Groundwater Database

3.1.5.5 Groundwater Quality

Regional Groundwater Quality

ANZG (2018) outlines the livestock drinking limit on total dissolved solids (salinity) for beef cattle of 4,000 mg/L, which equates to an approximate EC value of 6,000 $\mu\text{S}/\text{cm}$. Bores that recorded a salinity greater than this limit were determined to be of limited or no use for stock watering, with a decline in animal health at progressively higher salinity values.

As outlined in section 3.1.5.4, the majority of bores within or close to the ML recorded EC in excess of 6,000 $\mu\text{S}/\text{cm}$, JBT (2019) noted that the EC of groundwater within the Tertiary sediments was often in excess of 10,000 $\mu\text{S}/\text{cm}$ and at some sites in excess of 20,000 $\mu\text{S}/\text{cm}$ (highly saline). The majority of Tertiary bores outside the tenement area recorded an EC of <6,000 $\mu\text{S}/\text{cm}$, with four bores in Tertiary sediments to the east or south of the project area recording an EC <1000 $\mu\text{S}/\text{cm}$ (mostly fresh).

Local groundwater quality

Continuous groundwater monitoring has been undertaken since December 2018, with the most recent groundwater sampling completed in July 2024. Groundwater quality results are summarised in Table 10.

Table 10: Summary of groundwater quality results from monitored bores

Groundwater Unit		Field pH	EC ($\mu\text{S}/\text{cm}$)	Sulphate (mg/L)	Boron (mg/L)	Copper (mg/L)	Zinc (mg/L)
ANZG (2018) Livestock drinking water limit		6.5 - 8.5	5,970	1000	5	0.5	20
Quaternary Alluvium	Range	5.73 - 8.28	2,240 - 15,600	11-170	0.2 - 6	0 - 0.3	0 - 0.1
	Mean	7.35	10,317	104	3	0.1	0.04
	Median	7.77	13,500	137	4	0.07	0.04
Tertiary Sediments	Range	5.74 - 12.20	387 - 27,300	17-645	0.2 - 2	<0.001 - 0.01	<0.005 - 3
	Mean	7.61	13,641	212	0.8	<0.001	0.1
	Median	7.65	13,150	166	0.7	<0.001	<0.005
Coal Seams	Range	5.59 - 12.50	24 - 28,900	4 - 817	0 - 2	0 - 0.01	0 - 2
	Mean	7.50	14,493	302	0.8	<0.001	0.07
	Median	7.56	14,300	230	0.7	<0.001	0.01

All groundwater units (Quaternary alluvium, Tertiary sediments and Permian coal measures) recorded very high EC with values occurring above the ANZG (2018) livestock drinking limit for beef cattle (5,970 $\mu\text{S}/\text{cm}$). Salinity increases with aquifer depth, and groundwater units within the Project are unlikely to be used for stock watering. Samples were also relatively variable in sulphate concentrations, with the highest levels recorded in the coal seams. Sulphate concentrations in all groundwater units were recorded below the livestock drinking water limit of 1,000 mg/L.

The pH (field testing) of groundwater within the Project area was primarily neutral; however, some sharp increases in pH were observed within the tertiary sediments and coal seams. Given the low mean and median values for these seams, it is reasonable to conclude that such exceedances are rare and are not representative of the groundwater quality surrounding the Project, which is generally neutral.

Groundwater quality was typically below the ANZG (2018) livestock drinking water limit for boron, copper and zinc.

3.1.5.6 Hydraulic Conductivity of aquifers

Falling head tests were undertaken on 25 bores from the Project bore network to obtain site-specific hydraulic conductivity data from all Project groundwater units. Hydraulic conductivity and air-lift yield data for each monitoring bore is in Table 4-2 of Appendix E (JBT 2019) and has been summarised for each groundwater unit in Table 11.

A total of 17 slug tests were performed on bores screened within the coal seams. The hydraulic conductivity decreased with depth, with the difference evident when comparing coal seam bores screened at a depth of less than 80 meters below ground level (mbgl) to bores screened at a depth greater than 80 mbgl.

Table 11: Hydraulic conductivity and Air-Lift yield data per groundwater unit

Groundwater Unit	No. of Tests	Hydraulic Conductivity (metres per day)			Average Air-lift Yield (L/s)
		Min	Max	Geometric Mean	
Quaternary Alluvium	1	0.097	-	-	-
Tertiary	5	0.027	3.805	0.27	0.548
Permian Coal Seams	17	0.002	5.387	0.13	1.185
Coal Seams <80 mbgl	11	0.012	5.387	0.37	1.578
Coal Seams >80 mbgl	6	0.002	0.245	0.02	0.320
Permian Interburden	2	0.001	0.002	-	-

The relationship between hydraulic conductivity and depth is shown graphically in Figure 23. The data for the coal seam bores are of particular interest. The trend line and the 95% confidence interval applied to the data illustrate the trend for lower hydraulic conductivity with increasing depth.

The Permian coal seams, specifically those less than 80 mbgl, are the primary conduits for groundwater flow at the Project. As identified in Table 11, coal seams located <80 mbgl had the highest hydraulic conductivity maximum and geometric mean, which is further reflected in the average air-lift yield. With pit depths expected to reach approximately 80 mbgl, it is unlikely that groundwater inflows will occur as a result of the deeper coal seams. When comparing the estimated hydraulic conductivity and air-lift yield for the coal seams against the interburden/overburden units, the apparent increases strongly support the understanding that the Permian coal seams are the primary conduits for groundwater flow.

Despite this, the Gemini geology is heavily faulted, which may act to influence groundwater occurrence and movement through the identified groundwater units. Shear zones associated with faulting may act as a store of water and as locally higher hydraulic conductivity zones. As recharge to the groundwater system is assessed to be low, the faults may initially provide relatively high inflow rates to the workings. Still, the total storage within the faults is anticipated to be relatively low, with the initial inflow rates not able to be sustained in the long term. Where the faults completely disrupt the coal seams, especially in cases where the coal seam terminates against lower-hydraulic conductivity interburden, the faults will act to disrupt groundwater flow.

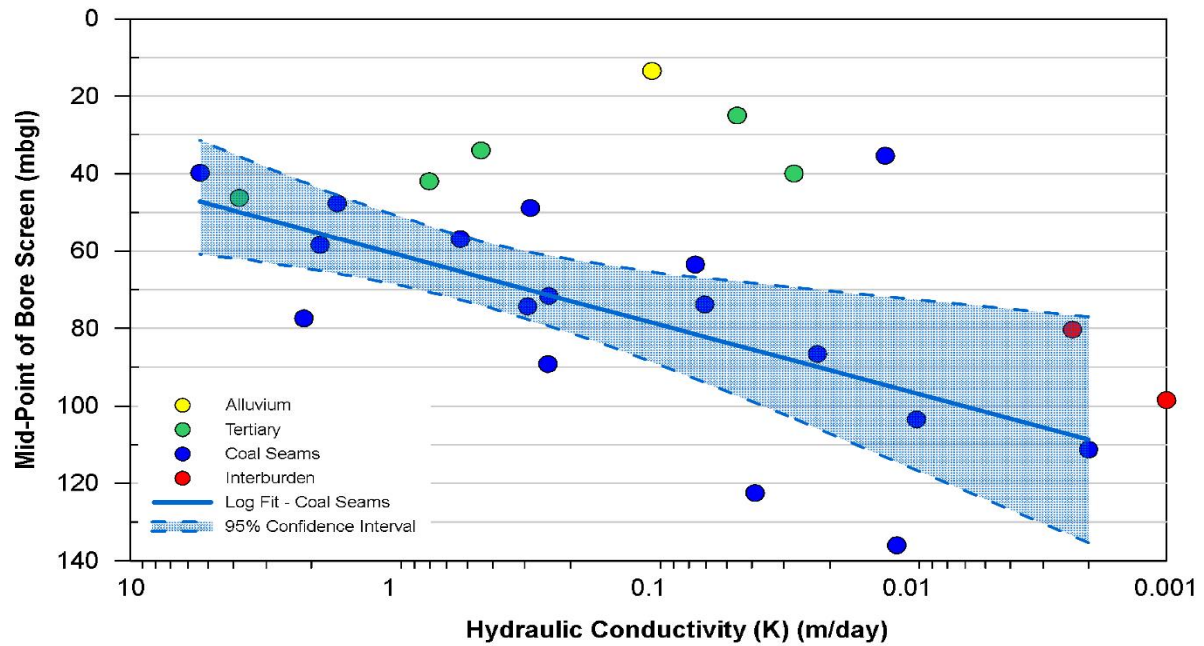


Figure 23: Relationship between hydraulic conductivity and depth

3.1.5.7 Groundwater Level

Groundwater monitoring has continued to be undertaken at Gemini after the original EA Application, with the most recent monitoring data collected in November 2024. Groundwater level data at the Gemini Project site has been assessed over a two-year period and can generally be described as follows:

- Alluvium groundwater levels range from 11 m to 14 m below ground level (mbgl) for bores adjacent to the creek channels, with an average standing water level of 13 m below ground level (105 mAHD);
- the water level within the Tertiary sediments ranges from dry (5 bores, ranging in depth from 14 to 23 m) to 16 to 47 mbgl (where water is present). The presence of water within the Tertiary sediments is related to the RL of the base of Tertiary and from review of available data it is assessed that it is probable that the Tertiary sediments are dry above 120 mAHD and likely dry above 110 mAHD, with the average groundwater level sitting at 97 mAHD; and,
- the water level in the coal measures ranges from 18 to 48 mbgl, with an average water level of 99 mAHD, approximately 31 mbgl.

A graph showing the groundwater levels over the two-year period can be found in Figure 24. Groundwater levels across the Tertiary units and Permian Coal Seams, modelled from the existing bore network, are illustrated in Figure 25 and Figure 26.

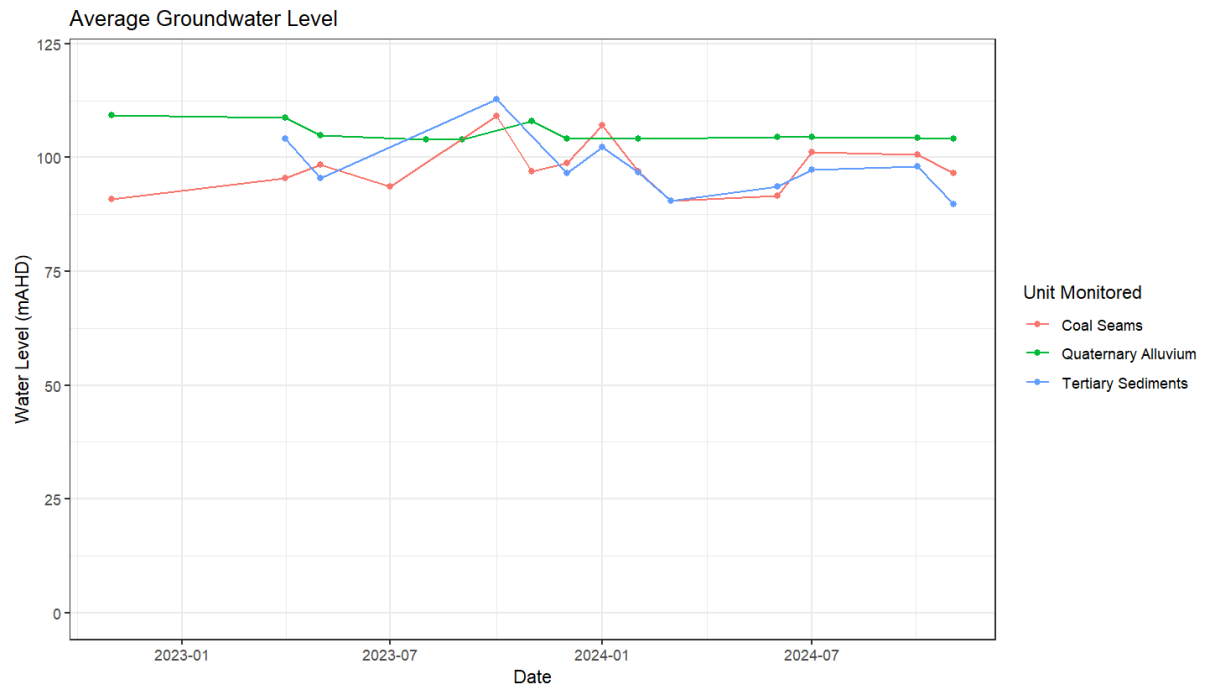


Figure 24: Baseline groundwater levels at Gemini

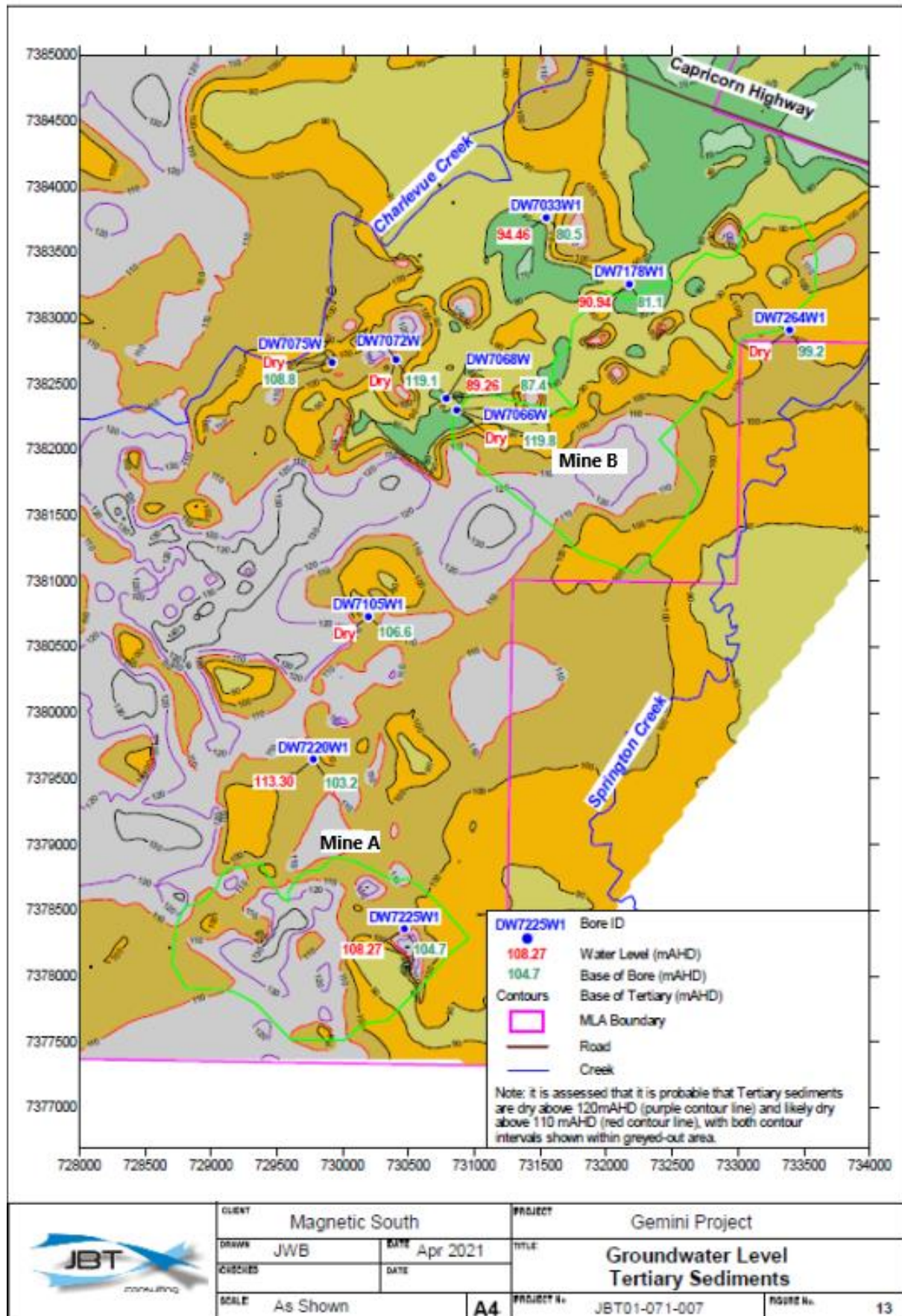


Figure 25: Groundwater level – Tertiary sediments

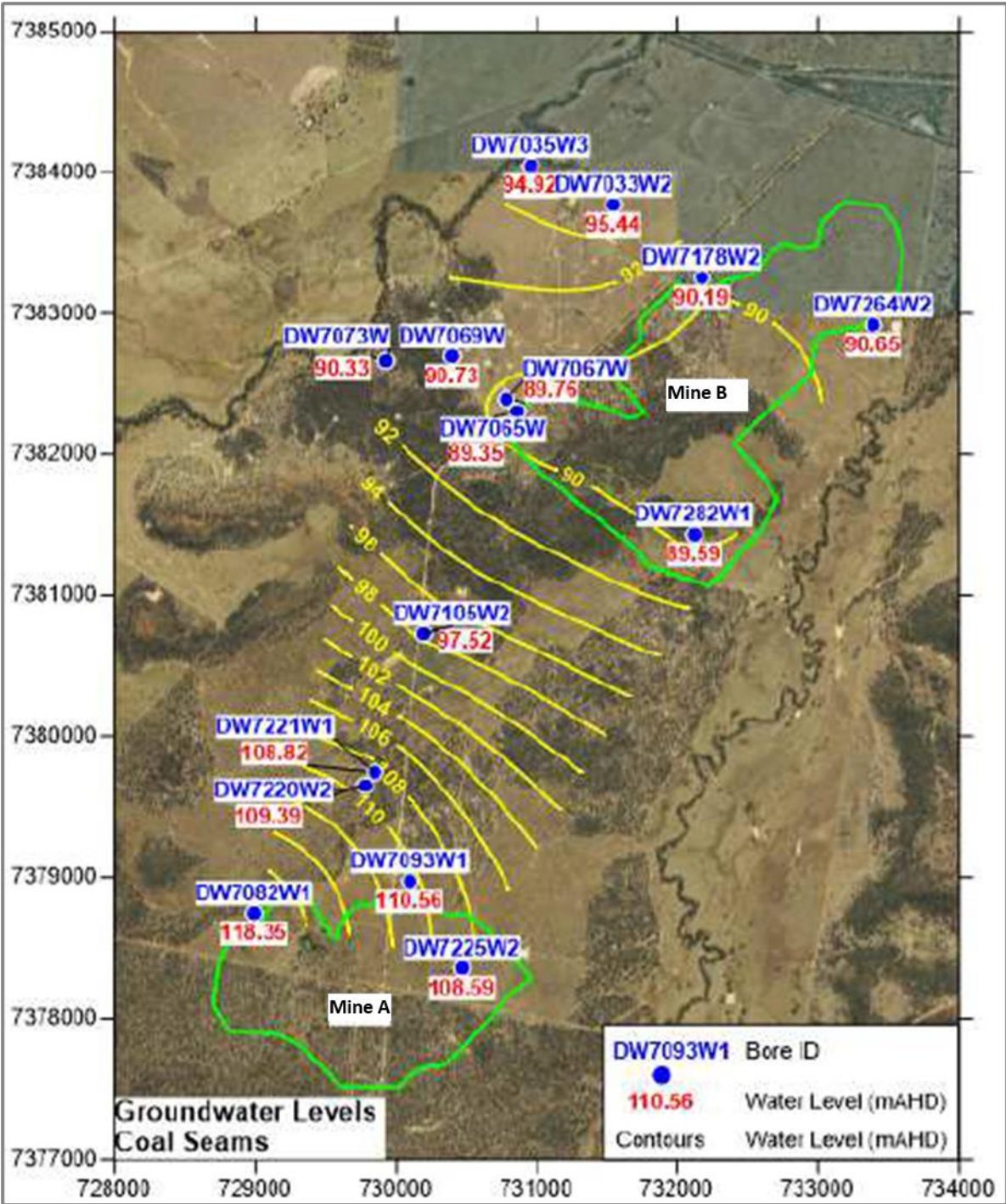


Figure 26: Groundwater level - Permian coal seams

3.1.6 Land and Soil

3.1.6.1 Underlying landholders

The properties underlying the Gemini ML include freehold, leasehold and road reserve land parcels owned by Magnetic South or the State of Queensland (Department of Transport and Main Roads). Underlying land ownership is outlined in Table 12 and shown in Figure 27.

A number of publicly gazetted road reserves are located within the ML, including the Capricorn Highway and Cooina Road. The Blackwater Railway occurs within leasehold land (643 / SP260475) along the northern side of the Capricorn Highway. The Capricorn highway will be used for site access to facilitate the delivery of goods and services, access by mine personnel and other activities. The Blackwater Railway will be used for the transport of coal, with a TLO and rail loop proposed to be constructed on the ML north of the Capricorn highway. Cooina Road currently runs through the Mine A footprint and will be closed and diverted prior to impact. The new road alignment is not within the scope of the EA (P-EA-100114292), with separate approvals required. As such, it falls outside of the scope of this PRCP.

Table 12: Underlying land ownership

Registered Owner/s	Lot / Plan	Tenure	Property Name
Blue Valley Land Pty Ltd	100 / SP325594	Freehold	Redrock
Magnetic South	1 / RP904099	Freehold	Ellesmere
	2 / RP904099	Freehold	
	1 / HT424	Freehold	Longdale
	2 / HT138	Lands Lease	Sanders
	47 / H406	Freehold	Fairview
	4 / HT165	Freehold	Gumflat
	4 / RP801280	Freehold	Olives
The State of Queensland (Department of Transport and Main Roads)	643 / SP260475	Lands Lease	Rail corridor
	624 / SP260477	Lands Lease	

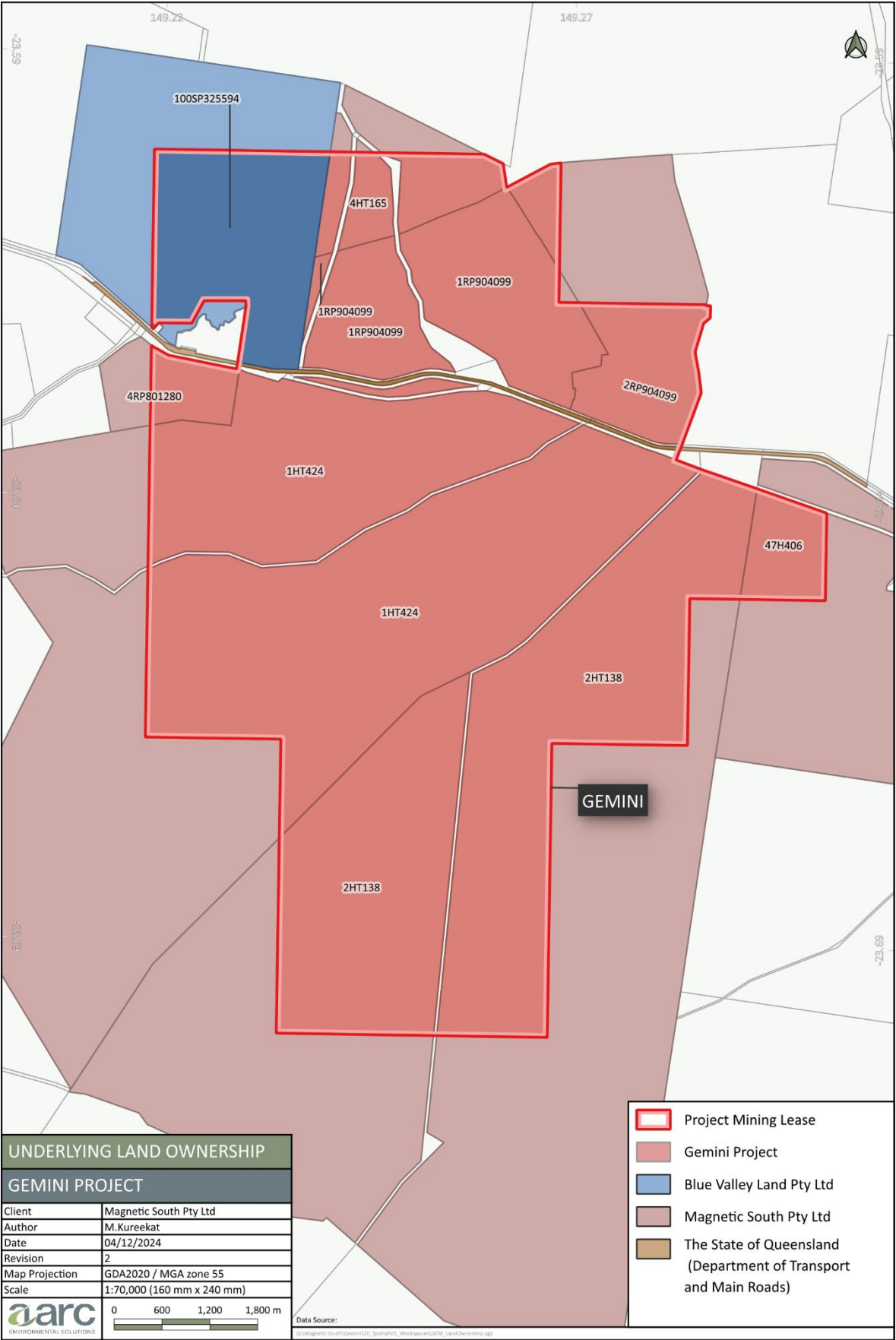


Figure 27: Land ownership

3.1.6.2 Current land use

The Central Highlands Regional Council Planning Scheme (2016) identifies the majority of the Project area as being zoned as rural land use which has a purpose defined as to:

- provide for rural uses and activities; and
- provide for other uses and activities that are compatible with—
 - existing and future rural uses and activities; and
 - the character and environmental features of the zone; and
- maintain the capacity of land for rural uses and activities by protecting and managing significant natural

Other minor land use classifications over the site include residential, reservoir/dam, marsh/wetland, and, primarily in association with the Capricorn Highway, transport and communication, utilities, and services. resources and processes.

The land within the Project boundary is currently used for low-intensity cattle grazing and resource exploration activities. Cattle grazing, being the major land use within the Project, reflects the land suitability assessment, which describes the site as predominantly Class 3 (70%) and a much smaller portion of Class 2 (17%), suitable for grazing with moderate and minor limitations, respectively. Most of the area has been cleared for cattle grazing; however, some patches of remnant vegetation remain, including riparian vegetation along Charlevue Creek. The land in and around the Project is also used for purposes other than cattle grazing, including road transport, stock routes, protected areas, and coal mining.

3.1.6.3 Land Systems

Two land systems are mapped within the Project area and are described as follows.

Dingo Land System

The Dingo land system is characterised by fluvial plains surrounding significant waterways. It is mostly composed of stable flood plains traversed by a branching pattern of drainage floors. The majority of deposits are weathered alluvium, with slopes of coarser or finer textured alluvium (depending on flow patterns). Channels can be up to 30 m wide and 3 m deep, with fringing riparian vegetation. Main drainage floors can then extend 800 m outwards, with deep texture contrast sandy loams over mottled clays, and open spaces of *Eucalyptus tereticornis* (blue gum) and *Eucalyptus crebra* (narrow-leaved ironbark) with sparse shrubs. Large plains surround drainage features (up to 3 km wide) which can contain either deep texture contrast soils with *Eucalyptus populnea* (poplar box) woodlands, or deep layered soils on alluvium with woodlands of blue gum and narrow-leaved ironbark. Slopes within this land unit are usually the result of strongly Gilgai shrink-swell clays, forming depressions of finer soil textures with *Acacia harpophylla* (brigalow) scrub. Geology in this unit is comprised of weathered Quaternary alluvium.

Melbadale Land System

The Melbadale land system is characterised by the shallow dissection of weathered tertiary land surfaces, forming undulating plains dominated by complex depositional mid and lower slopes, with minor lateritic upper slopes in some places. This land system features moderately dense branching drainage patterns, with local relief usually less than 15 m. Depending on the steepness of terrain, upper slopes are often dominated by deep loamy red earths (gentle slopes) with narrow-leaved ironbark, or shallow fine sandy loams (steep terrain) with *Acacia shirleyi* (lancewood) forests. Mid to lower slopes are often associated with deep texture contrast soils of loamy sands overlying mottled sandy clays, with grassy woodlands of open-spaced narrow-leaved ironbark and shrubs. Lower slopes are often associated with deep light to medium clays, with tall forests of narrow-leaved ironbark. Tributaries have variable soil textures depending on slope, though stratified loams and texture contrast soils are common.

The geology in this land system consists of Quaternary to late Tertiary colluvial/alluvium, lateralised tertiary sandstone, conglomerate, and shale.

3.1.6.4 Areas of regional interest

The Project activities are not located within mapped areas of regional interest; however, a strategic cropping land trigger area exists northeast of the Project. The Project does not intersect any areas mapped as priority living areas, priority agricultural areas, strategic cropping land, or strategic environmental areas.

3.1.6.5 Soil types, properties and productivity

A Soil and Land Suitability Assessment was undertaken within the ML by AARC (2019) (Refer to Appendix E). A total of 12 SMUs were identified within the Project. Table 13 provides an overview of each SMU and its extent within the ML. The spatial distribution of the SMUs has been mapped at a scale of 1:70,000, as illustrated in Figure 28.

Methodologies employed throughout this study are detailed in (AARC 2019) (Appendix E) and followed procedures in the *Australian Soil and Land Survey Field Handbook* (NCST 2009) and the *Guidelines for Surveying Soil and Land Resources* (McKenzie et al. 2008). The soil survey was based on a free-survey technique with soil profile and observation sites located to best represent all soil types present in the Project. At the time of the survey, the Project ML boundary was subject to various alterations. Consequently, the study area was based on the EPC 881 boundary, land owner access, and a 5 km buffer around the boundary of the Walton State Forest. No acid sulphate soils have been identified within the Project.

As assessment of the suitability of the below soil types for rehabilitation can be found in section 3.1.6.6.

Table 13: SMUs within the study area

SMU	Surface Area (ha)	Percent of Study Area (%)	General Description
Anderson	37.8	0.61	Hard-setting soil unit associated with isolated hills. Soil textures grade from loams at the surface to light medium clays with depth, sometimes exhibiting red mottling. Vegetation associated with this unit includes <i>Eucalyptus crebra</i>, <i>Corymbia clarksoniana</i>, and <i>Acacia rhodoxylon</i> with <i>Erythroxylon australe</i> in the shrub layer. The Anderson SMU has a very strongly acidic pH throughout the profile, ranging from 4.6 in the topsoil to 4.8 in the lower subsoil. EC and chloride results indicate that salinity is very low at all depths, with EC ranging from 0.064 deciSiemens per metre (dS/m) in the topsoil to 0.02 dS/m in the subsoil layer. Chloride concentrations reflected this result, decreasing with depth from 30 mg/kg to 10 mg/kg, both well below toxic limits.
Barry	156.5	2.54	Hard setting soil associated with rivers, drainage lines and levees. Surface soils in this unit are comprised of clay loams to medium clays, grading into light or medium clays at variable depths. Dominant vegetation includes <i>Eucalyptus tessellaris</i>, <i>Eucalyptus populnea</i> and <i>Eucalyptus tereticornis</i>, with <i>Bauhinia hookeri</i>, <i>Carissa spinarum</i> and <i>Cassia brewsteri</i> in the shrub layer. The Barry SMU has a slightly acidic pH (6.5), which increases gradually with depth, becoming neutral at 0.2 m (6.8) and increasing to pH 7.2 with depth. EC is very low throughout the profile, ranging from 0.063 dS/m in the topsoil to 0.012 dS/m in the lower subsoil. Chloride concentrations reflect this result, ranging from 20 mg/kg to <10 mg/kg with depth.
Charlevue	232.9	3.77	Hard-setting soil associated with plains and rises. Textures within this unit grade from sandy clay loams or light clays in the surface soil to medium-heavy clays in the subsoil horizons. Dominant vegetation includes <i>Eucalyptus populnea</i> and <i>Eucalyptus crebra</i>, with <i>Flindersia dissosperma</i> (sometimes dominant) and <i>Carissa spinarum</i> in the shrub layer. The Charlevue SMU has a variable pH ranging from 5.4 (strongly acid) in the topsoil to 7.9 (moderately alkaline) in the lower subsoil. EC is medium in the surface soil (0.28-0.43 dS/m) and increases to high in the subsoil (0.46 dS/m). Chloride is considered to be high from 0.2 m depth downwards (>600 mg/kg), which can cause toxicity by interfering with plants' osmotic capacity.
Cooinda	34.9	0.57	Hard-setting soil associated with plains. Texture development within this unit is gradual, changing from a sandy clay loam in the topsoil to a sandy light clay at mid-depth and a medium-heavy clay in the deeper subsoil. Dominant vegetation includes <i>Eucalyptus populnea</i> and <i>Flindersia dissosperma</i> (sometimes dominant), with <i>Carissa spinarum</i> in the shrub layer. The pH of the Cooinda SMU ranges from moderately acid (5.6) in the topsoil to neutral (6.8) in the lower subsoil. EC is very low throughout the profile, with topsoil values of 0.015 dS/m, increasing to 0.043 dS/m in the subsoil. Chloride levels reflect EC, increasing from <10 mg/kg to 40 mg/kg with depth.

SMU	Surface Area (ha)	Percent of Study Area (%)	General Description
Ellesmere	14.6	0.24	Hard-setting soil associated with isolated hills of weathered tertiary surfaces (laterite). Textures within this unit grade from fine sandy loams in the surface soil to medium clays in the subsoil horizons. The dominant vegetation is <i>Acacia shirleyi</i>, with <i>Erythroxylon australe</i> in the shrub layer. The Ellesmere SMU is a highly acidic soil unit, ranging from 4.6 (very strongly acid) in the topsoil to 5.5 (strongly acid) in the lower subsoil layer. EC is very low throughout the profile, changing from 0.02 dS/m in the topsoil to 0.026 dS/m in the lower subsoil. Chloride concentrations are deficient, consistently presenting at <10 mg/kg.
Geoffrey	4,079.0	66.10	This unit consists of texture-contrast soils with soft surface conditions associated with undulating plains and rises. Textures range from loamy sands to sandy light clays, overlying sandy medium clays with conspicuous orange or red mottling. Extensive washouts and large erosion gullies were observed where these soils were exposed due to insufficient groundcover. In these areas, overland flow removed coarse sandy material, leaving the easily eroded clays exposed to surface runoff. The Geoffrey SMU was often cleared, though when present, dominant vegetation included <i>Eucalyptus crebra</i>, <i>Melaleuca leucadendra</i>, <i>Casuarina cunninghamiana</i> and <i>Corymbia clarksoniana</i>, with <i>Alphitonia excelsa</i>, <i>Petalostigma pubescens</i>, and <i>Acacia rhodoxylon</i> in the shrub layer. Due to the stark difference in textures between the topsoil and subsoil layers, pH for the Geoffrey SMU changes quite dramatically down the soil profile. Sandy, massive horizons (0.0-0.6 m) are moderately acidic, with pH gradually increasing with depth from 5.8 to 6.0. The clay B2 horizon has a pH value over two units higher (8.1) and is classified as 'moderately alkaline'. This is likely due to the increased CEC of the clay in the B2 horizon compared with the sand in the upper horizons.
James	145.2	2.35	Hard-setting red soils are associated with hills and rises. Textures within this unit vary depending on slope, with lesser-developed soils found on crests (sandy clay loams to clay loams) and more developed/deeper soils found on mid-slopes (clay loams to light medium clays). Dominant vegetation includes <i>Acacia rhodoxylon</i>, <i>Eucalyptus crebra</i>, and <i>Corymbia clarksoniana</i>. The pH in the James SMU is slightly acidic throughout the profile, with minimal variation. It increases gradually with depth from 6.2 in the topsoil to 6.4 in the lower subsoil. EC is very low at all depths, ranging from 0.013 dS/m in the topsoil to 0.015 dS/m in the subsoil. Chloride levels reflect this result, presenting at <10 mg/kg throughout the profile.

SMU	Surface Area (ha)	Percent of Study Area (%)	General Description
Kosh	927.6	15.03	Hard-setting soil associated with alluvial plains, plains, and low rises. Textures within this unit are gradational, changing from sandy clay loams and light clays in the topsoil to medium heavy clays in the lower subsoil. Commonly, this unit was cleared for grazing, with regrowth consisting of scrub species, including <i>Vachellia nilotica</i>, <i>Carissa spinarum</i>, <i>Capparis lasiantha</i>, <i>Cassia brewsteri</i>, and <i>Eucalyptus spp.</i> shrubs. When present, vegetation included <i>Eucalyptus tereticornis</i>, <i>Acacia hemiglauca</i>, <i>Acacia salicina</i>, <i>Bauhinia hookeri</i>, <i>Eucalyptus crebra</i> and <i>Eucalyptus populnea</i>. Due to the stark difference in textures between the topsoil and subsoil layers, pH for the Kosh SMU changes quite dramatically down the soil profile. Sandy, massive horizons (0.0 to 0.6 m) are moderately acid, with pH gradually increasing with depth from 5.8 to 6.0. The low CEC calculated for this unit resulted in extremely low concentrations of exchangeable cations. In the surface soil, calcium and magnesium were relatively equally represented, though concentrations of these cations were extremely limited.
Namoi	177.6	2.89	Hard-setting soil associated with hills and rises. Textures within this unit are gradational, with soils transitioning from a sandy clay loam in the topsoil to a light, medium clay in the subsoil. Dominant vegetation includes <i>Eucalyptus crebra</i>, with <i>Heteropogon contortus</i> and juvenile <i>Acacia spp.</i> The pH in the Namoi SMU is slightly acidic throughout the profile, with minimal variation. It increases gradually with depth from 6.2 in the topsoil to 6.4 in the lower subsoil. EC is very low at all depths, ranging from 0.013 dS/m in the topsoil to 0.015 dS/m in the subsoil. Chloride levels reflect this result, presenting at <10 mg/kg throughout the profile. CEC remains fairly consistent with depth, ranging from 4.3 milliequivalent per 100 grams (meq/100g) (very low) in the topsoil to 5.8 meq/100g (very low) in the subsoil.
Nigel	286.4	4.64	Hard-setting soil associated with isolated high-relief areas of tertiary land surface. Textures within this unit are rudimentary, grading from sands to sandy light clays. Vegetation is variable between sites but includes <i>Acacia Shirley</i>, <i>Acacia rhodoxylon</i>, <i>Eucalyptus crebra</i>, <i>Melaleuca leucadendron</i>, <i>Corymbia clarksoniana</i>, and <i>Eucalyptus tessellaris</i>. The pH within the Nigel SMU is highly variable, changing from 6.3 (slightly acid) in the topsoil to 8.5 (strongly alkaline) in the lower subsoil. EC follows a similar pattern, changing from very low, between 0.0-0.3 m depth to medium in the subsoil. CEC increases with depth from low (6.8 meq/100g) to moderate (17.4 meq/100g), likely due to the increased clay content in the subsoil layers.

SMU	Surface Area (ha)	Percent of Study Area (%)	General Description
Normanby	48.50	0.79	Deep red earth with soft surface condition, associated with plains, and the flat areas of upper slopes. Textures within this unit are relatively consistent throughout the profile, ranging from loamy sands to sandy light medium clays. Vegetation is mostly cleared, but when present, includes <i>Eucalyptus crebra</i> and <i>Alectryon oleifolius</i>. The Normanby soil unit has a neutral to slightly acidic pH throughout the soil profile, decreasing with depth from 6.7 to 6.1. EC is very low throughout the profile, ranging from 0.036 dS/m in the topsoil to 0.003 dS/m in the subsoil. Chloride levels reflect this result, presenting at less than 10 mg/kg at all depths. CEC measurements are considered very low, ranging from 2.4 meq/100g to 1.6 meq/100g with depth. The limited nutrient-holding capacity of the Normanby soil unit can be attributed to its low clay content and low organic matter levels.
Wallace	32.00	0.52	Shallow, self-mulching, cracking clay associated with upper slope flats. Textures within this unit grade from medium heavy clays to heavy clays, with the B3/C horizon met at approximately 0.24 m depth. The Wallace SMU is extensively cleared, with the boundary of the unit corresponding to an increase in standing vegetation. The dominant grass species is likely <i>Aristida latifolia</i>, with confirmation required during the wet season when an accurate identification can be made. The pH within the Wallace SMU is variable, changing from 6.8 (neutral) in the topsoil to 7.4 (slightly alkaline) in the lower subsoil. EC changes from low in the topsoil to very low in the lower subsoils (0.09 - 0.038). CEC increases with depth from high (39 meq/100g) to very high (44 meq/100g), likely due to the increased clay content in the subsoil layers. High clay content, low sodicity, and desirable nutrient concentrations make this unit one of the best growth mediums in the survey area.

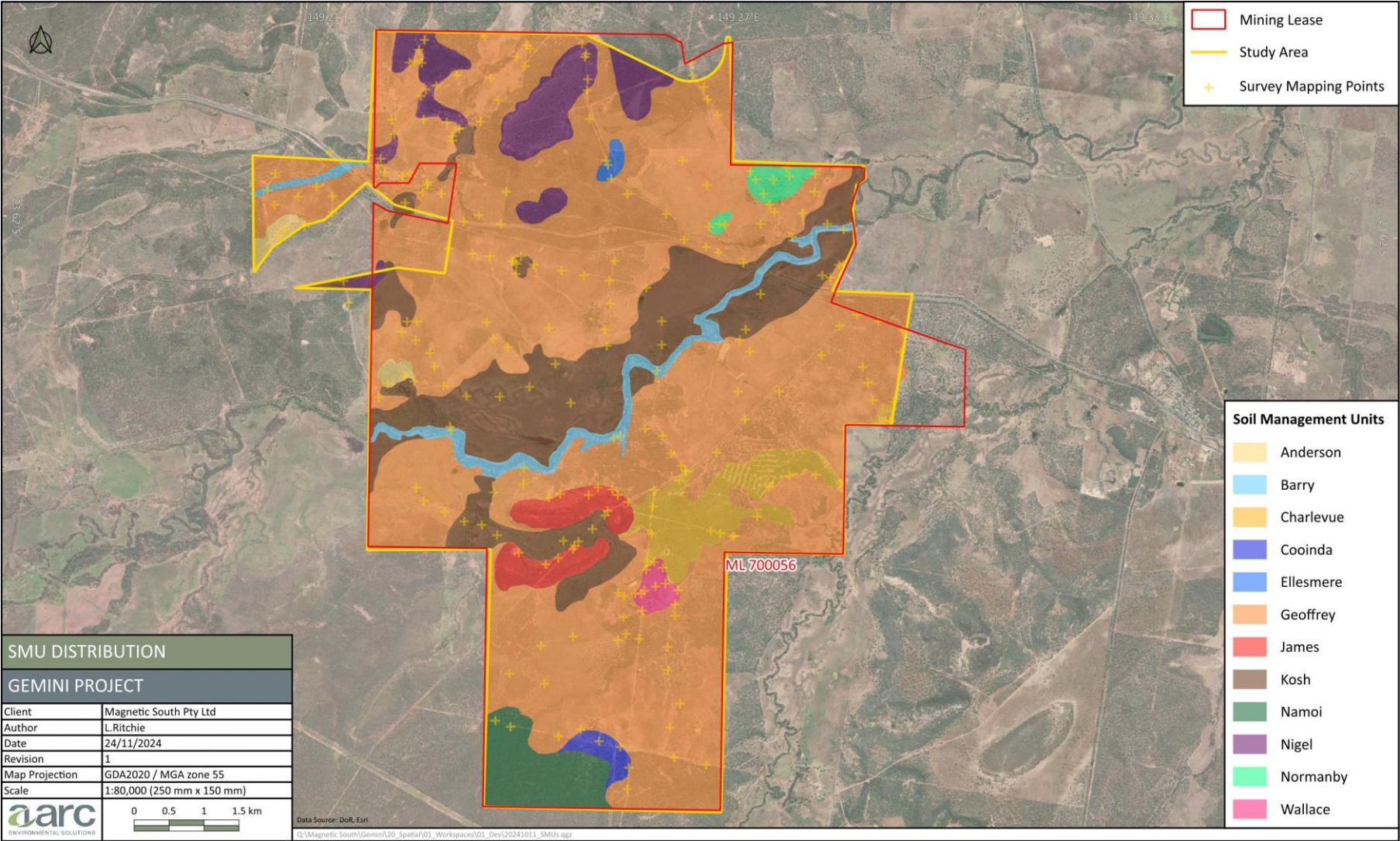


Figure 28: Distribution of SMUs across the Project site

3.1.6.6 Land Suitability

The *Soil and Land Suitability Assessment* (AARC 2019) (Appendix E) considers environmental factors including climate, soils, geology, geomorphology, erosion, topography and the effects of pre-mine land use. The classification indicates the potential of the land to be used for a range of agricultural activities.

The assessment for land suitability (cattle grazing and dryland cropping) was carried out in accordance with the methodologies described in:

- Guidelines for Agricultural Land Evaluation in Queensland (DSITI & DNRM 2015); and
- Chapter 10 (Suitability framework for the inland Fitzroy and southern Burdekin area) of the Regional Land Suitability Frameworks for Queensland (DNRM & DSITI 2013).

An interpretation of the data collected on the physical, chemical and nutritional characteristics of the soil was made to rank the land according to the five-class land suitability system provided in the *Technical Guidelines for Environmental Management and Exploration and Mining in Queensland* (DEM 1995). Although the PRCP follows the *Rehabilitated mined land suitability for beef cattle grazing in the Bowen Basin (2023)* guideline. The five land suitability classes used for assessing the land are defined in Table 14.

Table 14: Agriculture and conservation land class

Agricultural Land Class	Type	Description
Class 1	Agricultural	Suitable land with negligible limitations. This is highly productive land requiring only simple management practices to maintain economic production.
Class 2	Agricultural	Suitable land with minor limitations which either reduce production or require more than the simple management practices of class 1 land to maintain economic production.
Class 3	Agricultural	Suitable land with moderate limitations which either further lower production or require more than those management practices of class 2 land to maintain economic production.
Class 4	Agricultural	Currently unsuitable land. The limitations are so severe that the sustainable use of the land in the proposed manner is precluded. In some circumstances, the limitations may be surmountable with changes to knowledge, economics, or technology.
Class 5	Agricultural	Unsuitable land with extreme limitations that preclude its use.

Notes: Green shading indicates that the land is suitable for agricultural purposes whereas red shading indicates that the land is unsuitable.

The land use of the Project area is more suitable for cattle grazing than dryland cropping based on the average land suitability class across the identified SMUs of the Project. A summary of the land suitability classes for both dryland cropping and cattle grazing for each SMU identified within the study area is provided in Table 15.

Table 15: Land suitability classes for SMUs

SMU	Land Suitability Class (Grazing)	Land Suitability Class (Cropping)
Anderson	4	4
Barry	2	3
Charlevue	4	5
Cooinda	3	5
Ellesmere	3	5
Geoffrey	3	5
James	4	4
Kosh	2	5
Namoi	3	4
Nigel	4	5
Normanby	4	4
Wallace	3	5

Notes: Green shading indicates that the land is suitable for agricultural purposes whereas red shading indicates that the land is unsuitable

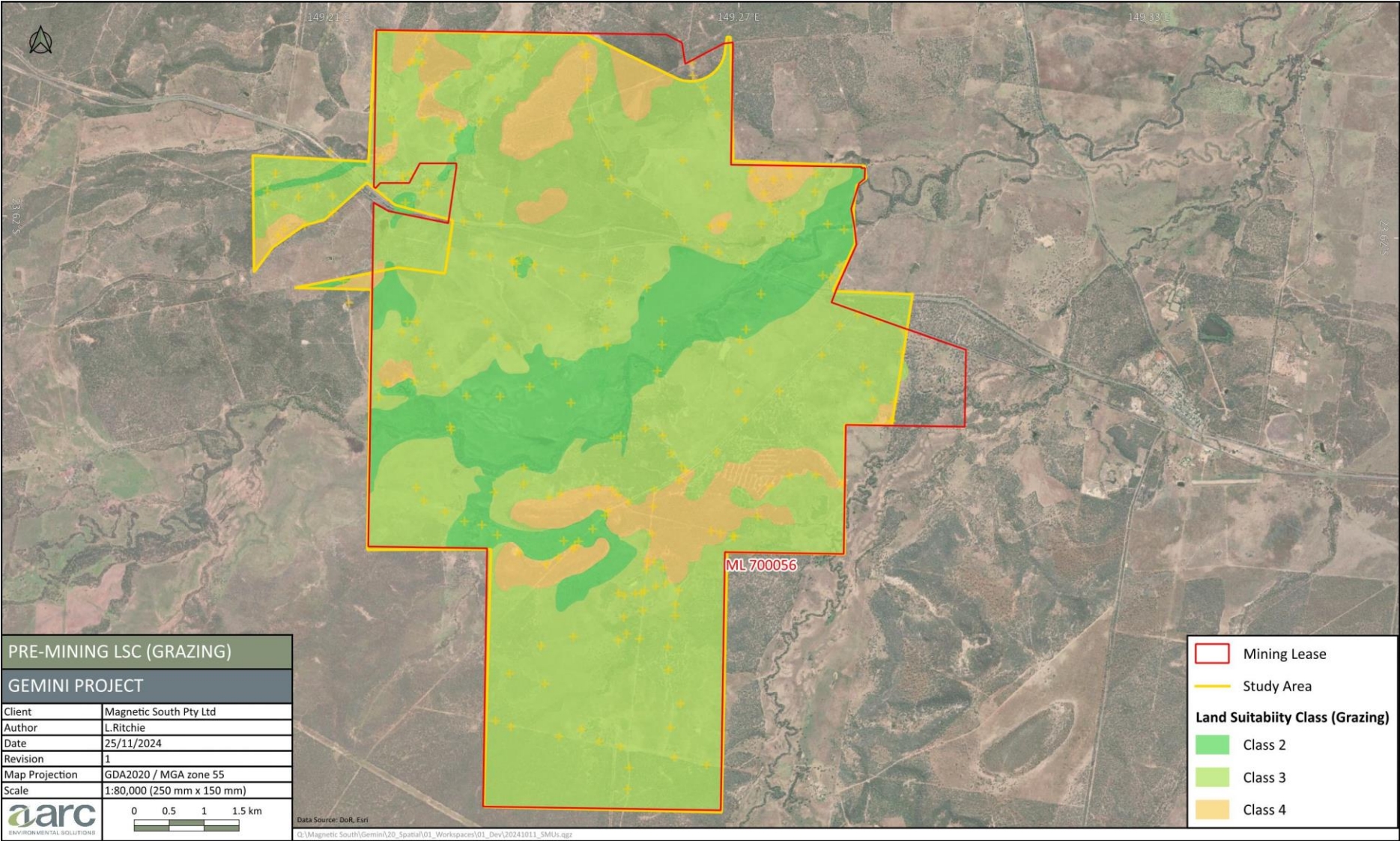


Figure 29: Pre-mining land suitability classes (grazing)

3.1.7 Flora and fauna

3.1.7.1 Terrestrial Flora

The Project area falls within the Brigalow Belt bioregion, which is characterised by Brigalow (*Acacia harpophylla*) woodland but also presents other vegetation such as semi-evergreen vine thickets, dry eucalypt woodlands, and native Bluegrass (*Dichanthium sp.*) grasslands. Due to its size, the Brigalow Belt bioregion covers a broad climatic gradient and a diversity of soils and topography. As a result of agricultural and other land development activities, most of the relatively undisturbed areas are confined to the rugged parts of the landscape.

Surveys of the study area identified one non-remnant vegetation community and six remnant vegetation communities comprising four different Regional Ecosystems (REs). Table 16 outlines the RE characteristics of each vegetation community, where applicable, and provides a short description of the vegetation present. The distribution of vegetation communities across the Project site is illustrated in Figure 30.

Table 16: Vegetation community overview

Vegetation Community	Regional Ecosystem	Community Description	VM Act status
VC 1	11.5.2	Narrow-leaved ironbark and Clarkson's bloodwood woodland with a sparse shrub layer on sand plains.	Least concern
VC 2	11.7.2	Lancewood (<i>Acacia shirleyi</i>) and/or Rosewood (<i>Acacia rhodoxylon</i>) woodland on lateritic duricrust.	Least concern
VC 3	11.3.25	Blue gum (<i>Eucalyptus tereticornis</i>) or <i>E. camaldulensis</i> with <i>Bauhinia</i> spp. and <i>Casuarina cunninghamiana</i> fringing woodland on drainage features.	Least concern
VC 4	11.3.2	Poplar box (<i>Eucalyptus populnea</i>) woodland on alluvial plains.	Of concern
VC 5	11.5.2/ 11.3.25	Mixed polygon where the dominant vegetation community was VC 1 (<i>Eucalyptus crebra</i> and <i>Corymbia clarksoniana</i> woodland) but along ephemeral creeks and with an important presence of Blue gums.	–
VC 6	11.3.25/ 11.3.2/ 11.5.2	Mixed polygon as a result of a combination of VC 3 with elements of VC 4 and some elements of VC 1 due to edge effects.	–
Non-Remnant	NA	Non-remnant vegetation	–

Consistent with the surrounding country, the ML has predominantly been cleared of remnant vegetation (Figure 30) and is subject to low-intensity cattle grazing. The remaining extent of remnant vegetation consists of patches of Eucalypt woodland within riparian areas and on flat plains. These communities are mapped as riverine wetlands associated with a major watercourse or floodplain. *Acacia sp.* closed woodlands occur on higher ground.

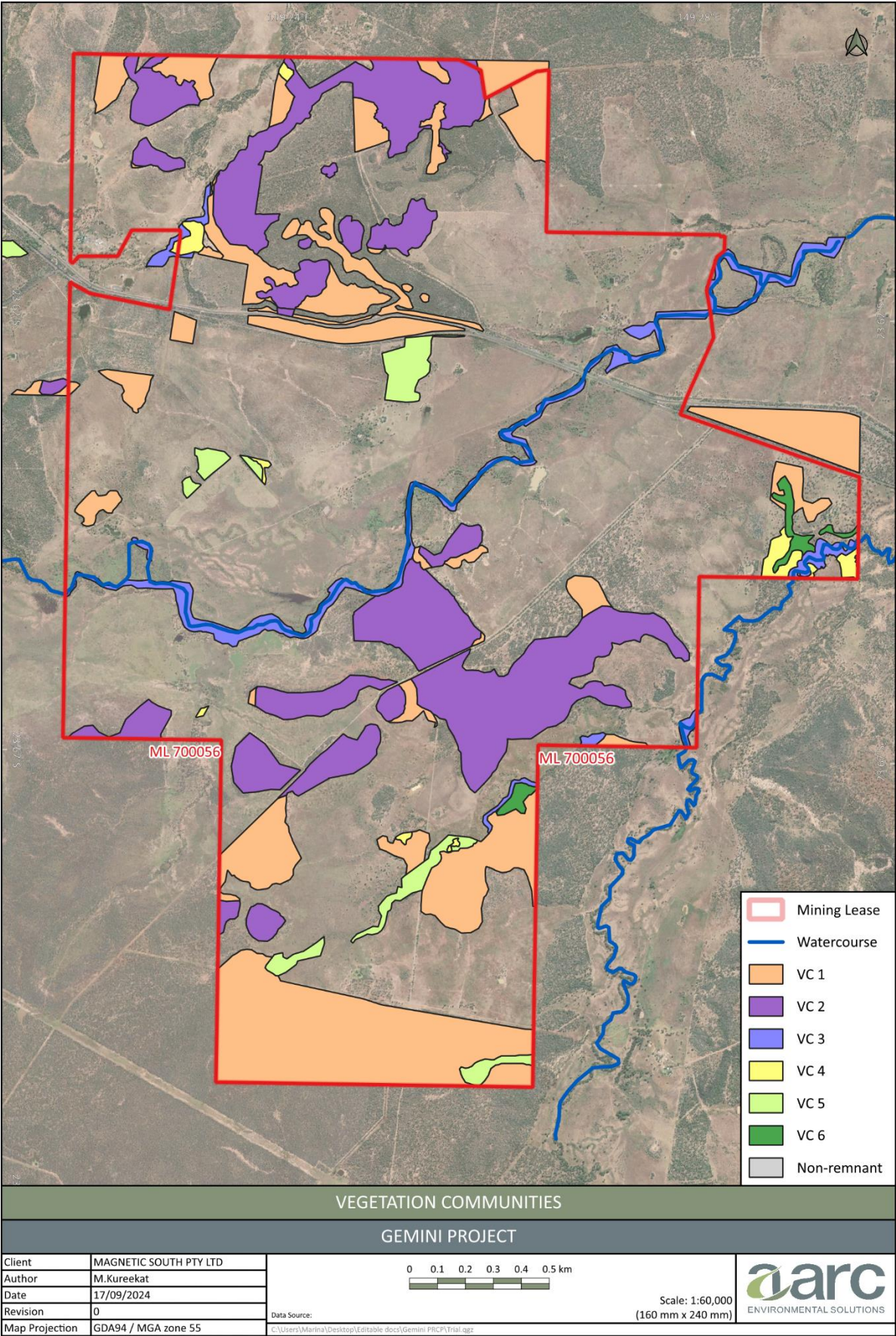


Figure 30: Vegetation communities occurring within the study area

Flora species of conservation significance

The near threatened plant species *Cerbera dumicola* was identified in two rocky areas to the central west of the ML. The project design avoids impacts on these populations.

Weed observation

Five flora species classified as Weeds of National Significance (WoNS) and/or restricted invasive species under the *Biosecurity Act 2014* (Biosecurity Act) (DAF 2023) were identified on the ML. Category 3 restricted invasive species must not be distributed by sale, gift, or release into the environment. These species are identified in Table 17 along with the species' weed status.

Table 17: Weeds of National or State significance

Scientific name	Common name	WoNS Status	Biosecurity Act 2014
<i>Harrisia martinii</i>	Harrisia cactus	n/a	Category 3
<i>Cryptostegia grandiflora</i>	Rubber vine	WoNS	Category 3
<i>Opuntia tomentosa</i>	Velvety tree pear	WoNS	Category 3
<i>Parthenium hysterophorus</i>	Parthenium	WoNS	Category 3
<i>Bryophyllum</i> sp.	Mother of millions	n/a	Category 3
<i>Vachellia farnesiana</i> *	Mimosa bush	n/a	n/a

* Denotes a species that is considered a noxious weed of management concern.

3.1.7.2 Terrestrial Fauna

A total of 145 vertebrate species have been positively identified in the Gemini Study area during field surveys. The suite of vertebrate fauna species includes 8 amphibians, 83 birds, 33 mammals, 21 reptiles and 6 introduced fauna species. One migratory and marine species and one marine species were recorded during field surveys.

Field surveys across the study area detected the presence of five fauna species of conservation significance:

- the southern Squatter pigeon (*Geophaps scripta scripta*) and Greater glider (*Petauroides volans*), both of which are listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Queensland *Nature Conservation Act 1992* (NC Act);
- the Rufous fantail (*Rhipidura rufifrons*), which is listed as a migratory and marine species under the EPBC Act, and the Rainbow bee-eater (*Merops ornatus*), which is a listed marine species under the EPBC Act; and
- the Short-beaked echidna (*Tachyglossus aculeatus*), which is not an EVNT species but is listed under the NC Act as Special Least Concern.

All fauna species are regionally abundant, having been recorded outside of the study area on numerous occasions. Ample equivalent or improved habitat is available for these species in the surrounding area. The Project proposes no significant impact on the species.

Several protected areas occur near the Project, most notably Taunton National Park, which was established to protect a population of Bridled nail-tail wallabies (*Onychogalea frenata*). The Bridled nail-tail wallabies are found in open grassy eucalypt woodland dominated by poplar box (*Eucalyptus populnea*), dense acacia forest dominated by brigalow (*Acacia harpophylla*), transitional vegetation intermediate between the woodland and forest areas of very dense brigalow regrowth (Lundie-Jenkins and Lowry 2005). The Bridled nail-tail wallaby is

considered endangered under the EPBC and NC Act. The species was not recorded on the Project site during ecological surveys.

3.1.7.3 Aquatic Ecology

The waterways of the study area are ephemeral, experiencing periodic flows. Charlevue Creek and Springton Creek are the major Water Act 'determined watercourses'; all other waterways crossing the Project are 'determined drainage features'. Extensive clearing for agricultural purposes has been undertaken across much of the study area, including the removal of riparian vegetation. The removal of riparian vegetation and direct stock access to the waterways has resulted in bank instability, erosion and the occurrence of weeds.

The Aquatic Ecology Assessment identified the presence of seven fish species within the study area, six of which are classified as least concern under the NC Act, and one species which is listed as introduced under the Biosecurity Act. A complete list of fish detected at each site is provided in the Aquatic Ecology Assessment (AARC 2020a; Appendix E). All fish species recorded in the study area are considered to be common or widespread species in the Mackenzie River Sub-basin.

No threatened aquatic fauna or flora species were detected within the study area during the baseline studies. This is consistent with the highly ephemeral nature of watercourses and the disturbed conditions resulting from past clearing and agricultural land use.

3.1.7.4 Groundwater Dependant Ecosystems

Where wetlands exhibit a degree of dependence on groundwater for survival, drawdown from the mine can result in a reduced ecosystem condition, changes to vegetation composition or dieback.

A Groundwater Dependent Ecosystem (GDE) assessment was undertaken across the Study area (3D Environmental 2020). Data from this assessment and the groundwater data obtained during several groundwater studies performed by JBT Consulting (2019 and 2020) were used to assess the GDEs and the associated impact of drawdown.

The GDEs identified within the study area are riverine-type wetlands, including riparian vegetation on watercourses and floodplains.

The potential impacts of the Project on the GDEs identified within the study have been assessed within the GDE study (3D Environmental 2020; Appendix E) and are summarised below:

- **Direct clearing:** The GDE located within the tributary of Springton Creek falls within the footprint of the mine and, therefore, is subject to unavoidable vegetation clearing.
- **Groundwater drawdown:** Groundwater modelling estimated that the Project has the potential to cause a maximum drawdown of 5 m (steady-state post-mining drawdown) at some locations below the Charlevue and Springton Creeks (JBT 2019), on the Tertiary and alluvial sediments (regional groundwater table). This drawdown will not impact the riparian habitat identified as GDE within Charlevue Creek based on the limited hydraulic connectivity between the regional groundwater table and the perched aquifer that supports the GDE (3D Environmental 2020). Further, considering that the Project is situated downstream of Charlevue Creek's GDE and there will be no loss of catchment area, it is unlikely the Project will reduce the surface flows that replenish the associated perched aquifer (3D Environmental 2020).

3.1.7.5 Matters of State Environmental Significance

The offsets framework requires that environmental offsets be delivered where an activity will likely result in a significant residual impact on a prescribed environmental matter. The *Queensland Environmental Offset Policy Significant Residual Impact Guideline* (EHP 2014) was used to determine whether Project impacts are considered to be significant. This guideline outlines the criteria for identifying when an impact on a prescribed environmental matter (i.e., MSES) may be significant. The significant impact criteria provide a trigger for consideration of offsets (EHP 2014).

As part of the ecological assessments (AARC 2020a; AARC 2020d), significant impact assessments were conducted for all prescribed environmental matters identified in the study area. A summary of the results from the assessment is provided in Table 18, and the full assessments can be found in Appendix E (AARC 2020a, AARC 2020d).

Magnetic South is committed to delivering environmental offset requirements for matters with a significant residual impact resulting from the Project. Offsets will be delivered as either a financial settlement or proponent-driven offset (i.e., a land-based offset or *Direct Benefit Management Plan*) or a combination of both.

Table 18: Summary of Project MSES and Likelihood of Significant Residual Impact

Protected Matter		NC Act Status	VM Act Status	Likelihood of Occurrence Within Study Area	Likelihood of Significant Impact
Of concern RE 11.3.2		n/a	OC	Present	Yes
REs located within the defined distance from the defining banks of a VM Act watercourse		n/a	n/a	Present	Yes
Connectivity area		n/a	n/a	Present	Yes
Wildlife Habitat and Essential Habitat	Southern squatter pigeon	V	n/a	Present	No
	Greater glider	V	n/a	Present	No
	Short-beaked echidna	SLC	n/a	Present	No
Waterways providing for Fish Passage		n/a	n/a	Present	No
HES Wetlands		n/a	n/a	Not present	No

Notes:

n/a	not applicable
OC	of concern
NT	near threatened
V	vulnerable
SLC	special least concern

3.1.8 Voids in floodplains

To assess the long-term impacts of the final void pit lake a GOLDSIM model (separate to the OPSIM model used for the operational modelling) was used. The historical rainfall and evaporation sequences were repeated 5 times to create a long-term climate record for use in the model. The potential effects of climate change were assessed using climate-change adjusted SILO climate data developed as part of the Consistent Climate Scenarios (CCS) project by the Queensland Government's Department of Environment and Science (DES).

Pre-mining conditions of PMF conditions of the mine are shown in Figure 31. The proposed final void catchments include the pits' plan areas, and immediate upslope catchments. Key details of the final voids are as follows:

- Mine B final void will be approximately 72 m deep, with a floor level of 40 mAHD and an overflow level of approximately 112 mAHD.
- Mine A final void will be approximately 70 m deep, with a floor level of 58 mAHD and an overflow level of approximately 128 mAHD.

The final void will be located and designed such that it is not inundated by flooding in the probable maximum flood (refer Figure 32) (refer Section 3.5.6.7).

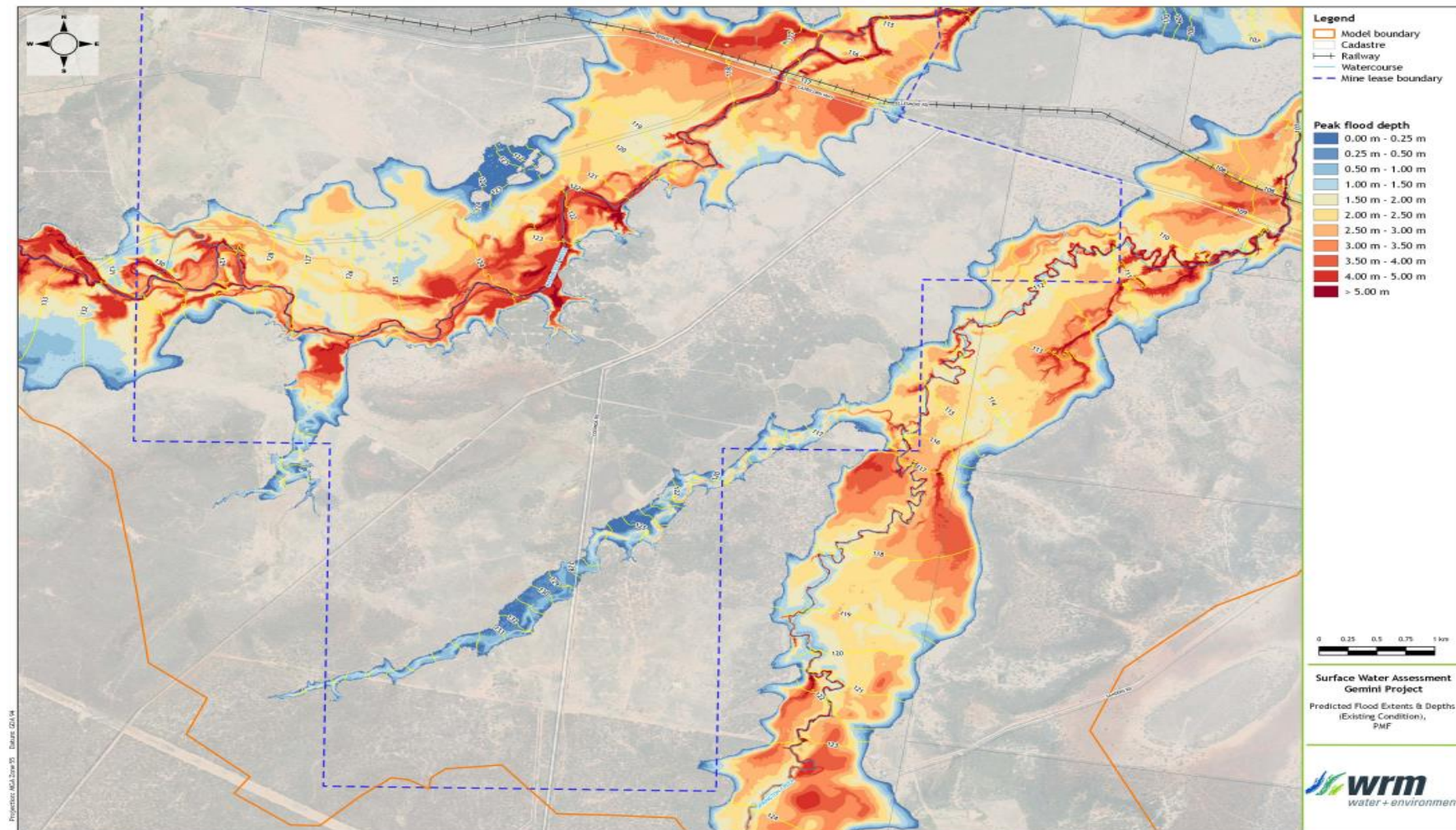


Figure 31: Predicted flood extent & depth (Pre-mining Condition) PMF

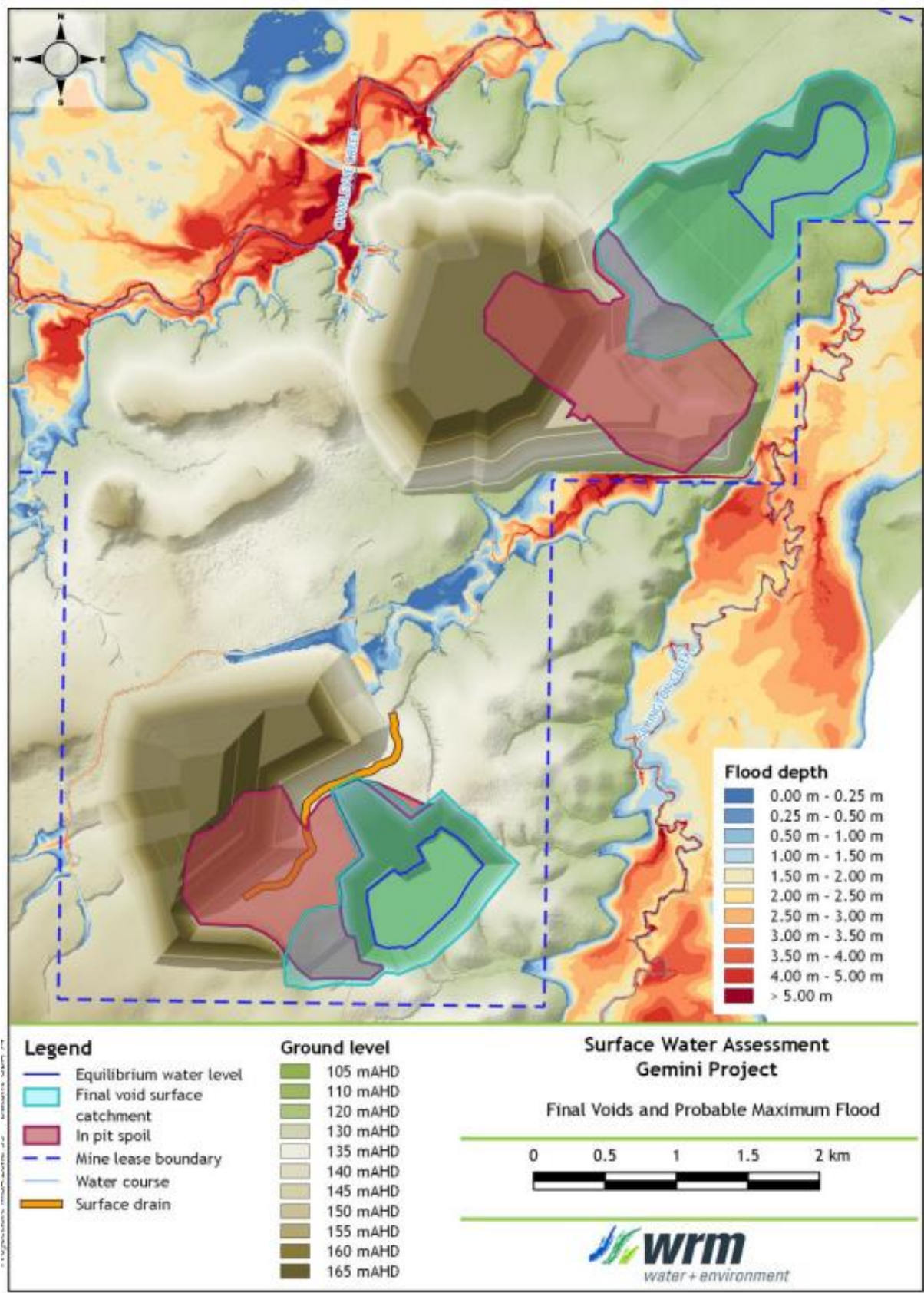


Figure 32: Post closure flood levels in Probable Maximum Flood

3.2 Community consultation

3.2.1 Previous stakeholder and community engagement activities

Magnetic South has undertaken consultation and discussions with underlying landholders, neighbours, native title groups (the Gaangalu Nation People), local council representatives and state government representatives. Consultation has been in the form of public notifications, formal meetings and informal discussions with potentially affected individuals to identify and address specific concerns relating to the Project development and closure.

Magnetic South acknowledges that they are a member of a larger community and consistently uphold their community responsibilities. In accordance with section 126C(1)(c)(iii) of the EP Act, and the PRCP Guideline, Magnetic South maintains a community consultation register (Table 19).

Magnetic South remains focused on ensuring a two-way conversation with stakeholders and the wider community and will actively seek feedback on the Project's impacts and benefits. Key messages and outcomes recorded in the register will be communicated internally to guide future decision making and rehabilitation.

3.2.2 Community consultation

Ongoing stakeholder and community engagement activities have been undertaken during different phases of the Project. Some specific examples of how community consultation has informed the PRC Plan (PMLUs) are as follows:

- The continuation of grazing interests was a key outcome of the consultation with the Central Highlands Regional Council during the presentation hosted by the proponent in 2019. Grazing has been adopted as the primary rehabilitation objective for land impacted by mining;
- While multiple rehabilitation options have been considered, low intensity grazing was chosen as the preferred PMLU for waste rock emplacement on the basis of pre-mining land suitability, landholder/stakeholder preferences, the existing land use and EVs of the surrounding landscape; and
- Unless water storage facilities are identified by the post-mining landholder as of value to their future use of the land, and an agreement is entered into, all water storages will be drained and de-silted, and re-profiled to ensure the area is free-draining and blends in with the surrounding landscape.

3.2.3 Stakeholder engagement plan

A Strategic Communication Framework (SCF) was developed in 2019 (Appendix D) to involve the public in the statutory approval regime, project planning and development. The SCF aims to establish and maintain the connection between Magnetic South (MS) and the community, identify and resolve issues regarding Project development and community concerns at early stages, inform the community about the Project (e.g. Project studies and planning), and satisfy regulatory consultation requirements.

The methods for stakeholder engagement in the SCF generally include:

- identification of stakeholders;
- identification of issues and concerns from stakeholders;
- selection and planned application of engagement tactics that are deemed effective in communicating meaningfully with the stakeholders;
- effective channelling of findings, feedback, issues, ideas, and opportunities to the Project team; and
- performing cyclic reviews of communications and adequacy.

The consultation program undertaken by Magnetic South and AARC consists of three rounds of implementation:

1. Advising intent and scoping selected issues
2. Testing the proposition
3. Finalization of expected communications and consultation

The ongoing stakeholder engagement will be conducted in accordance with methods defined in the SCF. The ongoing stakeholder engagement will:

- provide opportunities for the relevant stakeholders to leave comments and feedback on the Project development and the PRC Plan;
- ensure transparency and inclusion are being incorporated into the Project operation and rehabilitation;
- provide a compliant mechanism to allow affected communities and stakeholders to register complaints, queries or comments and enabling these complaints to be addressed in a timely manner; and
- ensure PMLUs are consistent with community expectations.

A list of tools has been developed to assist in the engagement process, define how community will be engaged and determine how feedback/comments will be considered, such as Stakeholder Assessment Notes, a Stakeholder Contact Planner, and a Stakeholder Assessment Prompter. A public consultation report will be provided. The feedback and comments will contribute to consolidation of the proposition to the stakeholder community. Issues raised during engagement activities will be analysed with a risk assessment, key issues will be categorised and organised in issues tree. The SCF has been provided in full as Appendix D.

Magnetic South has developed a consultation register (Table 19) in accordance with requirements in Section 126C(1)(c)(iii) of the EP Act. All the records of the ongoing engagement activities will be logged into the register during the life of the Project. A summary of the key consultation records relevant to PRC Plan has been provided in Table 19.

In addition to the SCF, a Cultural Heritage Management Plan also defines how the ongoing engagement and consultation with the Traditional Owner Group will be conducted.

Table 19: Summary of community consultation register

Category	Entity	Consultation record	Means of engagement	Key matters discussed/issued raised	How issues have been considered	Decisions / outcomes of engagement	Commitments made by the applicant
Government agency	Department of Natural Resources, Mines and Energy (DNRME)	Presentation - March 2019	Presentation	- Project background and infrastructure - Resource exploration (e.g., resource estimates and classification, drill hole locations, costs) - Plans of land acquisition from landowners - Exploration plans - Environment and water context - Environmental approvals and timelines	NA	Information shared and discussed with the agency, advice received.	- Regional interests of grazing has been identified; - Ongoing engagement of stakeholders and consideration of advice received.
Government agency	Department of Environment and Science (DES)	Presentation - May 2019	Pre-lodgement Presentation for EA Application	- Project background and infrastructure - Resource exploration (e.g. costs) - Environmental Assessment reports progress and key findings, including closure studies and PMLUs for Area B and A - EP Act and EPBC approvals process	NA	Information shared and discussed with the agency, comments received.	- Regional interests of grazing has been identified; - Ongoing engagement of stakeholders and consideration of advice received.
Affected landholders and interested parties	Affected landholders and interested parties	Mining Lease notice - October 2019	Newspaper / website notification of ML and EA application submission	- EA and ML application information. This information is now publicly available. - Timing and instructions for objections/submission.	Responses to landholders	Objections / submissions received.	- Information on the Project was shared with landholders; - Submissions were encouraged and welcomed.

Category	Entity	Consultation record	Means of engagement	Key matters discussed/issued raised	How issues have been considered	Decisions / outcomes of engagement	Commitments made by the applicant
Government agency	Council Meeting	Presentation - November 2019	Meeting	- Gemini Project Presentation to CHRC -Meeting 01 - Introduce Magnetic South PL & Gemini Project - Specific Magnetic South Comments Project is self-funded - Final rehabilitation and continuing grazing interests - Roads - temporary closures - Water supply, Sunwater pipeline & Dingo township - Infrastructure sharing - with council and private utilities companies (e.g. power, water, etc.) - Product Haulage - overhead conveyor to TLO - Sourcing labour - local preferences - Requirement to have a consent and compensation agreement with CHRC as owner of roads, land to allow inclusion of the roads in the surface area of the mining lease. - Proposing temporary closure of two roads, replacement connection from Sanders R to Cooina Rd south of the project, use of Red Hill Road as secondary access to TLO. - Timing and constraint agreement - last day of the Objections period.	NA	Information shared and discussed with the agency, and comments received	- Regional interests of grazing has been identified; - Ongoing engagement of stakeholders and consideration of advice received.
Affected landholders	Affected landholders	Objection/Submission and responses - June 2020	Objection/Submission and responses	- Landholder concern: Further testing to be carried out bi-annually regarding progressive rehabilitation. - HG response: A Rehabilitation Management Plan is being developed for the Project, including monitoring of receiving waters, soils and erosion.	Responses to landholders and a Rehabilitation Management Plan has been developed.	Objections / submissions received.	- Information on the Project was shared with landholders; - Submissions were encouraged and welcomed.

Category	Entity	Consultation record	Means of engagement	Key matters discussed/issued raised	How issues have been considered	Decisions / outcomes of engagement	Commitments made by the applicant
Indigenous Group	Gaangalu Nation People	Meeting - 25 July 2020 Meeting - 10 October 2020 Meeting - 12 December 2020	Meetings	• Provision of all Project information • The operations within the native title claim area and how the parties will maintain and protect Aboriginal cultural heritage • Consensus has been made, which was to sign a cultural heritage agreement to address how cultural heritage clearances are undertaken, and the management and avoidance of Aboriginal cultural heritage within the Project area • Arrange annual consultation meeting to engage GNP in a assisting Magnetic South during the life of the Project including the closure and rehabilitation phases.	Magnetic South and the GNP will be parties to the cultural heritage agreement which provides a process for the parties to follow regarding identification, preservation and avoidance of any cultural heritage found within the Project area.	Execution of a cultural heritage agreement	- To ensure that the GNP undertake cultural heritage clearances as required by the agreement and to make certain payments to the GNP as compensation.
Affected landholders	Affected landholders	Letters sent - August 2021	Public notification letter regarding the EA changing application	• Magnetic South notified affected landholders regarding the change application for EA application. Changes include: - o Relocation of the camp and associated infrastructure to the south of the Capricorn Highway, on Lot 4 on RP801280 and Lot 1 on HT424, to be accessed via the main mine access road. - o Removal of the Train Load Out Facility (TLO) access road from the Redrock Park Property to an alternate location further to the east.	NA	NA	- Information on the Project was shared with landholders.

Category	Entity	Consultation record	Means of engagement	Key matters discussed/issued raised	How issues have been considered	Decisions / outcomes of engagement	Commitments made by the applicant
Affected landholders	Affected landholders	Public consultation / submission - September 2021	Submissions	• Discussion of final void PMLUs. • Responses provided to the landholder regarding: ◦ The relatively small extent of the final voids compared to the total disturbance area. ◦ The major PMLU will be grazing. ◦ The analysis of alternative PMLU for the final voids, and the reason why fauna habitat was selected as the most feasible option.	Responses to landholders and a Rehabilitation Management Plan has been developed.	Objections / submissions received.	- Information on the Project was shared with landholders; - Submissions were encouraged and welcomed.
Government agency	Council Meeting	Pre-lodgement meeting - 03 July 2024	Meeting	• Discussion with DESI concerning the proposed EA amendment and changes to the Gemini mine sequence	Concerns raised addressed in EA amendment application and in the development of the PRCP.	EA amendment application submitted and approved.	- Information on the Project was shared with DESI for preliminary consideration.

3.3 Post-mining land use

This section of the PRCP describes and discusses the PMLUs proposed for the Project in accordance with section 126C(1)(d) of the EP Act. PMLUs align with the pre-approved outcomes defined in the relevant land outcome document (LOD).

3.3.1 Land outcome documents

As defined by the EP Act under section 750, the LOD for the Project is “an environmental authority for a resource activity on the land”. The EA is thereby considered to satisfy the definition of a land outcome document (LOD) for the Project.

3.3.2 Pre-mining and existing land use

The Queensland Land Use Mapping (DES 2020) classifies the majority of the Project area as the ‘Grazing Native Vegetation’ land use (Figure 33), which is defined as (ABARES 2016):

Land uses based on grazing domestic stock on native vegetation where there has been limited or no deliberate attempt at pasture modification.

Other minor land use classifications over the site include residential and farm infrastructure, reservoir/dam, marsh/wetland, and other minimal use, primarily in association with the Capricorn Highway, and transport and communication utilities (Figure 33).

This dominant land uses in the surrounding region are grazing of native vegetation, improved pasture, cropping and mining. Other land uses in the region include road transport, stock routes, and protected areas. The Project area is subject to low-intensity cattle grazing, consistent with the surrounding country and has predominantly been cleared of remnant vegetation (Figure 30).

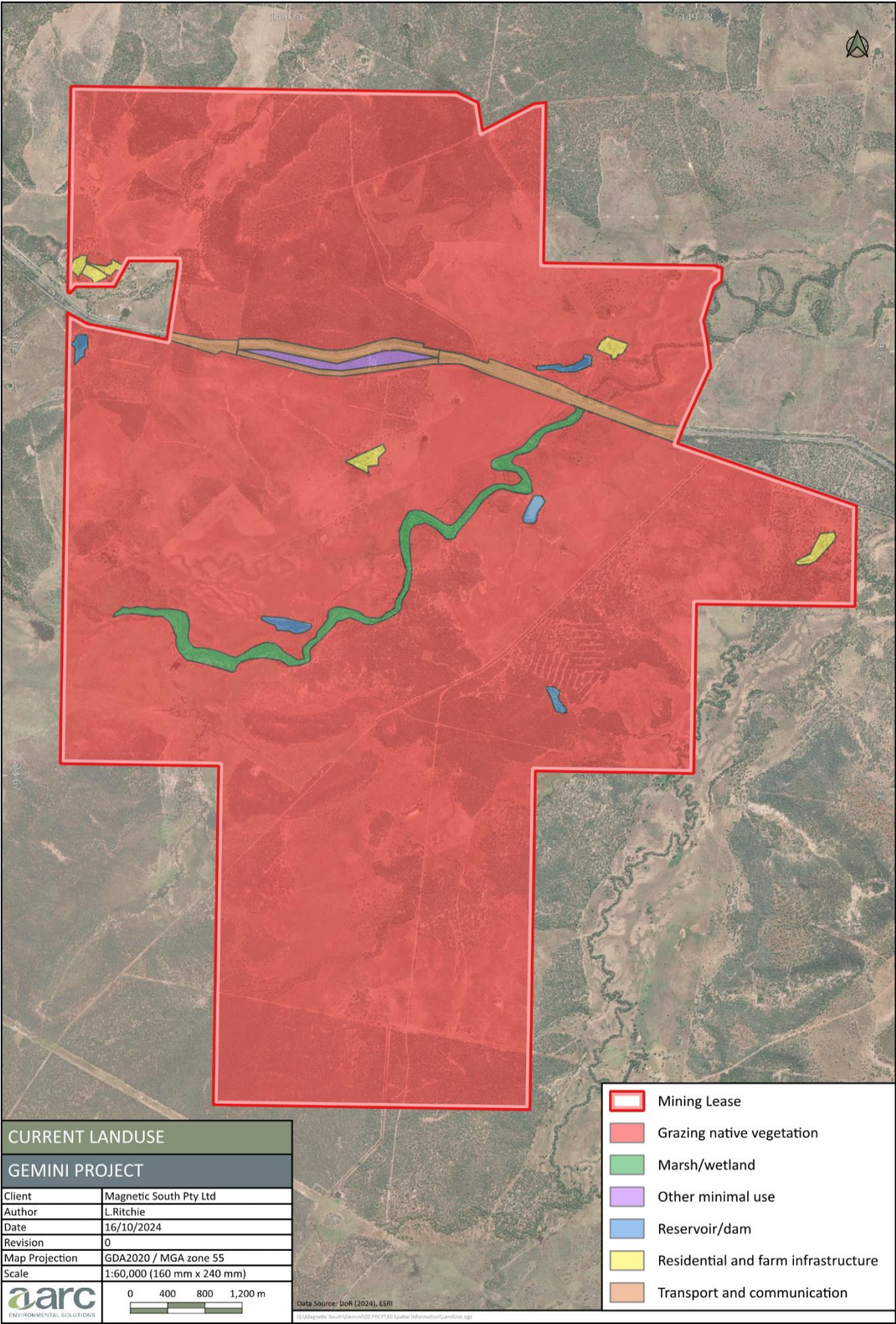


Figure 33: Current Land Use of the Project

3.3.3 Proposed post-mining land uses

3.3.3.1 Prescribed post mining land use

This section describes the proposed PMLUs for the Gemini Project, which are currently authorised under the Gemini EA (P-EA-100114292), the LOD for the PRC Plan. The PMLUs were developed with consideration for the existing local and regional land use, the Central Highlands Regional Council Planning Scheme (2016), the local ecological values and the site characteristics.

Other key factors considered in the determination of the PMLUs for the Project included:

- the pre-mining land use of low-intensity cattle grazing;
- stakeholder consultation during the approvals process;
- planning considerations, as defined in the relevant Council Planning Schemes;
- environmental considerations, specifically the need to prevent release of contaminants to the receiving surface waters or groundwater;
- environmental values and physical considerations as they relate to the safe and stable nature of the final landform and the development of self-sustaining ecosystems required for successful rehabilitation; and
- economic considerations relating to the cost of recreating the final land uses and the likelihood of achieving rehabilitation success.

The proposed PMLUs aim to reinstate the existing land use of low-intensity grazing ('Grazing' and 'Grazing Native Vegetation') by returning the land to similar vegetation type and land class suitability to that existing prior to mine disturbance and delivering a beneficial environmental outcome by restoring, as far as practicable, existing native vegetation communities. Where a grazing land use is unsuitable, alternative PMLUs have been nominated and authorised. The alternative PMLUs intend to restore fauna habitat values, consistent with the local ecosystem values, through the restoration of 'Native vegetation supporting fauna habitat' and 'Fauna habitat' supporting aquatic flora and fauna.

The authorised closure domains for the Gemini Project are described in Table H1 of the Project EA and are presented below in Table 20. The location and extent of each PMLU is illustrated in Figure 34.

Table 20: Rehabilitation domains and post mining land use

Rehabilitation Area	Post-mining Land Use	Post mining land description	Approximate Footprint Area (ha)	Approximate Proportion of Total Disturbance
RA1: In-pit and out-of-pit waste emplacements, including dry rejects disposal areas	Grazing	Low intensity cattle grazing	720.7	37%
RA2: Temporary waste emplacements	Grazing	Low intensity cattle grazing	17.5	1%
RA3: Residual void lakes	Fauna habitat	Void lake to remain as water body to facilitate fauna habitat (aquatic plants and invertebrates)	76.3	4%
RA4: Residual void high walls	Native vegetation supporting fauna habitat	Native vegetation on the upper shallow slope areas Cliff habitat in the steeper high walls Both sustaining fauna habitat (avifauna, ground dwelling fauna)	132.8	7%

Rehabilitation Area	Post-mining Land Use	Post mining land description	Approximate Footprint Area (ha)	Approximate Proportion of Total Disturbance
		including small mammals and reptiles)		
RA5: Residual void low walls	Grazing	Low intensity cattle grazing	186.9	10%
RA6: Rehabilitated dams	Grazing/native vegetation	Marginal grazing comprising a mix of native and improved pasture species suitable for low intensity cattle grazing	35.8	2%
RA7: Retained dams	Retained infrastructure	Retained infrastructure at request of underlying landholder	34.0	2%
RA8: Diversion drains	Grazing/native vegetation	Marginal grazing comprising a mix of native and improved pasture species suitable for low intensity cattle grazing	14.3	1%
RA9: Mine Infrastructure areas	Grazing	Low intensity cattle grazing	735.9	37%
RM10: Retained infrastructure	Retained infrastructure	Retained infrastructure at request of underlying landholder	13.8	1%

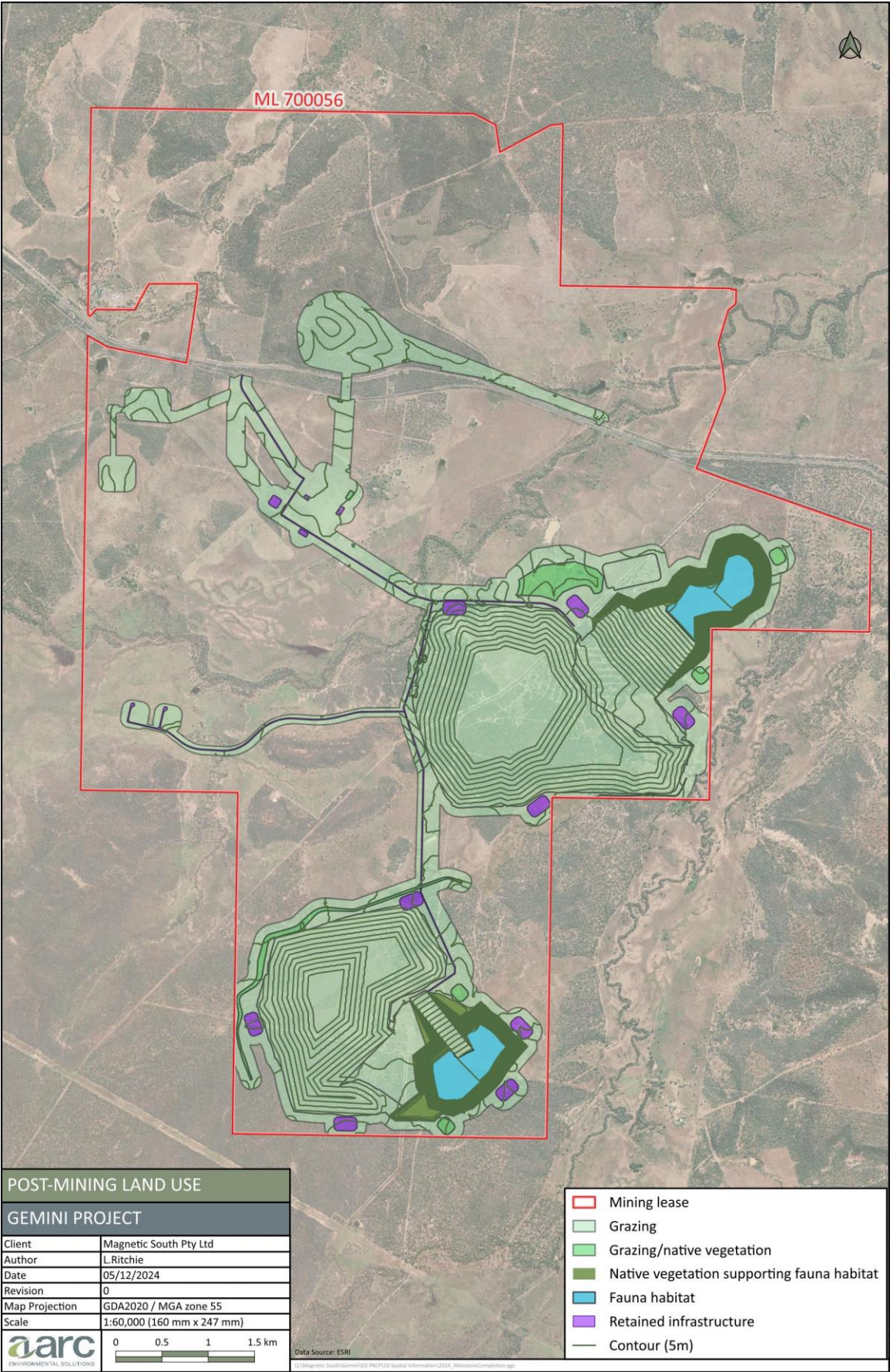


Figure 34: Post mining-land use

Justification for Fauna habitat

The Fauna habitat PMLU and residual void final landform design were assessed as part of the Gemini Project approvals process. The assessment demonstrated that the ecological value of pit lakes and adjacent high wall features can be facilitated through effective rehabilitation of the pit walls and the implementation of targeted design features such as littoral zones containing aquatic plants, and the placement of habitat features (i.e. rocks and logs). A conceptual design of the residual void landform and fauna habitat PMLU is provided in Figure 35.

The pit lake waterbody is expected to support a range of freshwater aquatic plants and invertebrates in shallower edge areas and, over time, transition to brackish water species as water quality changes. Pit lakes have demonstrated the capacity for the development of ecosystems able to behave similarly to natural wetlands (Lund and Blanchette, 2014) and have the potential to provide ecological value (Lund and Blanchette, 2021a). Water and sediments within pit lakes can host a diverse microbial community which plays a key role in pit lake ecosystem function through nutrient cycling, the fate and transport of metals and metalloids, mineral formation, biogeochemical processes, decomposition of organic matter, and interactions with other organisms (Lund, 2021b). Pit lakes may also act as a water refuge for highly mobile species during periods of low rainfall.

While biodiversity is often assumed to decrease as salinity increases, salinities of up to 10,000 mg/L (equivalent to an EC of approximately 15,600 $\mu\text{S}/\text{cm}^{-1}$) can support robust ecological systems and provide a valuable refuge for a range of species (pers comms. M. Lund, December 2019; Lund and Blanchette, 2021). Given that salinity in each of the Gemini pit lakes is predicted to remain below 5,000 mg/L during the first 100 years of post-mining operations (Appendix E, WRM 2020b), the pit lake and surrounding high-wall features are predicted to provide suitable habitat for a range of native fauna, including several species known from the Project site and surrounds.

Research indicates that pit lakes in the earlier stages of ecological development (TDS up to approximately 4,500 mg/L) can provide ecological value for regional species in central Queensland (Proctor and Grigg, 2006). Further, pit lakes may act as a water refuge during periods of low rainfall for mobile species such as the Grey Teal Duck (Hart, 1991) which was recorded within the Project site (Appendix E, AARC 2020a). Species of ducks and swans are regularly observed in saline pit lakes of open cut coal mines in central Queensland (pers comms. C. Cote, March 2020).

Macroinvertebrates are well-adapted to brackish and brackish-saline conditions however, species diversity typically decreases with higher rates of salinity. A study of pit lakes aged from 1-22 years and ranging from 330 $\mu\text{S}/\text{cm}$ to 4,416 $\mu\text{S}/\text{cm}$, associated with a nearby open cut coal mine in Moura, indicated that the diversity of aquatic invertebrates was similar to nearby natural waterbodies (Proctor and Grigg, 2006). The pit lakes studied by Proctor and Grigg (2006) were reported to support orders of macroinvertebrates that have been recorded on the Project site, including Diptera, Hemiptera, Odonata, and Coleoptera. (Appendix E, AARC 2020a)

In an open-cut coal mine located within the Fitzroy Basin, native fish including the Spangled Perch (a species recorded on site) have been documented to have pioneered pit lakes with TDS of up to 7,600 $\mu\text{S}/\text{cm}$ region (Appendix E, AARC 2020d)

A review of the ecological processes associated with nutrient webs of natural lakes, wetlands and pit lakes, van Etten (2011) concluded that rehabilitating vegetation along the low walls can assist with improving water quality, primary production and provide suitable habitat for aquatic and terrestrial fauna. Aquatic plants along the littoral fringe have been reported to inhabit areas with consistent water levels in pit lakes with salinity less than 10,000 $\mu\text{S}/\text{cm}$, in Queensland (pers comms. J. Fittler March 2020). Further, habitat complexity including the development microclimates (van Etten 2011) and additional habitat could be created through the addition of cleared vegetation (i.e., tree trunks) to both the low walls and the waterbody (Luek and Rassmussen 2017).

Justification for Native vegetation supporting fauna habitat PMLU

The high walls associated with pit lakes can provide suitable refuge and brooding habitat for several mobile fauna species (particularly birds and bats). Native vegetation proposed to rehabilitate the high-wall slopes will provide additional refuge for ground-dwelling fauna, including small mammals and reptiles. Similarly, grass tussocks provide nature refuges for a number of mammals and reptile species found on the Project site during the fauna survey, including the Delicate Mouse, Short Beaked Echidna, Rakalie Bynoes Gecko, Elegant Snake-Eyed Skink, Prickly Knob-tailed Gecko, Eastern Stone Gecko and Box-patterned Gecko (Appendix E AARC 2020d). The use of high-wall vegetation by goats, cattle, small mammals and reptiles has been observed in open cut mines of Queensland (pers comms. C.Cote March 2020).

The residual high wall offers the potential to provide a steeper slope habitat that can be used by native nesting birds. For example, a resident Peregrine Falcon pair has been recorded successfully breeding in nests created in the high walls of an open cut mining pit in the Northern Territory (Potts and Donato 2008). Additional individual Peregrine Falcons were observed utilising the various open pit high walls for roosting. Birds documented to nest on inland, flat land or slopes may utilise the high-wall pit slopes as nesting habitat (O'Donnell and Debus 2012). Anecdotally, birds of prey have been reported to utilise the high wall as refuges in an open cut coal mine located in central Queensland (pers comms. J. Fittler March 2020); the Wedgetail Eagle, a species that has been recorded on the Project site is one example such species of bird of prey.

Insectivorous bats have been documented feeding on insects in the airspace above pit lakes in both Western Australia and central New South Wales (Griffiths et al. 2014a; Griffiths et al. 2014b). A number of insectivorous bats have been identified on the Project site by ANABAT surveys including the Chocolate Wattled Bat, Eastern Bent-winged Bat, Eastern Cave Bat, Goulds Wattled Bat, Inland Forest Bat, Little Pied Bat, Northern Free-tailed Bat, Troughton's Sheath-tail Bat, White-striped Free-tailed Bat and the Yellow-bellied Sheath-tailed Bat (AARC 2020b).

Justification for grazing PMLU

Low intensity grazing was chosen as the preferred PMLU for waste rock emplacement, void low walls and mine infrastructure areas on the basis of the pre-mining land suitability (refer to section 3.1.6.6) , landholder/stakeholder preferences (refer to section 3.2), the existing land use of grazing/native vegetation (refer to section 3.1.6.3) and the environmental values of the surrounding landscape.

With appropriate management of the higher sodicity topsoils identified, it is anticipated that rehabilitated landforms will be capable of sustaining improved and native pastures equivalent to those currently existing.

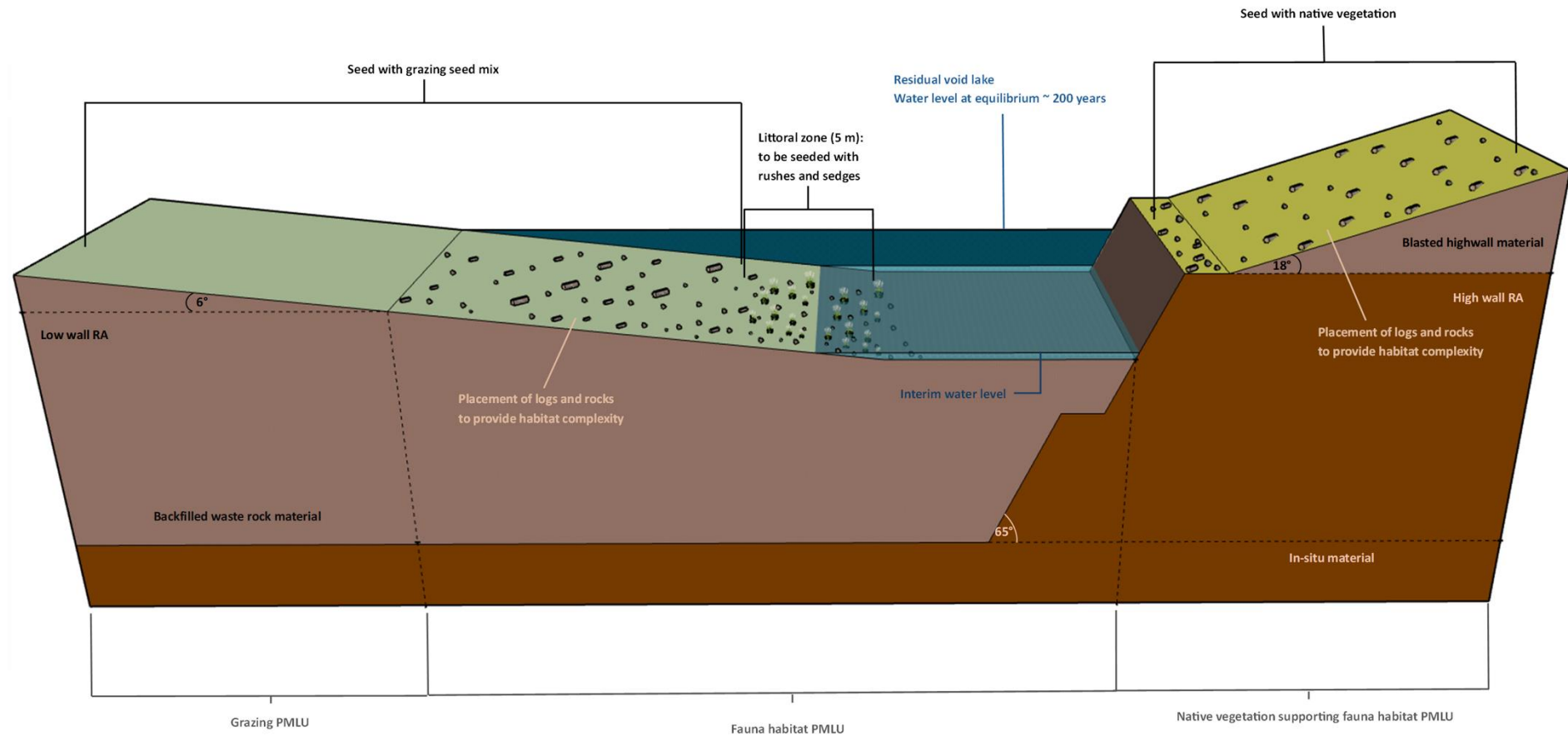


Figure 35: Conceptual 3D sketch of residual void final landform design

3.3.3.2 Post mining land suitability

The post mining cattle grazing Land Suitability Class (LSC) proposed to be achieved for each mine domain is shown in Figure 36. This was determined based on the *Land Suitability Assessment Technique* (DME 1995), with consideration of the pre-mining LSC for the Project site (refer to Figure 29) and physical characteristics of the post mining landscape, such as topography, recreated soil profiles and the underlying substrate (e.g. mine waste).

It was determined that where water storages are to be retained for use by the landholder these would have a post mining LSC of 5. Otherwise, they will be regraded to natural surface levels and returned to a grazing land use. It is anticipated that areas returned to a post mining land use of cattle grazing can be returned to LSC 3.

The calculated area (in hectares) for each pre and post mining LSC within the project disturbance area is provided in Table 21.

Table 21: Pre and post mining cattle grazing LSC areas

Area (ha)						
	Class 2	Class 3	Class 4	Class 5	Class 3/5	Total
Pre-mining	63.2	1644.0	246.3	0	0	1953.5
Post-mining	0	631.5	1027.1	224.4	70.5	1953.5
Change from pre to post	-63.2	-1012.5	+780.8	+224.4	+70.5	0

An examination of the land suitability limitations for cattle grazing indicated that the majority of the Project area (4,338 ha) is suitable for cattle grazing with moderate limitations (Class 3), whilst 1,080.5 ha of the study area is deemed suitable for cattle grazing with minor limitations (Class 2). The remaining area (750.84 ha) was comprised of Class 4 land. No Class 1 or Class 5 land was identified within the Project area.

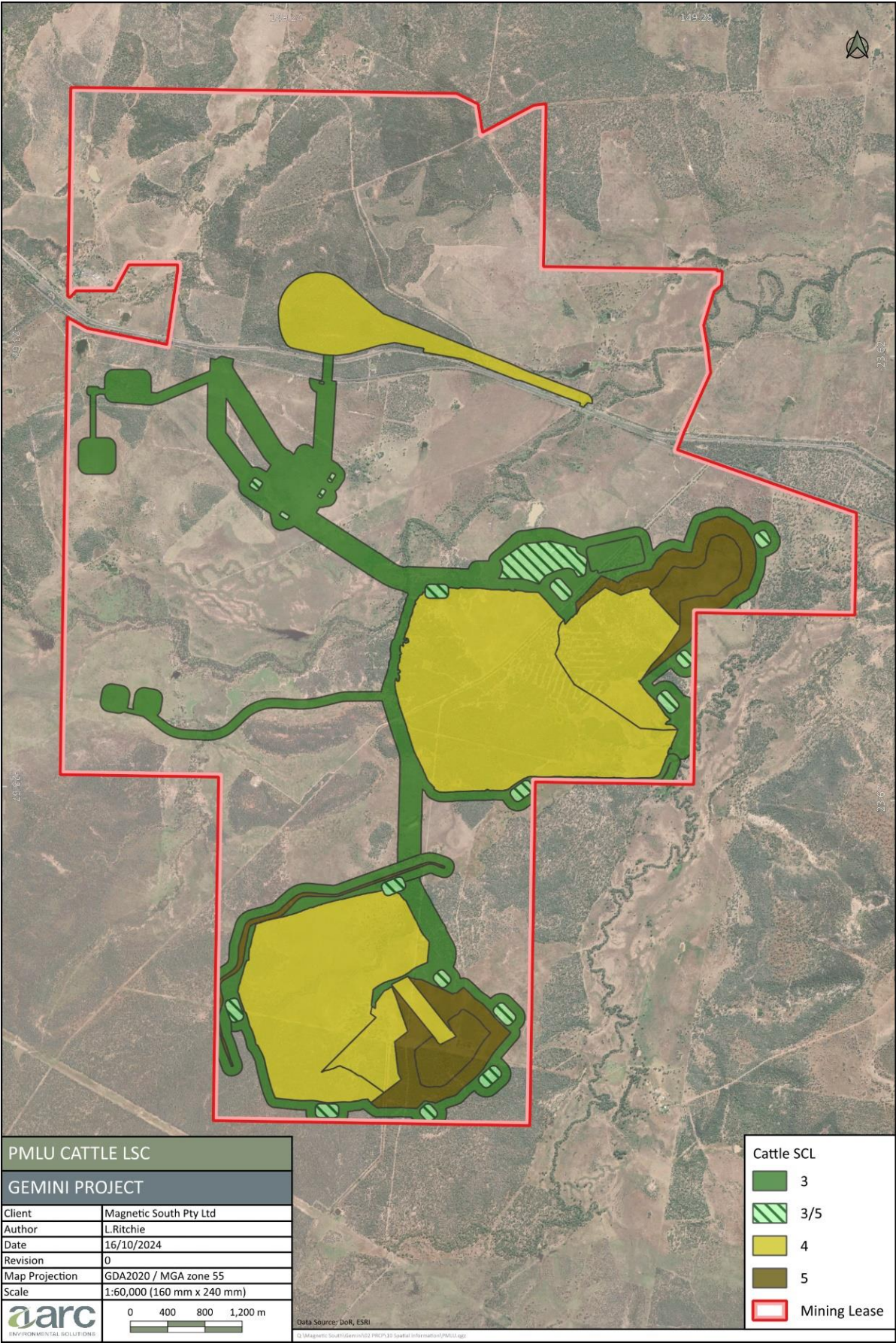


Figure 36: Proposed post mining land use (PMLU) LSC for cattle grazing

3.3.4 PMLU Evaluation

3.3.4.1 Alternate PMLUs considered

Mine planning assessed a number of options to manage and reduce final landform residual risk including backfilling the pits to a modified pre-mining topography, backfill to approximately 80 m below the pre-mining topography and no backfilling of pits. All options required the rehandle of waste rock material, the reduction of remnant high wall angles, the reshaping of waste rock emplacements, and normal rehabilitation techniques related to topsoiling, surface preparation and revegetation. Options were evaluated on the relative basis of cost, overall project value and relative reduction in environmental risk.

Option 1: The modified pre-mining topography option was based on backfilling voids to a level slightly higher than the original topography to allow for settlement over time. Once a sufficient period has been allowed for settlement, the area would be shaped and drained to manage erosion and then topsoiled and revegetated. Advantages of this option include negation of the need to stabilise high wall slopes or make safe the final void itself. The primary disadvantages with this option are:

- the significant cost of rehandling extremely large volumes of waste rock at the end of mine production;
- the significant limitation on being able to undertake progressive rehabilitation given the need to rehandle a majority of waste rock material at the end of mine life; and the ongoing settlement of the final landform surface potentially resulting in long term stability issues.
- The modified pre-mining topography option resulted in the net present value (NPV) of the project being so low that the Project could not proceed. In consideration of the margins of error within the financial model assumptions, the risk of a negative return was far too high for development. This option was therefore not considered further.

Option 2: The option of not backfilling the final void provides the greatest economic value to the Project by reducing the costs required to rehandle waste materials. However, it will decrease land availability for grazing activities post-mining and will significantly increase the salinity of the pit lake, likely to a level which cannot sustain the nominated PMLU (Appendix E, JBT 2019). As such, the environmental impacts of not backfilling the final voids were considered significant and the option was not considered further.

Option 3: The preferred (and approved) option is to backfill the residual voids to 80 m below ground level (bgl), based on the findings of the *Groundwater Impact Assessment* (JBT 2019). This study indicated that, with controls to limit surface water draining to the pits, saline inflows would be significantly reduced if the pit was backfilled to 80 mbgl. To achieve the final landform design, the base of the pit will be integrated with the in-pit waste emplacement by reshaping backfill to a maximum slope gradient of 6°, to be utilised for a grazing post-mining land use.

High wall slope management requirements would be reduced, and additional areas would be available for grazing. Only minor restrictions on progressive rehabilitation would arise. Although salinity will still increase over time, the pit lake water quality will remain suitable for aquatic ecosystem development for up to 100 years post-mining.

The residual voids will comprise three 'rehabilitation areas' having differing landform characteristics and, as a result, differing PMLUs. These areas are described as:

- Regraded, topsoiled and revegetated low wall slopes draining to the pit lakes and able to support a grazing PMLU.
- Two water bodies with a surface level modelled to gradually increase to an equilibrium level of between 70-80 mAHD; acting as a groundwater sink and having a gradually increasing salinity. A key rehabilitation objective for this rehabilitation area is to reduce the rate of predicted water salinity present in the void primarily to allow the ecology of the residual void waterbody sufficient time to adapt to salinity changes. Backfilling the voids to 42 mAHD for Mine B and 65 mAHD for Mine A reduces saline groundwater inflows and surface water drainage, resulting in a significant reduction in the rate of salinity development within the pit water body.

- Salinity is predicted to remain below 5,000 mg/L in the first 100 years following mining and will remain below 10,000 mg/L for the first 200 years. It should be noted that modelling inherently overestimates the rate of salinity increase in residual void water bodies by assuming that the source of mobile salts in overburden is infinite (Appendix E, AARC 2020c)
- . Recent research is challenging this assumption, but there is little currently available data on the long-term behaviour of water bodies resident in Bowen Basin coal mine overburdens, particularly the rate of approaching a long-term equilibrium salinity level. The backfilling option adopted is intended to seal the poorer quality remnant coal seam aquifers and limit salt inputs to the pit lake from groundwater.
- Residual void high walls will be regraded to 18° or lower, where located within unconsolidated sediments and saturated tertiary to achieve a factor of safety (FOS) of 1.5, or an appropriate site-specific FOS as advised by an Appropriately Qualified Person (AQP). For the remaining Permian geology, an overall angle of 55° will be achieved by 50 m high batters at 65° incorporating 15 m wide intermediate benches. Perimeter safety bunds and fencing adjacent to final high wall crests are designed and constructed to prevent human or animal injury and exclude cattle and prevent erosion. Safety bunds adjacent to final high wall crest are designed and constructed in compliance with industry best practice and safety bunds for high walls are certified as long-term stable.

Figure 37 and Figure 38 provides cross-sections depicting the proposed backfilling of waste rock within Mine A and Mine B

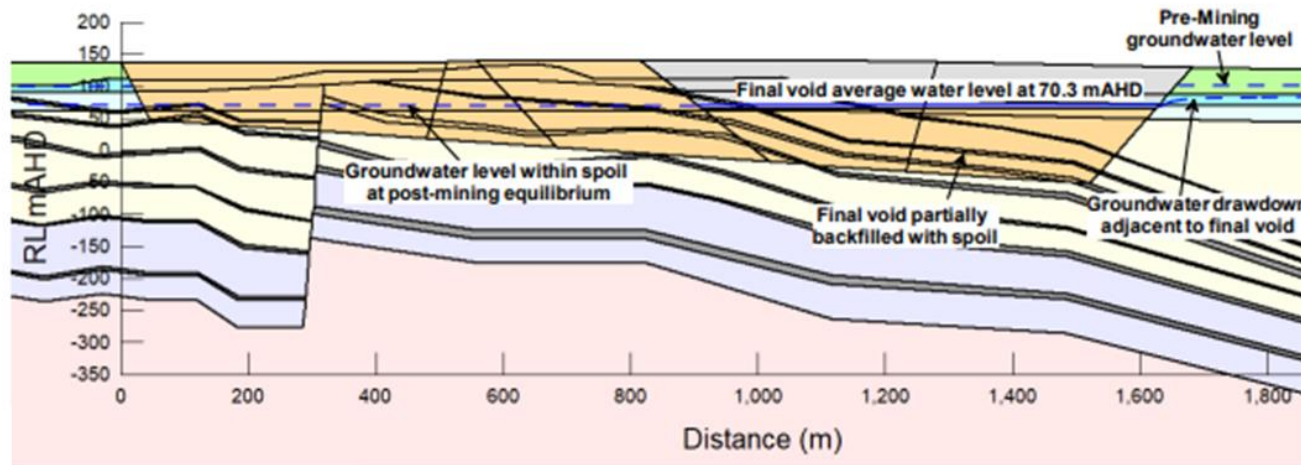


Figure 37: Conceptual layout of end of mining (Mine A) groundwater level

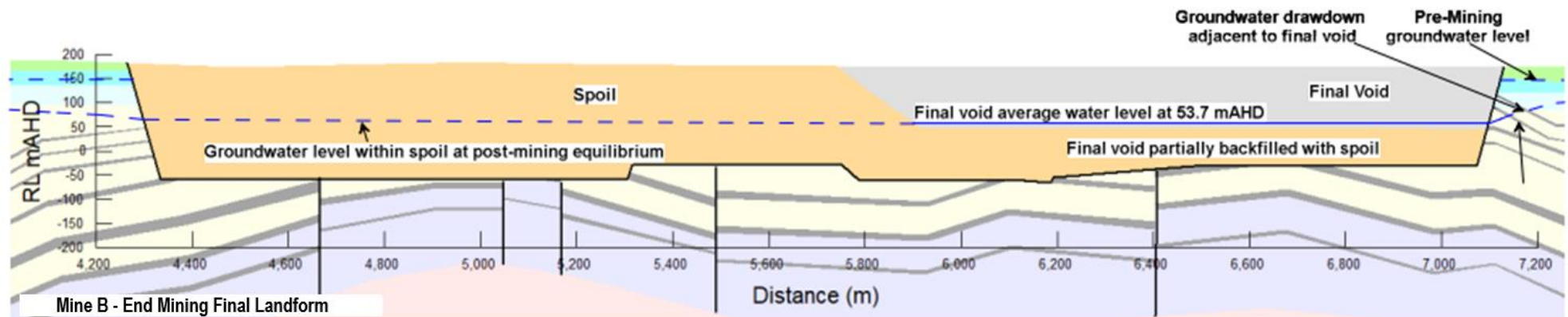


Figure 38: Conceptual layout of end of mining (Mine B) groundwater level

3.4 Non-use management areas

No non-use-management areas are proposed for The Project.

3.5 Rehabilitation management methodology

3.5.1 Rehabilitation objectives

In Queensland, mine rehabilitation is required under the EP Act. Amendments to the EP Act in late 2018 implemented key elements of the State Government's Mined Land Rehabilitation Policy (Queensland Government 2018) which intends to ensure that, for land disturbed by mining activities:

- the land is safe and structurally stable;
- there is no environmental harm being caused by anything on or in the land; and
- the land can sustain a post-mining land use (section 111A of the EP Act).

3.5.2 Rehabilitation areas and improvement areas

To allow the development of a PRCP schedule that satisfies the requirements of the PRCP Guideline, discrete rehabilitation areas (RAs) have been defined for the Project. An RA is defined in the EP Regulation as an area of land subject to a PMLU to which a rehabilitation milestone for the post-mining use relates. RAs have been nominated for areas of disturbance within the Project with consideration for the disturbance type and the proposed PMLU and are shown in Table 22 and Figure 39.

As no NUMAs have been identified for the Project, no improvement areas have been nominated.

Table 22: Rehabilitation areas and post-mining land use

Rehabilitation Area reference	Rehabilitation Area	Description	Post-mining Land Use
RA1	In-pit and out-of-pit waste emplacements	Overburden placed in pit and out of pit, including dry rejects disposed of in waste rock dumps.	Grazing
RA2	Temporary waste emplacement	Temporary waste rock emplacement required for backfilling of the Mine B void	Grazing
RA3	Residual void lakes	Pit lake supporting fauna habitat (Mine A and Mine B)	Fauna habitat
RA4	Residual void high walls	Reshaped high wall slopes with native vegetation supporting native fauna habitat	Native vegetation supporting fauna habitat
RA5	Residual void low walls	Gradual slope for cattle grazing; regraded, topsoiled and revegetated	Grazing
RA6	Rehabilitated dams	Temporary levee Permanent drainage structures Raw water dams Sediment dams Mine water dams	Grazing/native vegetation
RA7	Retained dams	Retained dams s request of underlying holders	Grazing
RA8	Diversion drains	Diversion drains regraded to natural landform	Grazing
RA9	Mine infrastructure areas ¹	MIA (except water management infrastructure footprint) Roads	Grazing
RA10	Retained infrastructure	Retained infrastructure at request of underlying landholder	Retained infrastructure

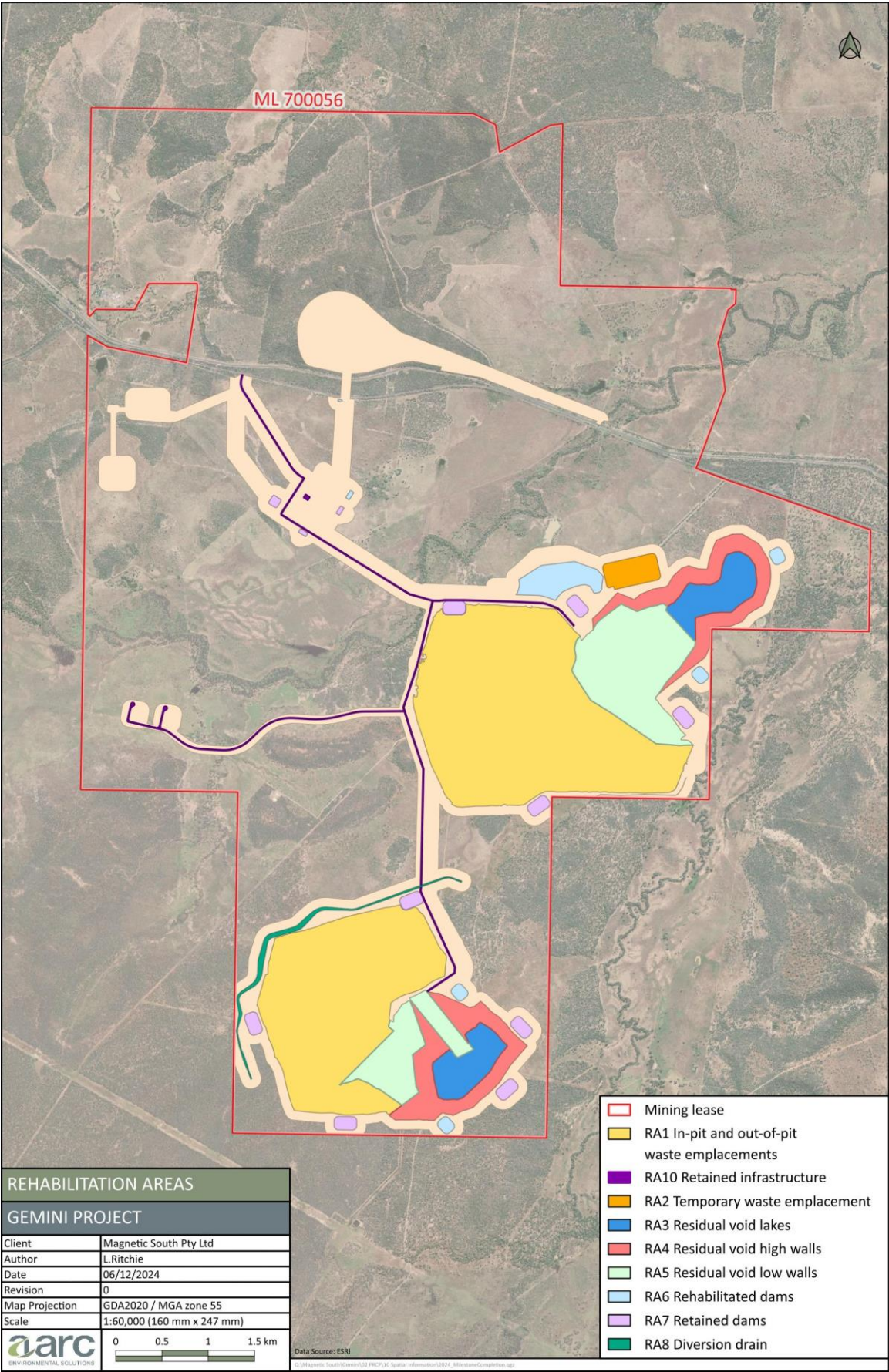


Figure 39: Rehabilitation areas

3.5.3 Rehabilitation milestones

Rehabilitation milestones are defined as each significant event or step necessary to rehabilitate an area of land to a stable condition (section 112, EP Act). Key to assessing the success of rehabilitation is the definition of milestone criteria. Milestone criteria must be consistent with the SMART (specific, measurable, achievable, realistic and timely) principles. They should:

- be outcome-based (linked to the end land use);
- be flexible to adapt to changing circumstances;
- be able to evolve as the mine life progresses;
- include metrics suitable to demonstrate that rehabilitation is trending positively;
- undergo periodic review; and
- include a measurement approach that details how the criterion will have been met (CoA 2016, ANZMEC and MCA 2000).

A set of milestone criteria has been identified for the Project to provide a clear definition of milestone completion and successful rehabilitation for each rehabilitation area (Table 23). The milestone criteria demonstrate the completion of progressive rehabilitation steps and events (refer Table 24). The completion criteria for each PMLU will be used as the milestone criteria for the final milestone in the proposed schedule, which shows achievement of the PMLU to a stable condition at surrender.

Table 23: Milestones and their applicability to rehabilitation areas

Milestone	Description	RA1 In-pit and out-of-pit waste emplacements	RA2 Temporary waste emplacement	RA3 Residual void lake	RA4 Residual void high wall	RA5 Residual void low wall	RA6 Rehabilitated dams	RA7 Retained dams	RA8 Diversion drains	RA9 Mine infrastructure areas	RA10 Retained infrastructure
RM1	Infrastructure decommissioning and removal									✓	
RM2	Remediation of contaminated land									✓	✓
RM3	Landform development of waste emplacement (RA1, RA2 & RA5)	✓	✓			✓					
RM4	Landform development of diversion drains (RA8)								✓		
RM5	Landform development of infrastructure areas (RA9) and rehabilitated dams (RA6)						✓			✓	
RM6	Landform development of residual void lake (RA3)			✓							

Milestone	Description	RA1 In-pit and out-of-pit waste emplacements	RA2 Temporary waste emplacement	RA3 Residual void lake	RA4 Residual void high wall	RA5 Residual void low wall	RA6 Rehabilitated dams	RA7 Retained dams	RA8 Diversion drains	RA9 Mine infrastructure areas	RA10 Retained infrastructure
RM7	Landform development of residual void high wall (RA4)				✓						
RM8	Surface preparation	✓	✓	✓		✓	✓		✓	✓	
RM9	Surface preparation and revegetation of residual void high wall (RA4)				✓						
RM10	Revegetation for grazing	✓	✓			✓				✓	
RM11	Revegetation for fauna habitat			✓							
RM12	Revegetation for grazing/native vegetation						✓		✓		
RM13	Achievement of surface requirements (grazing)	✓	✓			✓				✓	
RM14	Achievement of surface requirements (native vegetation supporting fauna habitat)				✓						

Milestone	Description	RA1 In-pit and out-of-pit waste emplacements	RA2 Temporary waste emplacement	RA3 Residual void lake	RA4 Residual void high wall	RA5 Residual void low wall	RA6 Rehabilitated dams	RA7 Retained dams	RA8 Diversion drains	RA9 Mine infrastructure areas	RA10 Retained infrastructure
RM15	Achievement of surface requirements (grazing/native vegetation)						✓		✓		
RM16	Achievement of surface requirements (fauna habitat)			✓							
RM17	Achievement of stable PMLU – grazing	✓	✓			✓				✓	
RM18	Achievement of stable PMLU – grazing/native vegetation						✓		✓		
RM19	Achievement of stable PMLU – native vegetation supporting fauna habitat				✓						
RM20	Achievement of stable PMLU – fauna habitat			✓							
RM21	Achievement of stable PMLU – retained dams							✓			

Milestone	Description	RA1 In-pit and out- of-pit waste emplacements	RA2 Temporary waste emplacement	RA3 Residual void lake	RA4 Residual void high wall	RA5 Residual void low wall	RA6 Rehabilitated dams	RA7 Retained dams	RA8 Diversion drains	RA9 Mine infrastructure areas	RA10 Retained infrastructure
RM22	Achievement of Stable PMLU– retained infrastructure										✓
RM23	Surface water and groundwater demonstrate non- polluting landform	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

3.5.4 Milestone criteria

Key to assessing the success of rehabilitation and improvement is the definition of milestone criteria. Milestone criteria are preferably specific, measurable, achievable, realistic and timely. They should:

- be outcome-based (linked to the end land use);
- be flexible to adapt to changing circumstances;
- be able to evolve as the mine life progresses;
- include metrics suitable to demonstrate that rehabilitation is trending positively;
- undergo periodic review; and
- include a measurement approach that details how the criterion will have been met (CoA 2016; ANZMEC and MCA 2000).

A set of milestone criteria has been identified for the Project to provide a clear definition of milestone completion and successful rehabilitation for each rehabilitation area or sufficient improvement of each improvement area. The milestone criteria demonstrate the completion of progressive rehabilitation or improvement steps and events.

Milestone criteria relevant to each RA are provided in Table 24. It should be noted that not all rehabilitation milestones are applicable to all RAs; the applicability of rehabilitation milestones to the various RAs is also indicated in Table 24.

Table 24: Rehabilitation milestone criteria

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
RM1: Infrastructure decommissioning and removal	RA9	- With the exception of any infrastructure to remain as part of the post-mining land use (PMLU) or where infrastructure is agreed to be retained by the landholder as evidence by a signed landholder agreement, the following are completed: - all non-required services disconnected and removed; - all concrete, bitumen and gravel road material removed; - all pipelines drained and removed; - all fencing that is not part of the PMLU removed; - all remaining infrastructure demolished and/or removed unless agreed to be retained by the landholder; - all machinery and equipment removed; - all surface water drainage infrastructure that is not retained in the final landform removed; and - all rubbish removed.	Milestone criteria demonstrate that no infrastructure remains in the final landform.
RM2: Remediation of contaminated land	RA9, RA10	- All potentially contaminated land is remediated or removed. - Site investigation report prepared by an AQP¹, which states that the site is safe for its intended use. - All hazardous and contaminated materials have been assessed and identified by an AQP¹ and disposed of lawfully. - Contaminated land investigation undertaken with an accompanying report prepared by an AQP¹ confirms that the land is not contaminated and is suitable for the proposed PMLU.	A contaminated land investigation completed by an AQP¹ demonstrates that risks to human health and the environment have been appropriately managed. Criteria allows for the removal / remediation and disposal of contaminated materials to ensure a safe and non-polluting site, as required. Once any contaminated soils have been removed and/or remediated, validation testing will ensure a safe, non-polluting PMLU remains.

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
RM3: Landform development of waste emplacement (RA1, RA2 & RA5)	RA1, RA2, RA5	- All bulk landform earthworks (excluding topsoil cover) completed. - Slopes of waste rock emplacements and void low walls conform to a maximum slope of 6°. RA1: Slopes of waste rock emplacements will have a maximum slope length of 230 m when measured for individual slope sections from the crest of the slope section to the toe of the slope section. - The final landform is assessed to be geotechnically stable by an AQP¹, modelled to achieve a factor of safety of ≥ 1.5. - Final landform surveyed and certified by an AQP¹, as constructed per design specifications. - Coal rejects have been placed within the landform such that no rejects are closer than 10 m from the outer slope of the landform. - No reactive material is present on the land surface.	To establish a stable condition for land, the final site design specifications must be met to demonstrate final landform stability. Certification must be provided by a geotechnical engineer that the final landform is geotechnically stable post reshaping / re-profiling the landform, meaning that there is low risk of mass failure.
RM4: Landform development of diversion drains (RA8)	RA8	- The clean water diversions are constructed in accordance with relevant design specifications prepared by an AQP¹. - AQP¹ certifies that the constructed landform is geotechnically stable.	To establish a stable condition for land, the final site design specifications must be met to demonstrate final landform stability. Certification must be provided by a geotechnical engineer that the final landform is geotechnically stable post reshaping / re-profiling the landform, meaning that there is low risk of mass failure.
RM5: Landform development of infrastructure areas (RA9) and rehabilitated dams (RA6)	RA6, RA9	- All bulk earthworks completed to reshape landform to final design. - AQP¹ certifies that the constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5.	To establish a stable condition for land, the final site design specifications must be met to demonstrate final landform stability. Certification must be provided by a geotechnical engineer that the final landform is geotechnically

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
			stable post reshaping / re-profiling the landform, meaning that there is low risk of mass failure.
RM6: Landform development of residual void lake (RA3)	RA3	- The residual void has been backfilled to the following levels: ≥65 mAHD for Mine A; and ≥42 mAHD for Mine B. - Updated predictive modelling undertaken by an AQP¹ based on final residual void lake landform which confirms that the void will remain as a groundwater sink. - The residual void has been located outside of the modelled PMF extent. - All bulk earthworks completed to establish a littoral zone at the interface of the low wall and the base of the residual void. - Slopes of the littoral zone conform to a maximum slope of 6°.	To establish a stable condition for land, the final site design specifications must be met to demonstrate final landform stability. Certification must be provided by a geotechnical engineer that the final landform is geotechnically stable post reshaping / re-profiling the landform, meaning that there is low risk of mass failure.
RM7: Landform development of residual void high wall (RA4)	RA4	- The final void high walls located within the unconsolidated sediments and saturated tertiary will be constructed at an angle of 18°. - The final void high walls located within the Permian geology will be constructed with an overall angle of 55° by constructing 50 m high batters at a maximum angle of 65°, incorporating 15m wide intermediate benches between batters. - AQP¹ certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5. - Safety bunds adjacent to final high wall crest are designed and constructed in compliance with industry best practice and are certified as long-term stable.	To establish a stable condition for land, the final site design specifications must be met to demonstrate final landform stability. Certification must be provided by a geotechnical engineer that the final landform is geotechnically stable post reshaping / re-profiling the landform, meaning that there is low risk of mass failure.
RM8: Surface preparation	RA1, RA2, RA3, RA5, RA6, RA8, RA9	- All earthworks completed with placement of topsoil. RA3: All earthworks completed within the littoral zone with placement of topsoil. - All surface drainage features installed.	Soil testing should be completed by a suitably qualified person to ensure soil is suitable for target vegetation establishment and specify any requirements for potential amelioration prior to seeding.

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
		- Topsoil placed over all reshaped surfaces to a depth of 0.2 m and deep ripping to be undertaken along the contour of slopes. - An assessment of placed growth media health and suitability completed by an AQP¹ to confirm soil is suitable for target revegetation outcomes. - Soil testing requires the following requirements: - Soil pH >4.5 to <8; - EC < 1.0 dS/m; and - Exchangeable Sodium Percentage (ESP%) <6% (at 0-10cm depth). - Where required, ameliorants such as gypsum are added to improve soil quality characteristics at the rates recommended by an AQP¹.	Ameliorants may be required to improve cohesion with the subsoil / topsoil and given local variability in soil quality it is considered appropriate for recommendations to be made following testing of the material to be used in rehabilitation prior to use. Ripping to encourage water infiltration and grass root development to a depth that is sufficient for adequately stabilising surface soils.
RM9: Surface preparation and revegetation of residual void high wall (RA4)	RA4	- Hydromulch placed over the upper high wall (18° slope) and exposed benches. Before application, an assessment of placed growth media health and suitability is completed by an AQP¹ to confirm hydromulch is suitable for target revegetation outcomes. - Where required, ameliorants such as gypsum are added to improve hydromulch quality characteristics at the rates recommended by an AQP¹. - Seed mix incorporated into hydromulch and applied to upper high wall and exposed benches in accordance with a selection of seed mix provided in Attachment 3 (Table 27). - Revegetation completed for tree/shrub seed mix at a minimum total rate of 4kg/ha and a minimum of 6 native species; and - Revegetation completed for a ground cover seed mix at a minimum total rate of 12kg/ha and a minimum of 4 native species. - Seeding undertaken prior to forecasted rainfall during the wet season. - Details to be documented to indicate completion of the milestone: - GIS files of areas where seeding and/or planting has occurred; - date the seed mix was applied, or planting of tube stock was carried out;	Hydromulching enables the revegetation of steep slopes due to the additional binder agents with the slurry. In addition to binders, soil ameliorants and fertiliser can be included as part of the hydromulch composition to improve vegetation growth. Ameliorants may be required to improve cohesion with the subsoil / topsoil and given local variability in soil quality it is considered appropriate for recommendations to be made following testing of the material to be used in rehabilitation prior to use. Records to demonstrate that seeding has been undertaken in accordance with the rehabilitation objectives set out in the PRCP.

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
		c) if seeding, the seed mix and rate of seeding applied; and d) if planting, the number of tube stock planted.	
RM10: Revegetation for grazing	RA1, RA2, RA5, RA9	1. Seeding of all topsoiled surfaces completed in accordance with a selection of seed mix provided in Attachment 1 (Table 25) 2. The seed mix sown should comprise a minimum of 25% (by weight) native pasture species and include a minimum of 3 x 3P native species from Attachment 1 (Table 25). 3. Seeding undertaken prior to forecasted rainfall during the wet season. 4. Details to be documented to indicate completion of the milestone: a) GIS files of areas where seeding and/or planting has occurred; b) date the seed mix was applied, or planting of tube stock was carried out; c) if seeding, the seed mix and rate of seeding applied; and d) if planting, the number of tube stock planted. 5. Where required, fertiliser, mulch and ameliorants, such as gypsum, are added to improve growth media quality characteristics at the rates recommended by an AQP¹.	Records to demonstrate that seeding has been undertaken in accordance with the rehabilitation objectives set out in the PRCP.
RM11: Revegetation for fauna habitat	RA4	1. Seeding of a 5m wide littoral zone at the interface of the low wall and the base of the residual void, completed in accordance with seed mix provided in Attachment 4 (Table 28). 2. Seeding undertaken prior to forecasted rainfall during the wet season. 3. Details to be documented to indicate completion of the milestone: a) GIS files of areas where seeding and/or planting has occurred; b) date the seed mix was applied, or planting of tube stock was carried out; c) if seeding, the seed mix and rate of seeding applied; and d) if planting, the number of tube stock planted.	Records to demonstrate that seeding has been undertaken in accordance with the rehabilitation objectives set out in the PRCP.

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
		4. Where required, fertiliser, mulch and ameliorants, such as gypsum, are added to improve growth media quality characteristics at the rates recommended by an AQP ¹ .	
RM12: Revegetation for grazing/native vegetation	RA6, RA8	- Seeding of all topsoiled surfaces completed in accordance with a selection of seed mix provided in Attachment 2 (Table 26). - Revegetation completed for tree/shrub seed mix at a minimum total rate of 3kg/ha and a minimum of 4 native species; and - Revegetation completed for a ground cover seed mix at a minimum total rate of 16kg/ha and a minimum of 3 native species. - Seeding undertaken prior to forecasted rainfall during the wet season. - Details to be documented to indicate completion of the milestone: - GIS files of areas where seeding and/or planting has occurred; - date the seed mix was applied, or planting of tube stock was carried out; - if seeding, the seed mix and rate of seeding applied; and - if planting, the number of tube stock planted. - Where required, fertiliser, mulch and ameliorants, such as gypsum, are added to improve growth media quality characteristics at the rates recommended by an AQP¹.	Records to demonstrate that seeding has been undertaken in accordance with the rehabilitation objectives set out in the PRCP.
RM13: Achievement of surface requirements (grazing)	RA1, RA2, RA5, RA9	- Rehabilitation polygons have a median fractional vegetation cover greater than the first quartile of reference polygons² for at least 85% of all sample times, as determined using the satellite-derived fractional vegetation cover method.^{2 3 4} - Minimum of 3 target species established (Attachment 1, Table 25). - Weed⁵ presence is a maximum of 10% of total vegetative groundcover confirmed by an AQP¹ in annual monitoring. - No areas of "Moderate" or "Severe" erosion as defined in Attachment 5 (Table 29)	The purpose of this milestone is to demonstrate that the RA is trending towards the final milestone, allowing for early intervention with reparation activities as required. Monitoring against the criteria nominated for this milestone should be consistent with monitoring undertaken as part of the Project's annual rehabilitation monitoring, with datasets already collected to be used for tracking progress against milestone criteria

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
RM14: Achievement of surface requirements (native vegetation supporting fauna habitat)	RA4	1. A BioCondition assessment is completed by an AQP¹ using the methodology outlined in the latest version of the Queensland Herbarium's 'BioCondition Assessment Manual'. 2. ≥60% established and persistent native groundcover species from (Attachment 3, Table 27) on 18° slopes and intermediate benches. 3. Evidence of flora recruitment from rehabilitation monitoring data. 4. Weed⁵ presence is a maximum of 10% of total vegetative groundcover confirmed by an AQP¹ in annual monitoring. 5. No areas of "Moderate" or "Severe" erosion as defined in Attachment 5 (Table 29).	The purpose of this milestone is to demonstrate that the RA is trending towards the final milestone, allowing for early intervention with reparation activities as required. Monitoring against the criteria nominated for this milestone is consistent with monitoring undertaken as part of the Project's annual rehabilitation monitoring, with datasets already collected to be used for tracking progress against milestone criteria
RM15: Achievement of surface requirements (grazing/native vegetation)	RA6, RA8	1. Average vegetation ground cover is within 2 standard deviations of equivalent analogue sites. 2. Species richness is within 2 standard deviations of equivalent analogue sites. 3. Weed⁵ presence is a maximum of 10% of total vegetative groundcover confirmed by an AQP¹ in annual monitoring. 4. No areas of "Moderate" or "Severe" erosion as defined in Attachment 5 (Table 29).	The purpose of this milestone is to demonstrate that the RA is trending towards the final milestone, allowing for early intervention with reparation activities as required. Monitoring against the criteria nominated for this milestone is consistent with monitoring undertaken as part of the Project's annual rehabilitation monitoring, with datasets already collected to be used for tracking progress against milestone criteria
RM16: Achievement of surface requirements (fauna habitat)	RA3	1. Persistence of ≥ 50% of seeded/planted semi-aquatic or inundation-tolerant species in littoral zone. 2. Weed⁵ presence is a maximum of 10% of total vegetative groundcover confirmed by an AQP¹ in annual monitoring. 3. No areas of "Moderate" or "Severe" erosion as defined in Attachment 5 (Table 29).	
RM17: Achievement of Stable PMLU – Grazing	RA1, RA2, RA5, RA9	1. Sediment and erosion control structures removed after disturbed areas stabilised.	Land suitability assessment to demonstrate that land suitability is similar to the pre-mining landscape.

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
		- No evidence of erosion classified as 'moderate' or 'severe' as defined by Attachment 5 (Table 29). - Drainage follows intended and appropriate drainage paths. - Land suitability assessment by an AQP¹ certifies that land has achieved a post mine land suitability class of 3 or better. - A species presence that is consistent with those used in the recommended rehabilitation seed mix in Attachment 1 (Table 25). - Recommended species selected for revegetation which includes 3P grasses as recommended by Grazing Land Management information provided by NQ Dry Tropics⁶ or the Fitzroy Basin Association⁷ and are suitable to achieve the approved PMLU. - Assessed as Geotechnically stable by an AQP¹ indicating landform stability for a gradient slope of 6 degrees vegetative groundcover ≥80%. - Weed⁵ presence is a maximum of 10% of total vegetative groundcover confirmed by an AQP¹ in annual monitoring. - Maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance.	It is considered that the confirmation and certification by an AQP¹ that no potential for impacts to values exists is an appropriate metric of success, as the certification is underpinned by the life-of mine monitoring through the period of rehabilitation assessment. This approach requires that potential impacts are assessed in consideration of: - specific site-based factors; - actual monitoring data from the life-of mine, including from applicable upstream and downstream locations from the rehabilitated landforms; - long-term monitoring trend analysis; and - a broad-catchment overview with high local resolution. Monitoring of stream sediment parameters is to be undertaken in accordance with the requirements of the Project Receiving Environment Monitoring Program.
RM18: Achievement of Stable PMLU – Grazing/Native vegetation	RA6, RA8	≥70% of native groundcover species listed in the rehabilitation seed mix (Attachment 2, Table 26) are established and persistent. ≥60% of native tree/shrub species listed in the rehabilitation seed mix (Attachment 2, Table 26) are established and persistent. - Weed⁵ presence is a maximum of 10% of total vegetative groundcover confirmed by an AQP¹ in annual monitoring. - No areas of "Moderate" or "Severe" erosion as defined in Attachment 5 (Table 29). - Geotechnical assessment by an AQP¹ confirms that long-term geotechnical stability has been achieved for each relevant landform.	Assessment by an AQP¹ to demonstrate that the PMLU is safe, stable, sustainable and non-polluting.

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
RM19: Achievement of Stable PMLU – Native vegetation supporting fauna habitat	RA4	1. A BioCondition assessment is completed by an AQP¹ using the methodology outlined in the latest version of the Queensland Herbarium's 'BioCondition Assessment Manual'. 2. ≥80% established and persistent native groundcover species from (Attachment 3, Table 27) on 18° slopes and intermediate benches. 3. Evidence of flora recruitment from rehabilitation monitoring data. 4. Fauna survey report provides evidence of >5 native species inhabiting or utilising high wall ecosystems annually including macroinvertebrates, aquatic vertebrates, avian species, bats, and other mammals. 5. Weed⁵ presence is a maximum of 10% of total vegetative groundcover confirmed by an AQP¹ in annual monitoring. Weed⁵ management recommendations to be provided in annual reports. 6. No areas of "Moderate" or "Severe" erosion as defined in Attachment 5 (Table 29). 7. Perimeter safety bunds and fencing adjacent to final high wall crests are designed and constructed to exclude cattle use and prevent erosion. 8. Safety bunds adjacent to final high wall crest are designed and constructed in compliance with industry best practice and safety bunds for high walls are certified as long-term stable. 9. Geotechnical assessment by an AQP¹ confirms that long-term geotechnical stability has been achieved for each relevant landform. 10. Report prepared by an AQP¹ confirms the native ecosystem PMLU has been achieved with consistency to surrounding landscape.	Assessment by an AQP ¹ to demonstrate that the PMLU is safe, stable, sustainable and non-polluting.
RM20: Achievement of Stable PMLU – Fauna habitat	RA3	1. Void lake to be in line with following parameters: a) predictive modelling undertaken by an AQP¹ confirms that the voids will remain as a groundwater sink and that there is no risk of contaminant release to surface or groundwaters post-mining; and	Assessment by an AQP ¹ to demonstrate that the PMLU is safe, stable, sustainable and non-polluting.

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
		b) water in void lakes will have a TDS of less than 5,000mg/L over the first 100 years. 2. Groundwater quality monitored quarterly at monitoring bores listed in the P-EA-100114292, table E1, complying with quality characteristics limits listed in the P-EA-100114292, Table E2 for a minimum of 5 consecutive years. 3. Fauna survey report provides evidence of native species inhabiting or utilising pit lake ecosystems including macroinvertebrates, aquatic vertebrates, avian species, bats, and other mammals. 4. AQP¹ certifies that final void lake landform, including low and high walls, are geotechnically stable and achieved FoS ≥ 1.5.	
RM21: Achievement of Stable PMLU – retained dams	RA7	1. Transfer of ownership agreements in place for all dams to be retained. 2. AQP¹ certifies that all contaminated sediment has been removed from all dams that are not backfilled. 3. Dams to remain for landholder use are safe for stock access. 4. All retained water storages achieve geotechnical and erosional safety and stability as assessed and approved by an AQP¹. 5. No areas of "Moderate" or "Severe" erosion as defined in Attachment 5 (Table 29). 6. Retained water storage water quality for quality characteristics to be below the trigger values for livestock drinking water defined in Environmental Protection (Water) Policy 2009 Mackenzie River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Mackenzie River Sub-basin, September 2011⁸, or the most recent version. 7. Final landform survey confirms no built structures remain other than those that form part of a landholder agreement.	Assessment by an AQP ¹ to demonstrate that the retained dams are safe, stable, sustainable and non-polluting. It provides a justification that the transfer of infrastructure to the underlying landholder will not result in environmental impacts post-closure.
RM22: Achievement of Stable PMLU– retained infrastructure	RA10	1. Transfer of ownership agreements in place for all infrastructure to be retained. 2. All retained structures and landforms to be assessed and approved as safe and stable by an AQP¹.	Assessment by an AQP ¹ to demonstrate that the retained infrastructure is safe, stable, sustainable and non-polluting. It provides a justification that the

Rehabilitation Milestone	Applicable Rehabilitation Areas	Criteria	Justification for criteria
		3. Final landform survey confirms no built structures remain other than those that form part of a landholder agreement.	transfer of infrastructure to the underlying landholder will not result in environmental impacts post-closure.
RM23: Surface water and groundwater demonstrate non-polluting landform	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9, RA10	1. Surface water quality results monitored monthly during flow at, but not limited to, downstream locations specific in Table F1 of the P-EA-100114292 – Surface water monitoring locations, must not exceed the limits in Attachment 6 (Table 30)– Surface water quality limits, for a minimum of 3 consecutive years. 2. If the surface water quality in the downstream receiving environment exceeds criteria (1), the applicable upstream site must be compared to the downstream site result; and quality measured at a downstream site must be equal to or less than the quality measured at the applicable upstream site. 3. Groundwater level is monitored quarterly, and all results comply with Level Trigger Thresholds outlined in Ps-EA-100114292 Table E3 - Groundwater level triggers at the monitoring locations specified in Table E1 – Groundwater monitoring locations and frequency for 10 consecutive years. 4. For a minimum of 3 consecutive sampling years, groundwater quality must be monitored quarterly at bored specified in Table E1 of the P-EA-100114292, for all quality characteristics listed in Table E2 of the P-EA-100114292. 5. Groundwater quality results must not exceed the limits in Table 2 of P-EA-100114292 Groundwater Quality Limits, for 3 consecutive results.	Assessment by an AQP ¹ to demonstrate that the PMLU is safe, stable, sustainable and non-polluting.

¹ Appropriately 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 and analysis on performance relating to the subject matter using the relevant protocols, standards, methods or literature.

² Reference polygons for fractional vegetation cover are required to be of Land Class Suitability 3 or 4, or better. A minimum of two additional reference sites will be nominated by 2026, and upon assessment must represent a land suitability class of either 3 or 4, or better.

³ Spectral unmixing algorithm employed in seasonal fractional cover – Landsat, JRSRP algorithm, Australia coverage v1.0 (Beutel et al. 2019)

⁴ Fractional Cover: Satellite Assessment, AARC 2023, or equivalent, methodology to be used for rehabilitation monitoring

⁵ Weeds are defined by the Biosecurity Act 2014

⁶ <https://nrm.nqdrytropics.com.au/land/3p-grasses/>

⁷ <https://fba.org.au/services/graziers/>

⁸ https://environment.des.qld.gov.au/data/assets/pdf_file/0031/89068/fitzroy_mackenzie_river_wqo_290911.pdf

Table 25: Attachment 1 – Grazing PMLU seed mix

Scientific name	Common name	Minimum application rate (kg/ha)
<i>Bothriochloa bladhii</i>	Forest bluegrass	3
<i>Bothriochloa ewartiana</i> *	Desert bluegrass	3
<i>Bothriochloa pertusa</i>	Indian bluegrass	3
<i>Chamaecrista rotundifolia</i>	Roundleaf cassia	1
<i>Chloris gayana</i>	Rhodes grass	2
<i>Dichanthium sericeum</i> *	Queensland bluegrass	3
<i>Echinochloa esculenta</i>	Japanese millet	5
<i>Enteropogon acicularis</i> *	Curly windmill grass	3
<i>Panicum decompositum</i> *	Native millet	3
<i>Stylosanthes hamata</i> cvv. <i>Verano</i> or <i>Amiga</i>	Caribbean stylo	1
<i>Stylosanthes Seabrana</i> cvv. <i>caatinga</i>	Caatinga stylo	1
<i>Themeda triandra</i>	Kangaroo grass	3

*Denotes a 3P pasture species.

Table 26: Attachment 2 – Grazing/ Native vegetation seed mix

Scientific name	Common name
Canopy/Tree	
<i>Alphitonia excelsa</i>	Soap tree
<i>Corymbia clarksonia</i>	Grey bloodwood
<i>Eucalyptus crebra</i>	Narrow-leaved red ironbark
<i>Eucalyptus exserta</i>	Queensland peppermint
Shrub	
<i>Acacia excelsa</i>	Ironwood
<i>Acacia holosericea</i>	Soap bush wattle
<i>Acacia leiocalyx</i>	Black Wattle
<i>Owenia acidula</i>	Emu apple
<i>Senna artemisioides</i>	Cassia
<i>Myoporum acuminatum</i>	Coastal boobialla
Ground	
<i>Aristida calycina</i>	Dark wiregrass
<i>Bothriochloa bladhii</i>	Forest bluegrass

Scientific name	Common name
<i>Bothriochloa ewartiana</i> *	Desert bluegrass
<i>Chloris gayana</i>	Rhodes grass
<i>Stylosanthes hamata</i> cvv. <i>Verano</i> or <i>Amiga</i>	Caribbean stylo
<i>Stylosanthes Seabrana</i> cvv. <i>caatinga</i>	Caatinga stylo
<i>Dichanthium sericeum</i> *	Queensland blue grass
<i>Enteropogon acicularis</i> *	Curly windmill grass
<i>Panicum decompositum</i> *	Native millet

*Denotes a 3P pasture species.

Table 27: Attachment 3 – Native vegetation seed mix

Scientific name	Common name
Shrub	
<i>Acacia excelsa</i>	Ironwood
<i>Acacia holosericea</i>	Soap bush wattle
<i>Acacia leiocalyx</i>	Black Wattle
<i>Alstonia constricta</i>	Bitterbark
<i>Owenia acidula</i>	Emu apple
<i>Senna artemisioides</i>	Cassia
<i>Myoporum acuminatum</i>	Coastal boobialla
<i>Enchylaena tomentosa</i>	Ruby Saltbush
Groundcover	
<i>Aristida calycina</i>	Dark wiregrass
<i>Aristida caput-medusae</i>	Many-headed wiregrass
<i>Aristida queenslandica</i> var. <i>dissimilis</i>	Queensland Wiregrass
<i>Bothriochloa bladhii</i>	Forest bluegrass
<i>Cynodon dactylon</i>	Couch
<i>Dichanthium sericeum</i> *	Queensland blue grass
<i>Enteropogon acicularis</i> *	Curly windmill grass
<i>Heteropogon contortus</i> *	Black speargrass
<i>Lomandra longifolia</i>	Spiny-headed mat-rush
<i>Panicum decompositum</i> *	Native millet

*Denotes a 3P pasture species.

Table 28: Attachment 4 - Seed mix for littoral zone of the low walls

Scientific name	Common name
Rushes and Sedges	
<i>Atriplex semibaccata</i>	Creeping saltbush
<i>Cyperus polystachyos</i>	Bunchy sedge
<i>Ficinia nodosa</i>	Knobby club rush
<i>Fimbristylis dichotoma</i>	Common fringe-rush
<i>Fimbristylis ferruginea</i> or <i>Fimbristylis polytrichoides</i>	Fringe-rush
<i>Isolepis cernua</i>	Nodding club rush
<i>Lomandra hystrix</i>	Creek mat-rush
<i>Juncus bufonius</i>	Toad rush
<i>Juncus kraussii</i>	Sea rush
<i>Juncus usitatus</i>	Common rush
<i>Triglochin striata</i>	Streaked arrow grass

Table 29: Attachment 5 – Erosion classification framework

Erosion classification	Minor	Moderate	Severe
Sheet erosion	Shallow soil deposits downslope	Partial exposure of roots; moderate soil deposits downslope, etc	Loss of surface horizon; root exposure; moderate substantial soil deposits downslope
Rill erosion	<0.3m deep<15 rills/transect*	<0.3m deep 15-30 rills/transect*	<0.3m deep>30 rills/transect*
Gully erosion	Absent	>0.3m deep Gullies are linear, continuous, and restricted to primary or minor drainage lines	>0.6m deep Gullies are continuous or discontinuous, and either tend to branch away from primary drainage lines and on to foot slopes, or have multiple branches within drainage lines
Tunnel erosion	Absent	Absent	Present
Mass movement	Absent	Absent	Present

Source: NCST (2009) *Australian Soil and Land Survey Field Handbook, 3rd edition*. The National Committee on Soil and Terrain. CSIRO Publishing, Collingwood, Australia.

* Transect linear 100 m across the contour (Source: Tongway, D J. and Hindley, N.L. 2005. *Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes*. CSIRO Publishing, Canberra, Australia)

Table 30: Attachment 6 – Surface water quality limits

Quality characteristics (units)	Limit	Comment on limit
pH	pH 6.5-8.5	Mackenzie River WQO
Conductivity (EC) baseflow (µS/cm)	720	Mackenzie River WQO
Turbidity (NTU)	< 50	Mackenzie River WQO
Sulphate (mg/L)	25	Mackenzie River WQO
Aluminium – dissolved (µg/L)	55	ANZG 2018
Cobalt – dissolved (µg/L)	1.4	ANZG 2018
Chromium – dissolved (µg/L)	1900	ANZG 2018
Copper – dissolved (µg/L)	34	ANZG 2018
Manganese – dissolved (µg/L)	11	ANZG 2018
Molybdenum – dissolved (µg/L)	5	ANZG 2018
Nickel – dissolved (µg/L)	8	ANZG 2018
Selenium – dissolved (µg/L)	20	ANZG 2018
Zinc – dissolved (µg/L)	100	ANZG 2018
Total recoverable hydrocarbons (C6-C9) (µg/L)	20	
Total recoverable hydrocarbons (C10-C36) (µg/L)	100	
Major ions (mg/L) Calcium, chloride, potassium, magnesium, sodium, bicarbonate, carbonate	For interpretation purposes only	
Hardness (mg/L)	For interpretation purposes only	

Notes:

- All metal and metalloids must be measured as “dissolved” (from analysis of a field filtered sample) and total “unfiltered”
- Limits for metals and metalloids apply to dissolved results
- ANZG (2018) *Aquatic ecosystem protection for moderately disturbed system (95% protection)*

Table 31: Attachment 7 – Groundwater monitoring locations and frequency

Site	Bore ID	Easting (GDA94, Zone 55)	Northing (GDA94, Zone 55)	Bore Depth (m)	Groundwater Unit Monitored	Monitoring Frequency
2	DW7067W	730781	7382394	100-14	Permian	Quarterly
	DW7068W	730785	7382391	48	Tertiary	Quarterly
3	DW7069W	730397	7382699	71	Permian	Quarterly
	DW7071W	730394	7382703	32	Permian	Quarterly
	DW7072W	730403	7382687	14	Tertiary	Quarterly
4	DW7073W	729926	7382666	82	Permian	Quarterly
	DW7074W	729922	7382666	56	Permian	Quarterly
	DW7075W	729918	7382666	14	Tertiary	Quarterly
5	DW7076W	729750	7382723	12	Alluvium	Quarterly
6	DW7033W1	731543	7383768	45	Tertiary	Quarterly
	DW7033W2	731546	7383773	75	Permian	Quarterly
	DW7033W3	731548	7383777	81	Permian	Quarterly
10	DW7105W1	730192	7380733	23	Tertiary	Quarterly
	DW7105W2	730193	7380729	69	Permian	Quarterly
14	DW7225W1	730467	7378359	37	Tertiary	Quarterly
	DW7225W2	730466	7378355	79	Permian	Quarterly
	DW7225W3	730465	7378351	113	Permian	Quarterly
17	DW7292W1	732905	7381108	15	Alluvium	Quarterly

Table 32: Attachment 8 – Groundwater Quality Limits

Parameter	Groundwater Unit — Trigger Level		
	Alluvium	Tertiary	Permian
Physical Parameters/Sulphate			
Field Electrical Conductivity (S/cm)	15,993 ¹	22,545 ¹	28,603 ¹
Electrical Conductivity (S/cm) — DW7068W		22,910 ²	
Field pH	5.38 - 8.50 ³	5.38 - 8.50 ³	5.38 - 8.50 ³
Sulphate (mg/L)	216 ¹	364 ¹	768 ¹
Sulphate (mg/L) — DW7068W		380 ²	
Metals/metalloids (dissolved — mg/L)			
Aluminium	0.09 ¹	0.055 ⁴	0.06 ¹

Parameter	Groundwater Unit — Trigger Level		
	Alluvium	Tertiary	Permian
Arsenic	0.013 ⁴	0.013 ⁴	0.017 ¹
Chromium	0.001 ⁴	0.001 ⁴	0.001 ⁴
Cobalt	0.004 ¹	0.004 ¹	0.022 ¹
Copper	0.378 ¹	0.060 ¹	0.095 ¹
Manganese	1.9 ⁴	1.9 ⁴	1.9 ⁴
Molybdenum	0.034 ⁴	0.034 ⁴	0.056 ¹
Nickel	0.208 ⁵	0.328 ⁵	0.440 ⁵
Selenium (Total)	0.011 ⁴	0.011 ⁴	0.011 ⁴
Zinc	0.475 ¹	0.235 ¹	0.320 ⁵

Notes:

1. 95th Percentile of data for each groundwater unit
2. Maximum value recorded in bore DW7068W
3. Lower and upper range of site data
4. ANZG (2018) Aquatic ecosystem protection for moderately disturbed system (95% protection)
5. Hardness modified criteria, based on ANZG (2018) 95% aquatic ecosystem protection trigger

Table 33: Attachment 9 – Groundwater Level triggers

Groundwater Unit	Trigger level threshold (m) ¹
Alluvium	2m/year
Tertiary	2m/year
Permian	5m/year

¹ Water level triggers have been derived from Section 362 of the Water Act 2000.

3.5.5 Rehabilitation timeframes

The rehabilitation milestones must be achieved as soon as practicable after land becomes available for rehabilitation. Land is considered to become available for rehabilitation at the completion of mining, except where land is required for future activities, for future rehabilitation, or is identified as being retained infrastructure post-closure.

Rehabilitation milestone timeframes have been developed with consideration for the size of the rehabilitation area, the activities applicable to the milestone and interim rehabilitation activities that are scheduled to occur or anticipated to be required prior to the area becoming available for rehabilitation (Table 34).

Milestones that involve revegetation activities, including monitoring of revegetation, make provision for unfavourable growing seasons and unforeseen extreme events such as droughts or storms that could negatively impact vegetation establishment. As a result, milestone timeframes are extended to ensure achievement.

Table 34: Typical timeframes for RMs associated with each RA

Rehabilitation Milestones (RM)	Summary rehabilitation methodology	Associated risks	Risk level assigned	Typical time frame (years)	Justification for assigned timeframe
Infrastructure Decommissioning and Removal (RM1)	Infrastructure decommissioning and disposal	- Initial/ongoing gully/sheet erosion - Significant slope failure	Moderate	2	Some mine infrastructure (e.g. haul road) will be required to facilitate rehabilitation activities and will therefore not become available for rehabilitation for several years post closure. Decommissioning activities are considered low risk, therefore decommissioning is expected to take less than 2 years.
Mine water dam and Mine infrastructure areas -> Remediation of Contaminated Land (RM2)	- Remediation or removal of contaminated material (where applicable) - Determination of contaminated land status by appropriately qualified person	Contaminated land	Low	1	A contaminated land assessment will be undertaken by an appropriately qualified person. If contaminated land is identified, remediation works will be undertaken promptly. Given the low risk classification associated with this activity, the timeframe assigned is 1 year.
Land available for rehab -> Landform development (RM3, RM4, RM5, RM6, RM7)	- Void lake high walls and low walls to meet specification requirements including slope gradient, lengths - Geotechnical stability of the rehabilitated landform to achieve FOS ≥ 1.5.	- Void lake high walls and low walls failing to meet the specifications required for the PMLU; and - Significant slope failure - Initial/ongoing gully/sheet erosion	Moderate	2	As land becomes available, all bulk earthworks are to be completed according to rehabilitation design specifications and assessed as geotechnically stable by a suitably qualified person. Given the variability in the size of areas becoming available at the same time and changing climatic conditions that may affect scheduled earthworks, typical timeframe assigned is two years.

Rehabilitation Milestones (RM)	Summary rehabilitation methodology	Associated risks	Risk level assigned	Typical time frame (years)	Justification for assigned timeframe
Landform development (RM3, RM4, RM5, RM6) -> Surface preparation (RM8)	- Ripping of soil profile/subsoil - Soil health and suitability assessment - As required, application of ameliorants to subsoil and topsoil	- Erodible topsoils and subsoils not able to be rectified with amelioration. - Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas - Insufficient quality of topsoil resources onsite available to undertake rehabilitation activities	Moderate	2	Topsoil testing and classification before placement is the key process in this timeframe to minimise risk. As a low-level risk, a typical timeframe of 2 year has been assigned
Landform development (RM7) -> Surface preparation and revegetation (RM9)	- Application of hydromulch - As required, application of ameliorants - Seeding of target key species completed at specified sowing rates (refer section 3.5.4)	- Hydromulch fails to allow seeds to revegetate - Subsoil material is unable to support long-term vegetation growth - Insufficient quantity of hydromulch to be sourced for application	Moderate	7	Hydromulch testing and classification before placement is the key process in this timeframe to minimise risk. The seeding of key target species has been assigned a low-level risk. Rates of seeding are and seeding species in section 3.5.6.4 A typical time frame of 7 years has been assigned.
Surface preparation (RM8) -> Grazing & Fauna Revegetation (RM10, RM11)	Seeding of target key species completed at specified sowing rates (refer section 3.5.4)	- Failure to meet seeding rate of key target species. - Natural hazards (fire, drought, heavy rainfall) following planting resulting in poor seed establishment and loss of topsoil	Low	2	The seeding of key target species has been assigned a low-level risk. Rates of seeding are and seeding species in section 3.5.6.4 A typical time frame of 2 years has been assigned.

Rehabilitation Milestones (RM)	Summary rehabilitation methodology	Associated risks	Risk level assigned	Typical time frame (years)	Justification for assigned timeframe
Surface preparation (RM8) -> Grazing/Native ecosystem Revegetation (RM12)	Seeding of target key species completed at specified sowing rates (refer section 3.5.4)	- Failure to meet seeding rate of key target species. - Natural hazards (fire, drought, heavy rainfall) following planting resulting in poor seed establishment and loss of topsoil	Low	5	The seeding of key target species has been assigned a low-level risk. Rates of seeding are and seeding species in section 3.5.6.4 A typical time frame of 5 years has been assigned to allow for growth of trees and shrubs.
Revegetation (RM10, RM11) -> Achievement of surface requirements (RM13, RM16)	Revegetated areas to be assessed against ground cover and stability related completion criteria (refer section 3.5.4)	- Erodible topsoils and subsoil - Ongoing rill, gully or sheet erosion - Excessive rainfall, droughts or fire events that may directly affect groundcover establishment; and - Pests and weeds	Moderate	5	The achievement of target revegetation criteria is dependent on good climatic conditions, which result in optimal growing seasons and good soils to enhance plant growth. The four years assigned for this timeframe considers the time necessary for establishment of mature, self-sustaining vegetation (i.e., multiple seasons of successful recruitment). Consideration of allowances for poor growing seasons due to extreme events such as droughts or storms that may negatively impact the germination of seeds, cause erosion, or drive maintenance actions to be taken in previously revegetated areas.

Rehabilitation Milestones (RM)	Summary rehabilitation methodology	Associated risks	Risk level assigned	Typical time frame (years)	Justification for assigned timeframe
Grazing/Native Ecosystem & Native Ecosystem Revegetation (RM9, RM12) -> Achievement of surface requirements (RM14, RM15)	Revegetated areas to be assessed against ground cover and stability related completion criteria (refer section 3.5.4)	- Erodible topsoils and subsoil - Ongoing rill, gully or sheet erosion - Excessive rainfall, droughts or fire events that may directly affect groundcover establishment; and - Pests and weeds	Moderate	10	The achievement of target revegetation criteria is dependent on good climatic conditions, which result in optimal growing seasons and good soils to enhance plant growth. The four years assigned for this timeframe considers the time necessary for establishment of mature, self-sustaining vegetation (i.e., multiple seasons of successful recruitment). Consideration of allowances for poor growing seasons due to extreme events such as droughts or storms that may negatively impact the germination of seeds, cause erosion, or drive maintenance actions to be taken in previously revegetated areas.
Achievement of surface requirement (RM13, RM16) -> Achievement of stable PMLU (RM17, RM20)	Vegetation monitoring & maintenance as required	- Erodible topsoils and subsoils - Ongoing rill, gully or sheet erosion - Drainage of final landform not meeting the water quality objectives - Excessive rainfall, droughts or fire events that may directly affect groundcover establishment - Drainage of final landform not meeting the water quality objectives; and - Pests and weeds.	Moderate	5	Achievement of a target PMLU requires it to be stable, safe, non-polluting and sustainable. The five years assigned for this timeframe considers the time necessary for establishment of mature, self-sustaining vegetation (i.e. multiple seasons of successful recruitment) and the timing needed to achieve the surface water quality objectives. Allowance is also given for natural hazard events such as fires or severe storms that may drive additional maintenance works or even revegetation.

Rehabilitation Milestones (RM)	Summary rehabilitation methodology	Associated risks	Risk level assigned	Typical time frame (years)	Justification for assigned timeframe
Achievement of surface requirements (RM14, RM15) -> Achievement of stable PMLU (RM18, RM19)	Vegetation monitoring & maintenance as required	- Erodible topsoils and subsoils - Ongoing rill, gully or sheet erosion - Drainage of final landform not meeting the water quality objectives - Excessive rainfall, droughts or fire events that may directly affect groundcover establishment - Drainage of final landform not meeting the water quality objectives; and - Pests and weeds.	Moderate	5	Achievement of a target PMLU requires it to be stable, safe, non-polluting and sustainable. The five years assigned for this timeframe considers the time necessary for establishment of mature, self-sustaining vegetation (i.e. multiple seasons of successful recruitment) and the timing needed to achieve the surface water quality objectives. Allowance is also given for natural hazard events such as fires or severe storms that may drive additional maintenance works or even revegetation.
Achievement of stable PMLU – retained dams	Dams to remain safe, stable and accessible to livestock with appropriate water quality values based on stockwatering guidelines	- Water quality is not able to support stockwatering - Erodible topsoils and subsoils - Ongoing rill, gully or sheet erosion	Low	1	Retention of these dams has been confirmed by the underlying landholder. There is no indication that sediment dams will be unable to meet the relevant water quality objectives, or will experience high rates of erosion.

Rehabilitation Milestones (RM)	Summary rehabilitation methodology	Associated risks	Risk level assigned	Typical time frame (years)	Justification for assigned timeframe
Achievement of stable PMLU–retained infrastructure	Infrastructure to remain in good, working order and is able to facilitate the intended land use	Infrastructure dilapidation due to mine usage	Low	1	Retention of the infrastructure has been confirmed by the underlying landholder and it is expected that infrastructure will be in good, working order.
Surface water and groundwater demonstrate non-polluting landform	Groundwater and surface water values remain in compliance with the Gemini EA and no rehabilitated landforms are contributing to exceedances on site.	Water quality is unable to meet the relevant objectives described in the EA	High	End of Mining	Is it difficult to isolate sources of contaminants within surface water and groundwater systems during mine operations. As such, this milestone is expected to be relevant at the end of mining, once the site has been successfully rehabilitated and no contaminants are being produced by the site. There is a high risk that if rehabilitation works are unsuccessful due to water impacts, rehabilitation works may need to be removed and re-established to preserve environmental values.

3.5.6 General rehabilitation practice

The rehabilitation practices to be used for the Gemini project have been developed from increasing knowledge gained from experience at other local mines in the Blackwater area, including:

- early rehabilitation successes and failures;
- weather, subsoils, soils, local flora and fauna and revegetation species;
- final landform design, stability and erosion risks; and
- site preparation and seeding practices.

While rehabilitation objectives and completion criteria for the Project are detailed at sections 3.5.1 and 3.5.4, the following overarching rehabilitation principles will be adopted:

- Ensuring that reshaped areas proposed for rehabilitation meet the required landform design principles, that prepared areas meet the rehabilitation design specification for the area, and that local site drainage has been considered and surrounding areas graded to mitigate any rainfall runoff from adjacent areas to run-on to prepared rehabilitation areas.
- Soil testing will be carried out progressively to ensure topdressing materials, amelioration and final surface preparation methods support vegetative growth.
- Revegetation species selection, seeding and/or planting methods, and fertiliser applications target rapid vegetative ground cover effective at mitigating soil erosion, during the period of initial revegetation when areas are most at risk.
- Ongoing monitoring and maintenance will occur as needed to assess rehabilitated area performance against completion criteria and inform future rehabilitation practices; and to identify rehabilitation methodology adjustments such that RAs are proceeding along a trajectory towards the designated PMLU.

The following sub-sections outline the range of information considered necessary to inform the development of rehabilitation methods for the Gemini Project. The information addresses the content requirements of Guideline – Progressive rehabilitation and closure plans V3.01 (Department of Environment and Science).

3.5.6.1 Waste characterisation

Geochemical waste characterisation studies were carried out for the Gemini Project by RGS in 2019 (Appendix E) and RGS 2020 (Appendix E) with the aim of understanding any potential geochemical risks during operations and post closure. The assessments provide a geochemical characterisation of samples representative of the mining wastes (overburden and interburden materials) and coal reject materials.

Both static and kinetic testing methods were utilised to indicate the presence and degree of risk from the oxidation of reactive sulfides, and the potential for acid generation and leaching of soluble metals/metalloids and salts. The assessments also included characterisation of chemical parameters related to sodicity and material stability. Measurement of the geochemical/weathering behaviour of waste samples over time were assessed via kinetic leach column (KLC) test. The KLC tests comprised composite mining samples representing the main lithological rock types likely to be generated at the proposed open pit as well as some carbonaceous material and uneconomic coal. The KLC tests were completed over a period of six months from July 2017 to January 2018, under a monthly watering and leaching cycle.

Waste rock geochemistry

A total of 70 waste samples were collected from three drill holes within the Project area; representative of the main overburden, interburden and potential coal reject materials likely to be encountered during development of the Project. Samples were collected from the surface down through the stratigraphic profile (including economic and uneconomic coal seams) to the base of the open pit.

The pH (1:5) of samples were assessed using the 1:5 soil:water suspension method, which is considered the de facto standard pH measurement. Across all sample types, pH ranged from 5.0 to 9.7 with a median value of 9.2. The samples with the lowest pH values (pH 5.0 to 5.5) represent clay and soil materials.

EC(1:5) ranges from 270 to 1,440 $\mu\text{S}/\text{cm}$ with a median of 646 $\mu\text{S}/\text{cm}$, and is considered to be moderate. The weathered material tends to have a higher EC value than the fresh material.

Total sulphur content ranges from less than 0.01-0.60 %S (median 0.06 %S). Compared to the median crustal abundance of sulphur (0.07%) (INAP 2009), the median value of the mining waste materials is relatively low. The sulphur content of carbonaceous siltstone and coal are both higher than natural background values and both lithologies show greater variation in sulphur content than the weathered material, sandstone and siltstone.

The results of the multi-element analysis were assessed against the geochemical abundance index in accordance with relevant guidelines and practices (Bowen 1979; INAP 2009). The geochemical abundance index results indicate that, compared to median crustal abundance, only one of the 10 selected samples was enriched and then only with respect to cobalt.

Sample analysis indicated that the CEC of the materials varies between 4.2-18 meq/100g with a mean value of 10 meq/100g. The resulting effective CEC rating for the materials is from very low to moderate.

The ESP of the 10 selected samples ranged from low (4.5%) to very high (31.5%) with a median of 19.3%, indicating that some of the sample materials are likely to be sodic.

The findings of the geochemical assessment of waste rock samples (RGS 2019) can be summarised as follows:

- all of the mining waste samples tested are NAF, have excess ANC and typically have low sulphur content. The sulphur content of coal and carbonaceous siltstone can be elevated compared to typical background concentrations, but is mainly present in a non-sulfidic form, which does not contribute to acid generation. Overall, these materials have a low risk of acid generation and a high factor of safety with respect to potential for AMD;
- initial and ongoing surface runoff and seepage from mining waste materials is expected to be moderately alkaline and have a moderate level of salinity;
- KLC test results indicate that mining waste materials are unlikely to generate acid conditions and more likely to generate pH neutral to alkaline conditions;
- metal/metalloid enrichment in mining wastes, compared to median crustal abundance in unmineralised soils, is limited to cobalt in a single carbonaceous siltstone sample;
- most metals/metalloids are sparingly soluble at the neutral to alkaline pH of leachate expected from bulk mining waste materials. Dissolved metal/metalloid concentrations in surface runoff and leachate from bulk mining waste materials are therefore expected to be low and unlikely to pose a significant risk to the quality of surface and groundwater resources at relevant storage facilities;
- mining waste materials should be amenable to revegetation as part of rehabilitation activities, although, gypsum and fertiliser will be used as necessary for sodic materials to limit dispersion and erosion and to provide a reasonable growth medium for revegetation and rehabilitation; and
- mining materials are likely to be susceptible to dispersion and erosion, ongoing testing programs will be implemented to validate material properties during operations. Final landform slope angles have been designed at a maximum grade of 6°. Dispersive or saline waste rock types, typically weathered waste rock) will not be placed on the outer slopes of waste rock emplacements.

Coal rejects geochemistry

A total of 80 coal reject samples from coal quality washability tests were provided from 14 different drill holes, comprising 52 coarse reject and 28 fine reject samples.

The pH(1:5) of the 22 composite coal reject samples from the Project ranged from 5.1 to 8.3 with a median value of 7.4 indicating that coal reject materials are typically in the pH neutral range. There does not appear to be any significant correlation between pH and reject type or coal seam.

EC(1:5) ranges from 398 to 1,062 $\mu\text{S}/\text{cm}$ (median 774 $\mu\text{S}/\text{cm}$), with no apparent correlation between EC and reject type or coal seam. Based on the median pH and EC values, the coal reject samples tested are generally regarded as having 'high' soil pH and 'medium' salinity values with respect to the criteria for mining waste materials as defined by the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland (DME 1995).

The total sulphur content (measure as total sulphur concentration - %S) of the samples ranges from 0.23-4.20 %S with a median value of 1.03 %S. This compares to a median crustal abundance value of 0.07 %S in unmineralised soils (Bowen 1979; INAP 2009). Materials with a total sulphur content less than or equal to 0.1 %S have negligible capacity to generate acidity. The reject samples used in the KLC tests retained at least about 95.6% of their inherent total sulphur content after three months of exposure to idealised oxidising conditions. This reflects a relatively slow rate of sulfide oxidation (and potential acid generation) for these materials.

The results of the multi-element analysis were assessed against the geochemical abundance index (GAI) in accordance with relevant guidelines and practices (Bowen 1979; INAP 2009). The geochemical abundance index results indicate that of the metals/metalloids measured, none are significantly enriched compared to median crustal abundance. The main findings of the coal reject geochemical assessment (Appendix E, RGS 2020) are:

- the coal reject samples represent materials with a variety of geochemical characteristics. As a bulk material, coal reject is expected to be NAF with excess acid neutralising capacity (ANC). Overall, most coal reject materials have a relatively low risk of acid generation and an increased factor of safety with respect to potential for AMD;
- initial and ongoing surface runoff and seepage from coal reject materials is expected to be pH neutral and have a moderate level of salinity. The salinity of leachate from higher sulphur coal reject materials could increase over time if exposed to atmospheric conditions, due to the release of sulphate through sulphide oxidation;
- comparison with guideline values and median crustal abundance in unmineralised soils indicates that the coal reject materials are not significantly enriched with metals/metalloids; and
- most metals/metalloids are sparingly soluble at the current pH of the leachate from coal reject materials. Dissolved metal/metalloid concentrations in surface runoff and leachate from bulk coal reject materials are expected to be relatively low and unlikely to pose a significant risk to the quality of surface and groundwater resources at relevant storage facilities. To minimise risk, rejects materials will be contained within waste rock emplacements, well away from the outer surface of the final rehabilitated landform.

3.5.6.2 Soil and cover material

Cover materials

Coal rejects material presents a range of geochemical properties, however, the bulked reject stream is expected to be NAF with excess acid neutralising capacity (ANC). Conservatively, all rejects material will be placed as a dry material inside of NAF waste dumps, no closer than 10m to the outer slope of the final landform. No additional controls or cover systems are required.

Topsoil

Site clearing within the proposed footprint for the infrastructure and mining footprints will generate topsoil suitable for rehabilitation work. Soil studies conducted in the Project area (Appendix E, AARC 2019) conclude that most topsoils are suitable for use as plant growth medium for rehabilitation, while some subsoils were found to be limited for rehabilitation value due to increased potential for erosion and dispersion. A practical topsoil management plan will be adopted for management of soil resources, including a program of ongoing soil testing.

Soils with weak structures such as sands, loamy sands or massive structure soil may pose an erosion risk as a result of activities with the potential impact to result in soil erosion or sediment generation, including:

- land clearing, construction activities and maintenance of haul and access routes.
- movement of equipment; and
- surface water run-off from waste rock material, coal, and topsoil stockpiles.

These soils may be treated with gypsum to overcome dispersive properties.

Soil placement and surface preparation

Given available knowledge, the approach to surface preparation and topsoil placement will involve assessment by an AQP to advise on site-specific requirements such as :

- Identification of the topsoil resource to be utilised for a given rehabilitation area, and the carrying out composite soil sampling and agronomic laboratory analyses.
- Determination and procurement of type and quantity of ameliorants that would be beneficial for the topsoil resource (if needed).
- Topsoil is to be placed by scraper or truck at the top of the profiled slope and pushed by dozer or grader to achieve desired thickness.
- Gypsum and or other ameliorants considered necessary to promote revegetation will be spread on the soil surface prior to deep ripping.
- The dump surface will then be deep ripped (dozer or grader) to below the depth of the topsoil, to encourage infiltration of water for plant growth.
- Seeding and hay mulching of topsoil will occur as soon as possible to encourage plant growth and prevent soil loss erosion.

Topsoil inventory

Topsoil stripping depths and volumes are presented in Table 35. All topsoil material required for rehabilitation is anticipated to be sourced from the Project area. Rehabilitation topsoil requirements are summarised in Table 36.

Table 35: Estimated topsoil resources available for rehabilitation

Soil Management Unit	SMU area (m ²)	Surface Area to be Disturbed (m ²)	Topsoil Stripping Depth (m)	Estimated Volume of Recoverable Topsoil (m ³)
Anderson*	377,800	0.0	0.0	0
Barry	1,565,000	78,510	0.2	15,702
Charlevue*	2,329,000	2,183,000	0.0	0
Cooinda	349,400	349,400	0.3	104,820
Ellesmere*	145,900	0.0	0.0	0
Geoffrey	40,790,000	14,707,000	0.3	4,412,100
James	1,452,000	117,200	0.3	35,160
Kosh	9,276,480	549,000	0.2	109,800
Namoi	1,758,000	1,328,000	0.2	265,600
Nigel*	2,864,180	165,300	0.0	0
Normanby	484,960	0.0	0.3	0
Wallace	320,400	52,830	0.2	10,566
Total	61,713,120	19,530,240	n/a	4,953,748

* Soil properties limit plant growth and are unsuitable for use in revegetation activities.

Table 36: Topsoil required for each RA

Rehabilitation area	Volume of topsoil required (m ³)*
RA1 - In-pit and out-of-pit waste emplacements	1441560
RA2 - Temporary Waste Rock Emplacement	35000
RA3 - Residual Void Lakes	0
RA4 - Residual High Walls	0
RA5 - Residual Void Low Walls	373760
RA6 - Temporary Waste Rock Emplacement	168120
RA7 - Mine Infrastructure areas	1499440
Total volume of topsoil required for rehabilitation*	3,517,880

*Topsoil requirement based on the placement of topsoil to a depth of 0.2 m

Topsoil management

Vegetation and topsoil will be removed from the footprint area and will either be used directly in rehabilitation areas or stockpiled for use in the rehabilitation of the site. Suitable topsoil is generally stripped by either scrapers or excavators/trucks and either transported to areas prepared for rehabilitation or stockpiled for later use.

Topsoil will be temporarily stockpiled on or near waste rock dumps, in the proximity to placement location. Long term storage of topsoil stockpiles is located on natural surface within proximity to the mine infrastructure area.

Stockpiled soil will require careful management to protect its agronomic qualities and to optimise its value as a plant growth medium. Stockpiles will generally have a maximum height of 2 m to allow oxygen to diffuse through the topsoil stockpile, maintaining seed viability and micro organisms. Where topsoil stockpiles are to remain in place for an extended period due to operational requirements, stockpiles will be seeded as required to increase soil organic matter levels, encourage water infiltration, maintain soil structure, microbial activity and prevent erosion.

Before topsoil is used in rehabilitation, chemical analysis of soil is to be undertaken by an AQP to determine its quality and viability as a growth medium and amelioration requirements will form basis of treatment prior to use.

3.5.6.3 Landform design

The final landform design and the sequencing of landform development (and hence the resultant rehabilitation milestone schedule) are influenced by the nature of the mining practices proposed. The final landform has been designed with consideration for the pre-mining landscape, stakeholder consultation, proposed PMLUs and post-mining stability.

The proposed final landform for the Project is shown in Figure 40.

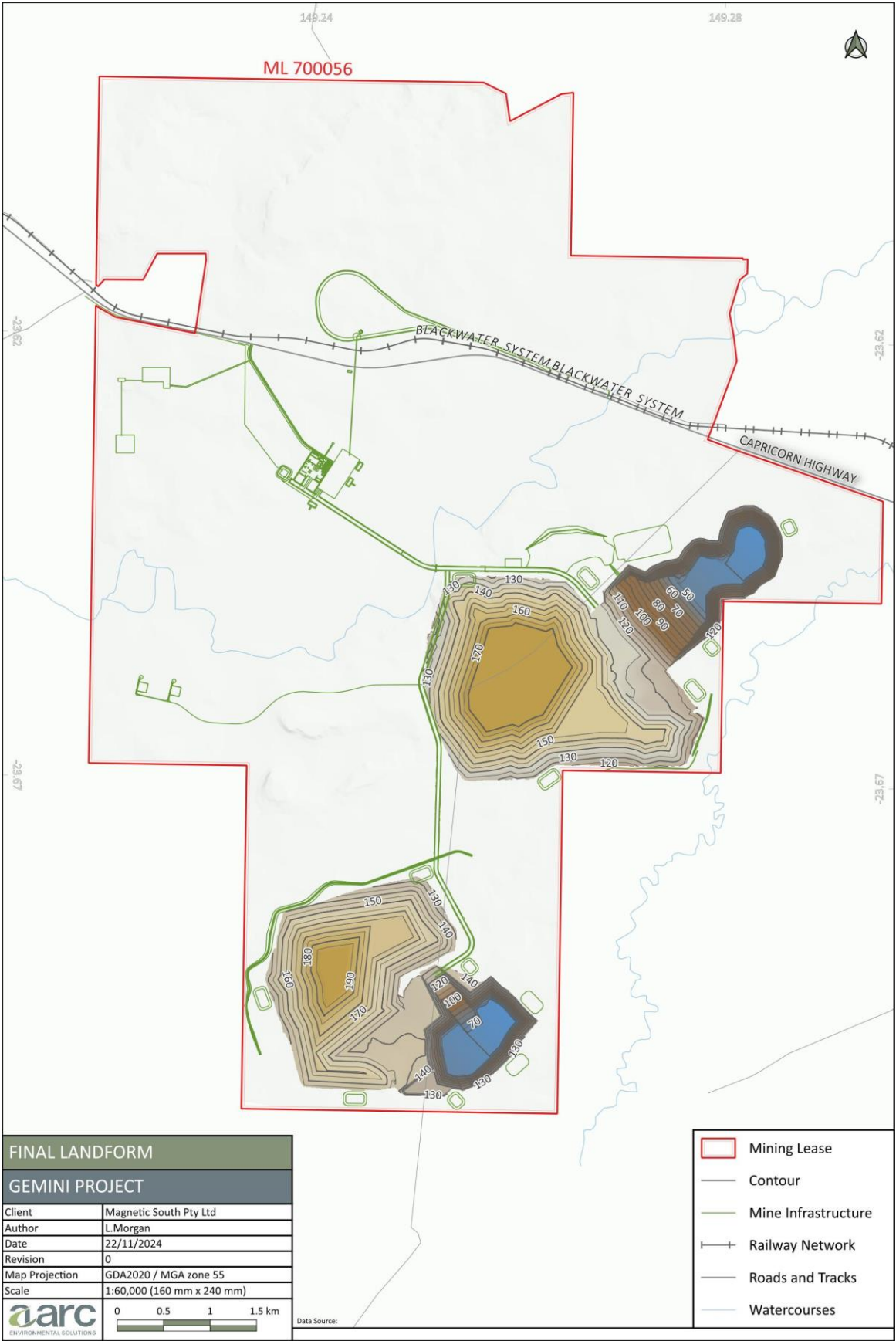


Figure 40: Final landform design

Waste emplacement landforms

Waste rock will be placed in mined-out pits after coal extraction and in external waste rock emplacements. With the exception of the temporary waste rock pile, waste rock dumps have been designed as permanent landforms, ensuring long-term stability post mining.

Excluding the final void high wall and pit lake, the design specification adopted for permanent waste rock dumps is as follows:

- Maximum elevation of 194 mAHD and 175 mAHD for Mine A and B, respectively;
- Maximum batter slope angle of 6°;
- Maximum uninterrupted batter slope length of 230m; and
- Separated by flat berms of 10-15m width, designed not to concentrate runoff.

Where possible, concentration of water will be minimised in the rehabilitated landform, preventing erosion on slopes.

These areas of in-pit and ex-pit waste rock will be revegetated to achieve a pasture grassland community, supporting the designated PMLU of grazing. Establishment of vegetation will naturally provide increased water infiltration and reduce runoff velocities, assisting with stability.

Previous studies conducted in central Queensland have investigated the groundcover required to minimise erosion on slopes. Erosion risk on rehabilitated landforms is greatest during the establishment phase, especially on steeper gradients. The greatest erosional risk is typically observed when >50% of the surface is exposed to rainfall and overland flow. In a study conducted on three open cut coal mines in central Queensland, Carroll, Merton and Burger (2000) found that erosion rates declined rapidly on slopes when vegetation cover was >50%, with erosion rates reduced to negligible levels by Year 6, even on steeper slopes. A literature review of erosion research conducted in the Fitzroy Basin region of Queensland (Carroll et al. 2010) also concluded that foliage surface cover of 40–60% reduces erosion to <0.5 t/ha/yr, regardless of slope. Similarly, Loch et al. (2000) found that approximately 50% foliage groundcover was sufficient to limit erosion rates to >0.5 t/ha/yr on <15% slopes, for slopes up to 70 m long.

To validate the literature described above and assess the long-term stability of the final landform, erosion modelling was undertaken for Gemini in-pit and ex-pit final landforms using the Water Erosion Prediction Project (WEPP) model. WEPP modelling considers four key data points: climate information, soil profile, land use management and slope design. Climate parameters were modelled from the area using CLIGEN 5.3, with input data sourced from SILO (daily rainfall, maximum and minimum temperature, solar radiation and maximum relative humidity) and BOM (pluviograph data). Twelve soil profiles were included for modelling derived from the Gemini Soil and Land Suitability Assessment (Appendix E, AARC 2019), namely:

- | | | |
|-------------|-------------|------------|
| • Anderson | • Ellesmere | • Namoi |
| • Barry | • Geoffrey | • Nigel |
| • Charlevue | • James | • Normanby |
| • Cooina | • Kosh | • Wallace |

In creating the land use management parameters for WEPP modelling, cover classes were established at 5% intervals ranging from 0% to 100%. Vegetation cover was fixed at these percentages throughout the WEPP simulations, such that consistent cover was maintained across the 100-year simulation period without growth or decay. Slope design specifications were based on a maximum slope angle of 6° over a length of 228 m, which is the longest slope proposed as part of the final landform design.

In total, 252 100-year WEPP iterations were run, covering the range of soil samples and land use management profiles identified above. To determine the maximum potential erosivity of the slope, the average annual soil loss, expressed in tonnes per hectare per year (t/ha/yr), for each iteration was calculated and assessed against

a target and maximum erosion rate. A target (or 'tolerable') erosion rate of 5 t/ha was adopted for assessing land suitability and erosivity risk (Landloch 2013; Howard and Loch 2019). Additionally, a maximum tolerable erosion rate of 10 t/ha was adopted, as the rate was considered acceptable for mining rehabilitation purposes (Lu 2001). The results of this analysis can be found in Figure 41.

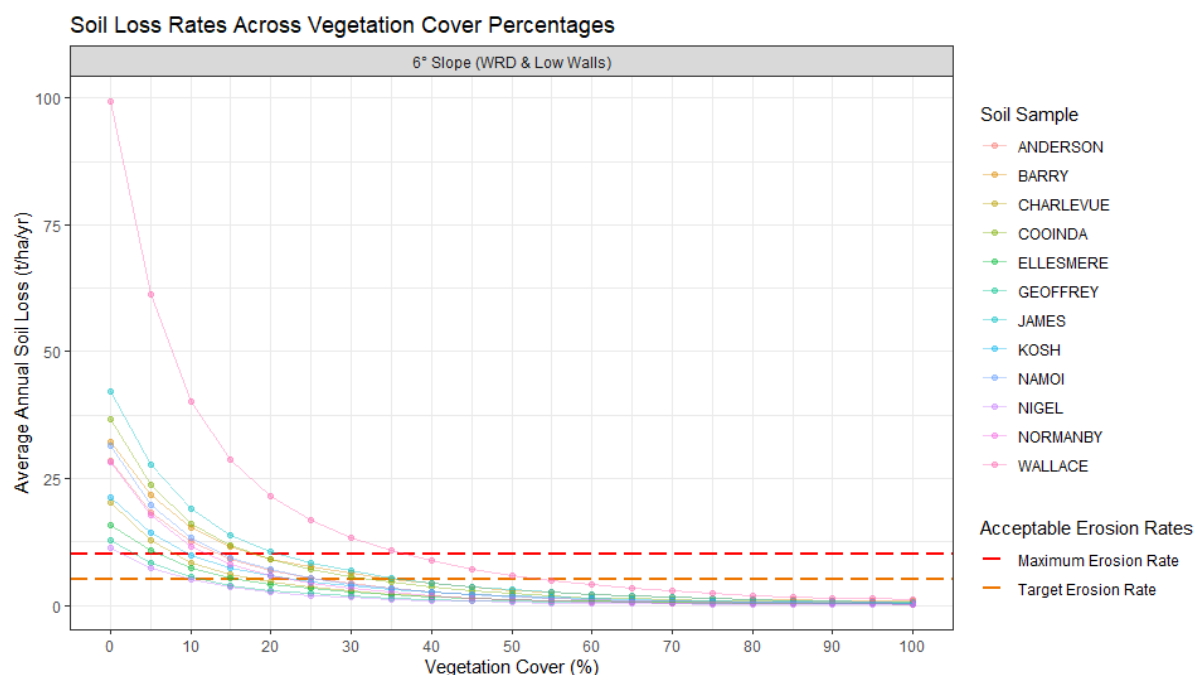


Figure 41: Average annual soil loss rates (t/ha/yr)

The average base erosion (i.e. no vegetation cover) modelled for the slope is 31.7 t/h/yr, with a maximum base erosion rate of 99.4 t/ha/yr, based on the properties of the Wallace SMU. At 25% vegetation cover, all SMUs, excluding Wallace, achieved the maximum tolerable erosion rate, with the Wallace SMU meeting the maximum erosion rate at 40% cover.

Similarly, all SMUs, excluding Wallace, achieved the target tolerable erosion rate at 40% cover, with the Wallace SMU meeting the target erosion rate at 55% cover (Table 37).

Table 37: Summary of required vegetation cover on slopes

Erosion Rate Thresholds	Vegetation Cover (%)	
	Wallace SMU	All other SMUs
Maximum tolerable erosion rate (10 t/ha/yr)	40	25
Target tolerable erosion rate (5 t/ha/yr)	55	40

Given these results, the final landform design is expected to remain stable and non-erosive irrespective of topsoil properties, where greater than 55% vegetation cover is maintained. However, vegetation cover can decrease to 40% while maintaining structural integrity on the slope when considering a maximum tolerable erosion rate of 10 t/ha/yr.

It is acknowledged that the data used to inform the erosion modelling above is based on pre-mining soil and climate information as well as design slopes not yet constructed. It is expected that as mining activities commence and improved site-specific information is obtained that the quality and accuracy of the model will improve. The Project proposed to engage with an AQP to provide updated erosion modelling based on updated information and conditions appropriate for the Project and the local region prior to rehabilitation activities commencing.

Final void landforms

The pit lakes and surrounding high walls are proposed to support a PMLU of fauna habitat comprised of the water body itself and the surrounding inwardly draining slopes which will be rehabilitated to sustain a native ecosystem able to support native fauna. Two pit lakes with a total footprint area of approximately 81 ha will be formed as part of the final Project landform. Both voids will be partially backfilled with water rock to ensure adequate coverage of the deeper coal seams and elevate the void floor above the level of significant groundwater inflows.

A pit lake will form within each void, reaching a steady state level where water losses through evaporation are equal to water inputs from rainfall, runoff and groundwater inflows. While water levels in the voids will vary over time dependent on the prevailing climatic conditions, the results of modelling indicate that an equilibrium level of approximately 70 mAHD in Mine A and 53 m AHD in Mine B will be reached after 200 years. The steady state water level of both voids is predicted to remain well below the base of Tertiary aquifers acting as groundwater sinks, thereby negating any risk of contamination.

The void low wall will be rehabilitated to a gradual slope of less than 6° to the base of the backfilled void, ensuring safe access and supporting a PMLU of cattle grazing above the long-term equilibrium water level of the pit lake. Below the long-term equilibrium level, rehabilitation will aim to develop a littoral zone at the waters edge, comprised of rushes, sedges and other water tolerant species. Logs and other forms of microhabitat will be placed between the waterline and the long-term equilibrium level to facilitate habitat development and the gradual advancement of the littoral zone ahead of the slowly rising pit water level.

Pit high walls will be throw blasted and/or shaped to achieve a stable slope of 18° in the unconsolidated weathered zone, above the pit long-term equilibrium water level of the void. For the remaining Permian geology, an overall angle of 55° will be achieved by 50 m high batters at 65° incorporating 15 m wide intermediate benches. A conceptual 3D sketch of the residual void final landform is provided in Figure 35.

Cartledge Mining and Geotechnics (Appendix E, Cartledge2021) assessed the proposed final void design to be geotechnically stable, achieving a Factor of Safety of 1.5.

The physical void characteristics are summarised in Table 38.

Table 38: Final Void Physical Characteristics

Mining area	Approx. Pit Lake Area (ha)	Low Wall Slope	High Wall Slope
Mine A	37	<6°	Final void high walls slopes are 18° or lower, where located within unconsolidated sediments and saturated tertiary.
Mine B	43		An overall angle of 55° by constructing 50 m high batters at 65°, incorporating 15 m wide intermediate benches.

Revegetation

The establishment of littoral zones is an important structural consideration to rehabilitate mine water infrastructure (Dunlop et al., 2024). The littoral zone of a natural lake is the nearshore interface between the terrestrial ecosystem and the deeper pelagic zone of the lake (Côte et al., 2023). Each of these structural elements provides valuable habitat needed to sustain a diverse range of taxa. A study by Bylak et al. (2019) found that improving habitat, plant communities and littoral areas of residual mine voids appeared to improve biodiversity.

Therefore, as recommended by Lund et al. (2014), the low walls will be seeded with a 5m wide littoral zone at the interface of the low wall and the base of the residual void (refer to Figure 35) such that the progression of the pit lake water level will be complemented by aquatic habitat complexity and sources of organic matter. While species richness in pit lakes will be influenced by the biodiversity of the surrounding region, the littoral zone provides immediate habitat value to facilitate the progressive development of natural aquatic ecosystem processes. Moreover, the addition of larger rocks and logs would enhance habitat complexity and allow the void lakes to support a diversity of phytoplankton, macroinvertebrates and flora and fauna from the surrounding landscape.

The littoral zone will be revegetated using a selection of native rushes and sedges known to occur commonly within the Project region (see sections 3.5.4 and for further details).

Permanent clean water drains

The permanent diversion of an unnamed tributary of Springton Creek will be constructed in two parts to divert clean water around the final landform dumps and voids. The diversions will be constructed during operations, providing for long-term monitoring and maintenance during the operational mine life.

The proposed landform design aims to achieve permanent stable landforms. The preliminary concept designs of the two drains are provided in Figure 42 and Figure 43 while general arrangement of site drainage and mans is provided in Figure 44. The final designs will be decided as per best practice by an AQP prior to constructions to achieve

- Mine A drain:
 - design 1 in 50 AEP depths are up to 1.3 m, and peak velocities range between 1.0 m/s and 2.0 m/s.
- Mine B drain:
 - design 1 in 50 AEP depths are up to 3.7 m, and peak velocities range up to 2.5 m/s;

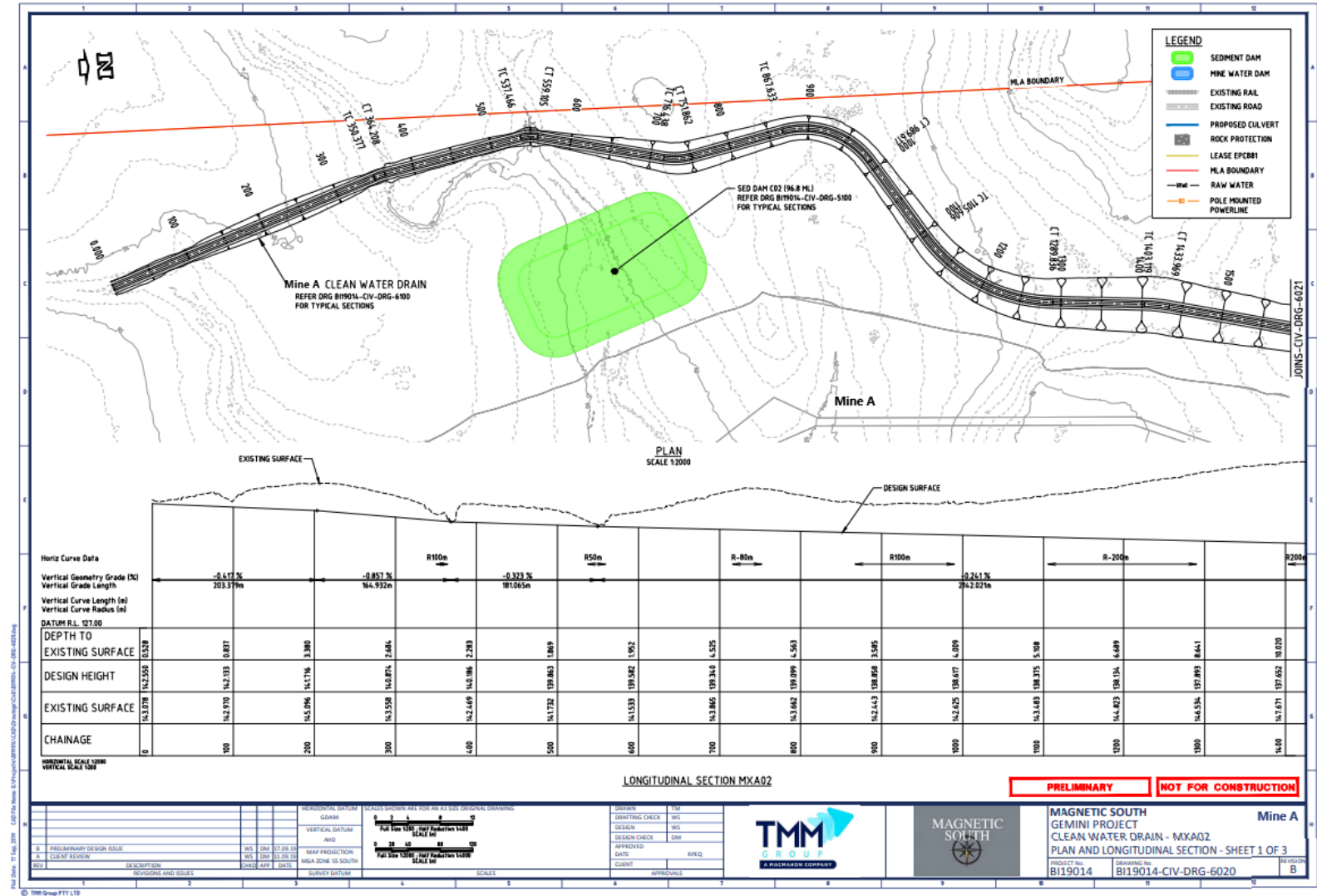


Figure 42: Mine A clean water diversion

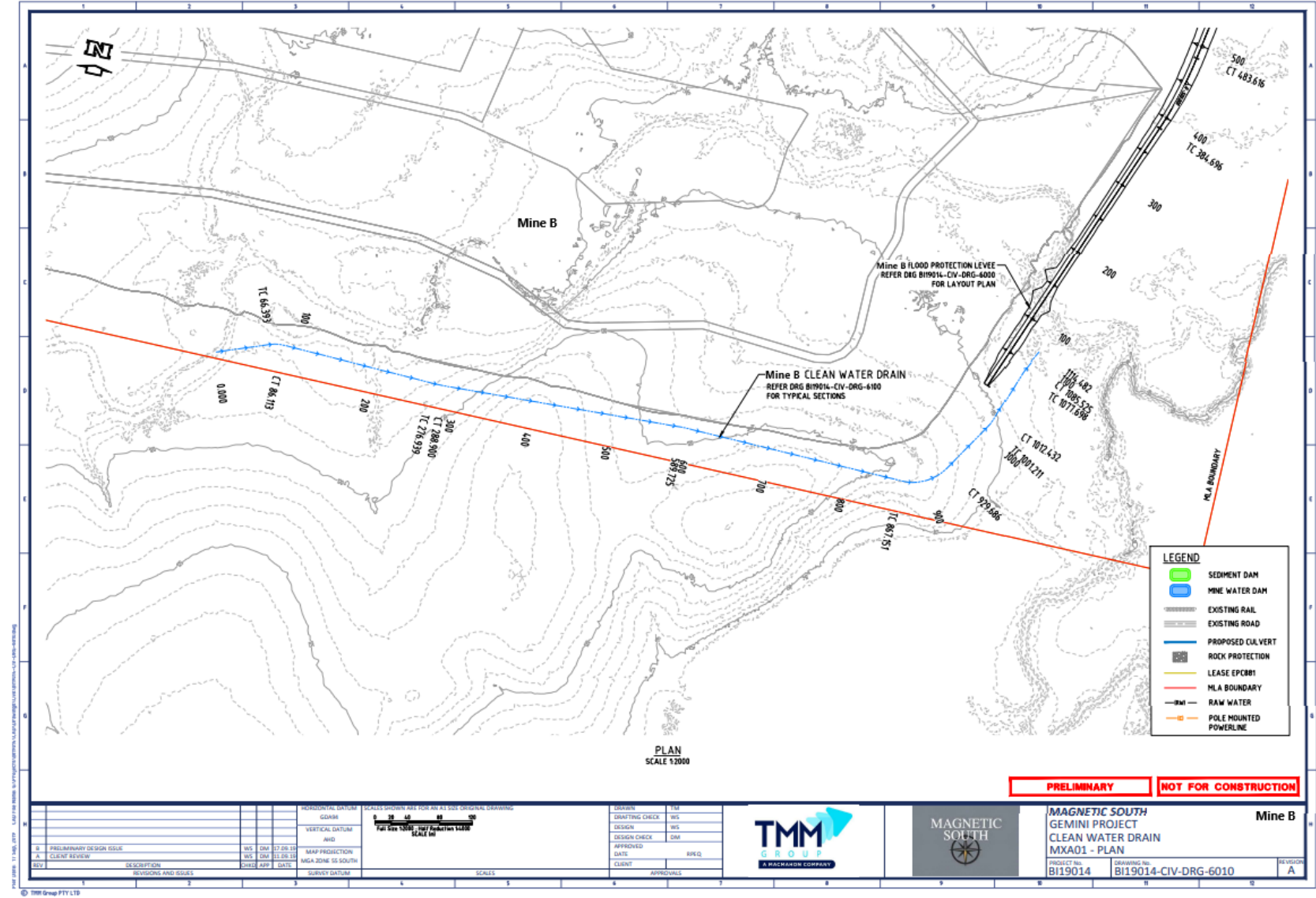


Figure 43: Mine B Clean water diversion

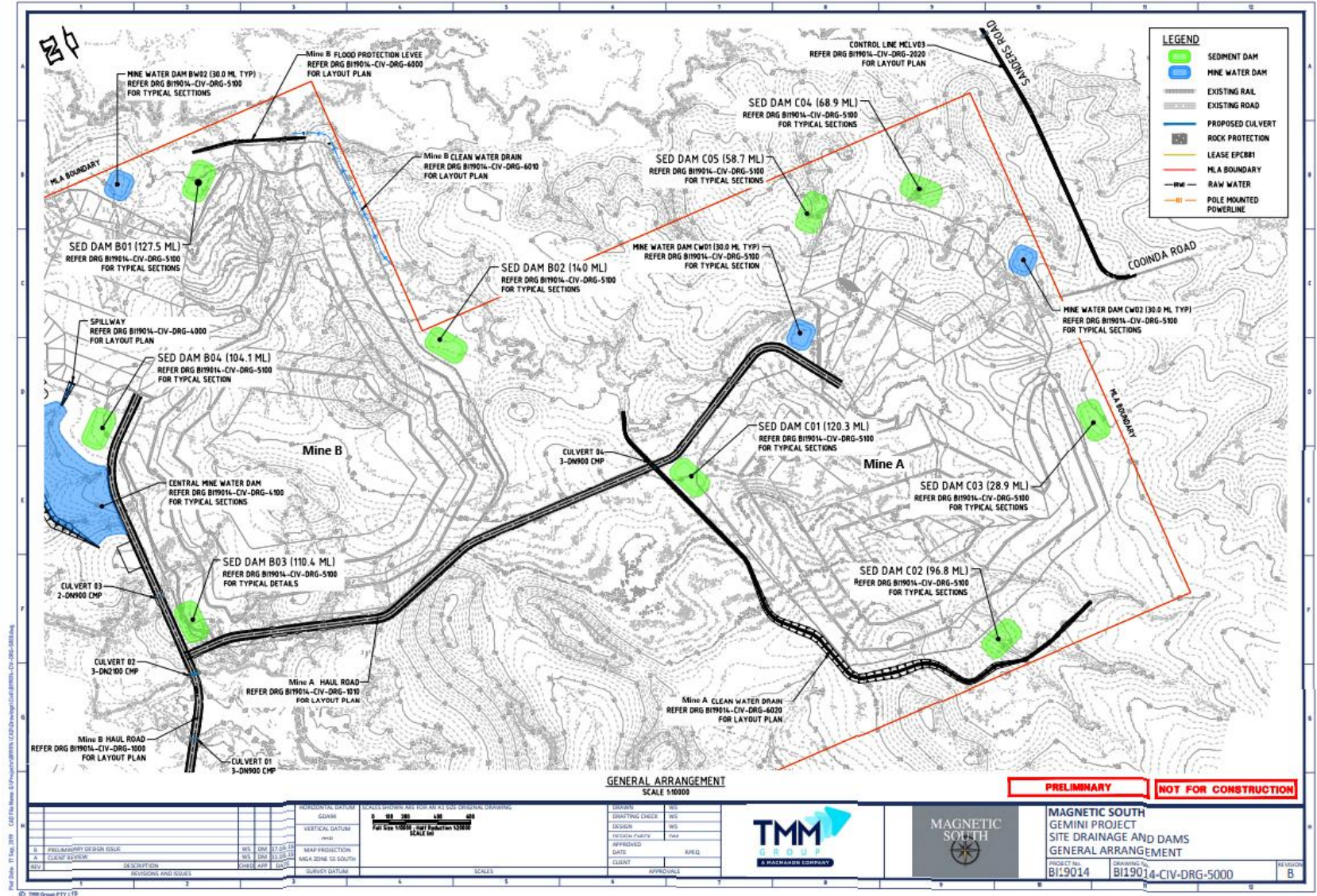


Figure 44: Site drainage and dams – General arrangement

3.5.6.4 Revegetation

The primary objective of the revegetation plan is to reinstate self-sustaining vegetation communities suitable for the target PMLU (refer section 3.3.2).

Revegetation activities will be scheduled to occur after landform reshaping, topsoiling and surface preparation works.

Growth media and ameliorants

Topsoils at the Project are generally suitable for supporting plant growth. However, some topsoils were identified as likely susceptible to dispersion and erosion and would require amelioration through the addition of gypsum and other ameliorants. A program of ongoing agronomic soil testing will occur during operations to inform the specific soil ameliorants for all topsoil used in rehabilitation.

The high-wall final landform design features a maximum slope design of 18°, for which traditional growth media application methods are not practical. As such, hydro mulching will be utilised as the growth media, as the resulting slurry can be easily applied via spray trucks or aerial spraying if required. The hydromulch will consist of subsoil ameliorants (where required), soil wetting agent, seed, fibre, binder, fertiliser and water in doses as advised by AQP. It is expected that the hydromulch will act as a binding agent to allow for seed germination and establishment on steep slopes while providing the necessary ameliorants to the underlying material to encourage vegetation growth and supporting the PMLU.

Grazing PMLU

Grazing areas will be evenly seeded with pasture grass species at the rates indicated in Table 39. The suite of pasture grasses includes native and introduced species known to occur in the project area, several of which are considered palatable, perennial and productive (i.e. 3P grasses).

The recommended grazing seed mix is indicative of the species suited to the Project area, the rehabilitation landforms and the PMLU. The suite of pasture species used in grazing revegetation areas may be subject to change due to seasonal availability and/or knowledge gained from previous rehabilitation performance. All species listed suit the central highlands climate and site-specific environmental conditions and, in most cases, have previously been recorded during baseline studies at the Project site.

The pasture species recommended within the species list are considered desirable native grasses for beef cattle grazing as per Clay et al. (2024) and a number of the nominated species are classified as 3P (palatable, perennial and productive) pasture grasses.

Table 39: Grazing PMLU seed mix

Scientific name	Common name	Recommended minimum application rate (kg/ha)
<i>Bothriochloa bladhii</i>	Forest bluegrass	3
<i>Bothriochloa ewartiana</i> *	Desert bluegrass	3
<i>Bothriochloa pertusa</i>	Indian bluegrass	3
<i>Chamaecrista rotundifolia</i>	Roundleaf cassia	1
<i>Chloris gayana</i>	Rhodes grass	2
<i>Dichanthium sericeum</i> *	Queensland bluegrass	3
<i>Echinochloa esculenta</i>	Japanese millet	5
<i>Enteropogon acicularis</i> *	Curly windmill grass	3
<i>Panicum decompositum</i> *	Native millet	3
<i>Stylosanthes hamata</i> cvv. <i>Verano</i> or <i>Amiga</i>	Caribbean stylo	1
<i>Stylosanthes Seabrana</i> cvv. <i>caatinga</i>	Caatinga stylo	1
<i>Themeda triandra</i>	Kangaroo grass	3

*Denotes a 3P pasture species.

Seed application

To maximise revegetation success, seeds will generally be spread during spring before the wet season rainfall begins. Excluding areas to be hydromulched, seeds will be sown using direct seeding with a tractor mounted spreader. Hay mulch will be applied immediately following the placement of seed providing benefits such as:

- improved conditions for germination;
- protection from predation;
- erosion prevention; and
- improvement of surface soil properties.

Tubestock planting of tree species may occur in place of seeding in particular areas where it makes strategic sense. High wall rehabilitation areas will likely utilise hydromulching for the spread of seed and growth medium due to the steeper rehabilitation slopes. Species mixes will target surface stability and fauna habitat.

Grazing/Native vegetation PMLU

The grazing / native ecosystem PMLU is to be applied along the permanent clean water diversions and around rehabilitated water management infrastructure. Rehabilitation areas including the banks of the reconstructed channel will be evenly revegetated with pasture grasses and native tree and shrub species, selected from the list of species recommended in Table 40. The dominant species from baseline vegetation communities were identified and included as part of the recommended seed mix for RA6. The suite of pasture grasses includes native grasses known to occur on the Project site and considered palatable, perennial and productive.

These seed mixes are indicative only and are subject to change due to seasonal availability, and/or experience from previous rehabilitation performance. All species listed are suited to the central highlands climate and site-specific environmental conditions.

Table 40: Grazing/Native vegetation species mix

Scientific name	Common name
Canopy/Tree	
<i>Alphitonia excelsa</i>	Soap tree
<i>Corymbia clarksonia</i>	Grey bloodwood
<i>Eucalyptus crebra</i>	Narrow-leaved red ironbark
<i>Eucalyptus exserta</i>	Queensland peppermint
Shrub	
<i>Acacia excelsa</i>	Ironwood
<i>Acacia holosericea</i>	Soap bush wattle
<i>Acacia leiocalyx</i>	Black Wattle
<i>Owenia acidula</i>	Emu apple
<i>Senna artemisioides</i>	Cassia
<i>Myoporum acuminatum</i>	Coastal boobialla
Ground	
<i>Aristida calycina</i>	Dark wiregrass
<i>Bothriochloa bladhii</i>	Forest bluegrass
<i>Bothriochloa ewartiana</i> *	Desert bluegrass
<i>Chloris gayana</i>	Rhodes grass
<i>Stylosanthes hamata</i> cvv. <i>Verano</i> or <i>Amiga</i>	Caribbean stylo
<i>Stylosanthes Seabrana</i> cvv. <i>caatinga</i>	Caatinga stylo
<i>Dichanthium sericeum</i> *	Queensland blue grass
<i>Enteropogon acicularis</i> *	Curly windmill grass
<i>Panicum decompositum</i> *	Native millet

Native vegetation PMLU

The native vegetation PMLU is designated for the final void high wall areas. The suite of native flora species recommended for seeding in the native vegetation PMLU areas is provided in Table 41. This species list is representative of the species composition recorded in VC2 - Lancewood (*Acacia shirleyi*) and/or Rosewood (*Acacia rhodoxylon*) woodland on lateritic duricrust (refer to section 3.1.7.1). The proposed seeding mix is therefore consistent with naturally occurring vegetation on the Project site and is considered best suited to the upper slopes of the high wall final landform Table 41.

Whilst the species presented in this list are recommended for seeding of the high wall upper slopes and benches in RA4 (Figure 35), the final seeding list will depend on the availability of seed stock at the time of revegetation (Table 41).

Where dieback occurs, the impacted area will be revegetated with appropriate species from the native vegetation species list. The species list is provisional, and subject to change based on species suitability and availability and as new information becomes available from rehabilitation monitoring and research.

Table 41: Native vegetation species list

Scientific name	Common name
Shrub	
<i>Acacia excelsa</i>	Ironwood
<i>Acacia holosericea</i>	Soap bush wattle
<i>Acacia leiocalyx</i>	Black Wattle
<i>Alstonia constricta</i>	Bitterbark
<i>Owenia acidula</i>	Emu apple
<i>Senna artemisioides</i>	Cassia
<i>Myoporum acuminatum</i>	Coastal boobialla
<i>Enchylaena tomentosa</i>	Ruby Saltbush
Groundcover	
<i>Aristida calycina</i>	Dark wiregrass
<i>Aristida caput-medusae</i>	Many-headed wiregrass
<i>Aristida queenslandica</i> var. <i>dissimilis</i>	Queensland Wiregrass
<i>Bothriochloa bladhii</i>	Forest bluegrass
<i>Cynodon dactylon</i>	Couch
<i>Dichanthium sericeum</i> *	Queensland blue grass
<i>Enteropogon acicularis</i> *	Curly windmill grass
<i>Heteropogon contortus</i> *	Black speargrass
<i>Lomandra longifolia</i>	Spiny-headed mat-rush
<i>Panicum decompositum</i> *	Native millet

Fauna habitat

To support the gradual development of aquatic habitat in association with the progression of the pit lake water level, a 5m wide littoral zone will be revegetated at the transitional zone between the base of the low wall and the initial pit lake shoreline.

For the littoral zone connecting to the low walls, a littoral zone seed mix is recommended, but not restricted to those species listed in Table 42. The nominated species of rushes and sedges are selected on the basis of known records from the Project site, or surrounding region (i.e. Atlas of Living Australia within a 10 km radius of the Project). The seed mix presented in Table 42 is indicative of the preferred seed mix; however, the seed mix is subject to change due to seasonal availability, and/or experience from previous rehabilitation performance.

The use of woody debris such as hollow logs and rocks is important for the development of fauna habitat to expedite biological processes. Any appropriate debris collected during the construction period will be stockpiled for installation strategically in areas of the void targeting a PMLU of fauna habitat, ahead of the gradually advancing pit lake water line and littoral zone.

Table 42: Seed mix for littoral zone of the low walls

Scientific name	Common name
Rushes and Sedges	
<i>Atriplex semibaccata</i>	Creeping saltbush
<i>Cyperus polystachyos</i>	Bunchy sedge
<i>Ficinia nodosa</i>	Knobby club rush
<i>Fimbristylis dichotoma</i>	Common fringe-rush
<i>Fimbristylis ferruginea</i> or <i>Fimbristylis polytrichoides</i>	Fringe-rush
<i>Isolepis cernua</i>	Nodding club rush
<i>Lomandra hystrix</i>	Creek mat-rush
<i>Juncus bufonius</i>	Toad rush
<i>Juncus kraussii</i>	Sea rush
<i>Juncus usitatus</i>	Common rush
<i>Triglochin striata</i>	Streaked arrow grass

3.5.6.5 Hydrogeology

Groundwater modelling by JBT (Appendix E, 2019) predicts that a permanent cone of depression will develop directing groundwater flow towards the final voids. The assessment concludes the risk of water quality impacts of the project (via outflow to the groundwater system) to be low.

However, it was assessed that the Project could impact groundwater quality if the water within the final void were able to exit the void via unconsolidated sediments (i.e. the base of Tertiary) and flow via the groundwater system towards sensitive environmental receptors such as Springton Creek. For this reason, an assessment of the potential for water within the final voids to exit the void via the base of Tertiary sediments has been undertaken as follows:

- Contours for the base of Tertiary sediments was obtained for the area of Mine A and Mine B from the site geological model.
- The final void water level was obtained for each of the final voids from the surface water assessment report WRM (Appendix E, 2020a) and was assessed for:
 - The maximum final void water level for the Base Case; and,
 - The maximum final void water level for the High Inflow Case.

The data for each mining area was assessed to establish whether any pathways existed for water to exit the final void via the base of Tertiary sediments, for the maximum Base Case and maximum High Inflow Case final void water levels.

Based on the assessment described above it was concluded that there is no outlet via the base of Tertiary for water within the final void of either the Mine A or Mine B, for either the maximum Base Case water level or the maximum High Inflow Case water level. It is therefore concluded that there is a low risk of the Project impacting on groundwater quality.

The modelled drawdown extent at the end of mining is shown in Figure 45 and at post-mining equilibrium (i.e., steady-state post-mining drawdown) in Figure 46.

At the end of mining, the 5 m drawdown extent is approximately 2 km from Mine B and 1.8 km from Mine A, on the western side of the mining areas. On the eastern side, the 5 m extent is approximately 2 km from both Mine B and Mine A. The 5 m extent of drawdown is approximately 1 km from Mine A at the southern end of the mining area, and approximately 2 km from Mine B at the northern end. The 2 m drawdown contour extends approximately 1 km further than the 5 m drawdown extent.

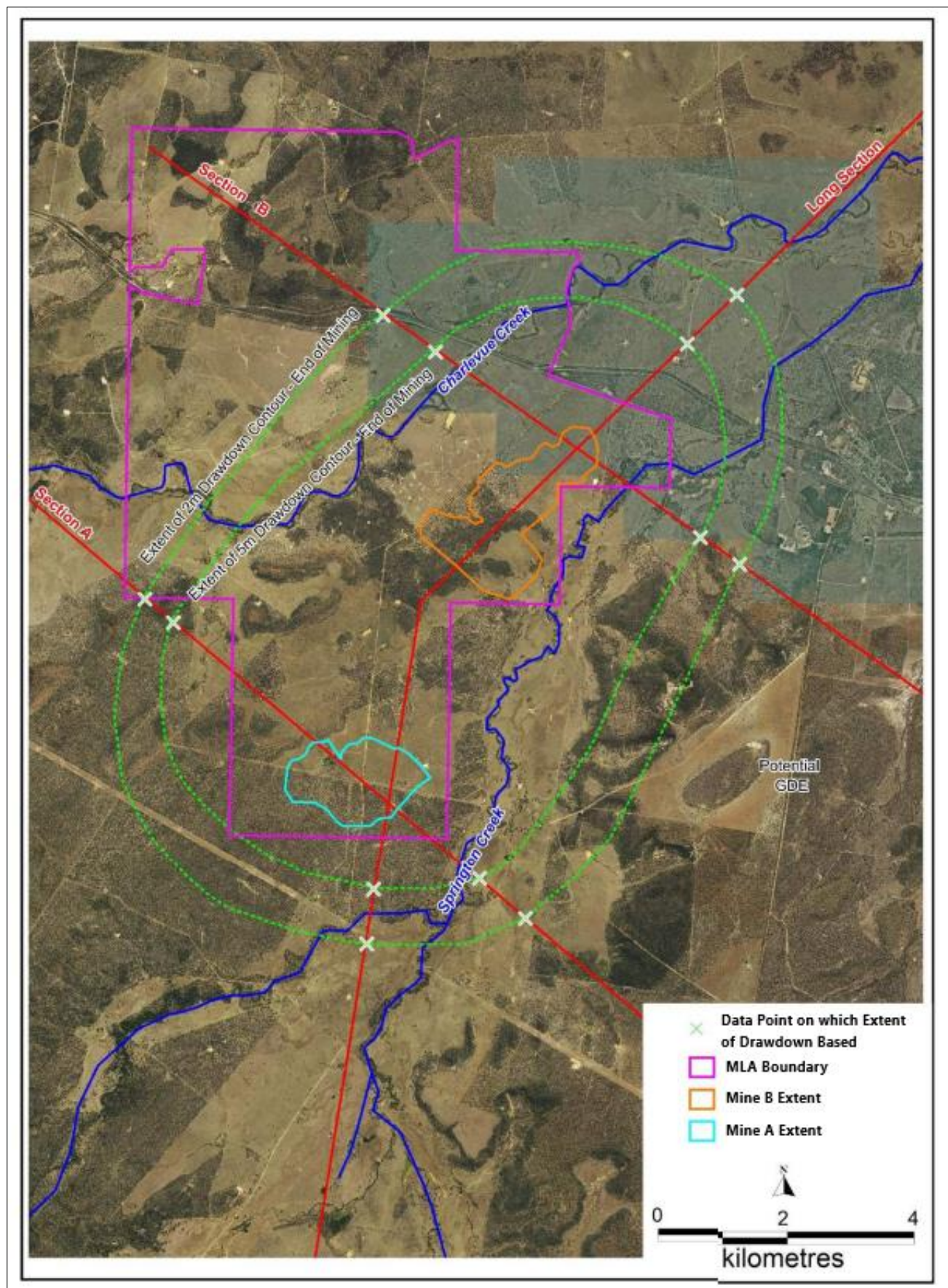


Figure 45: Drawdown at end of mining

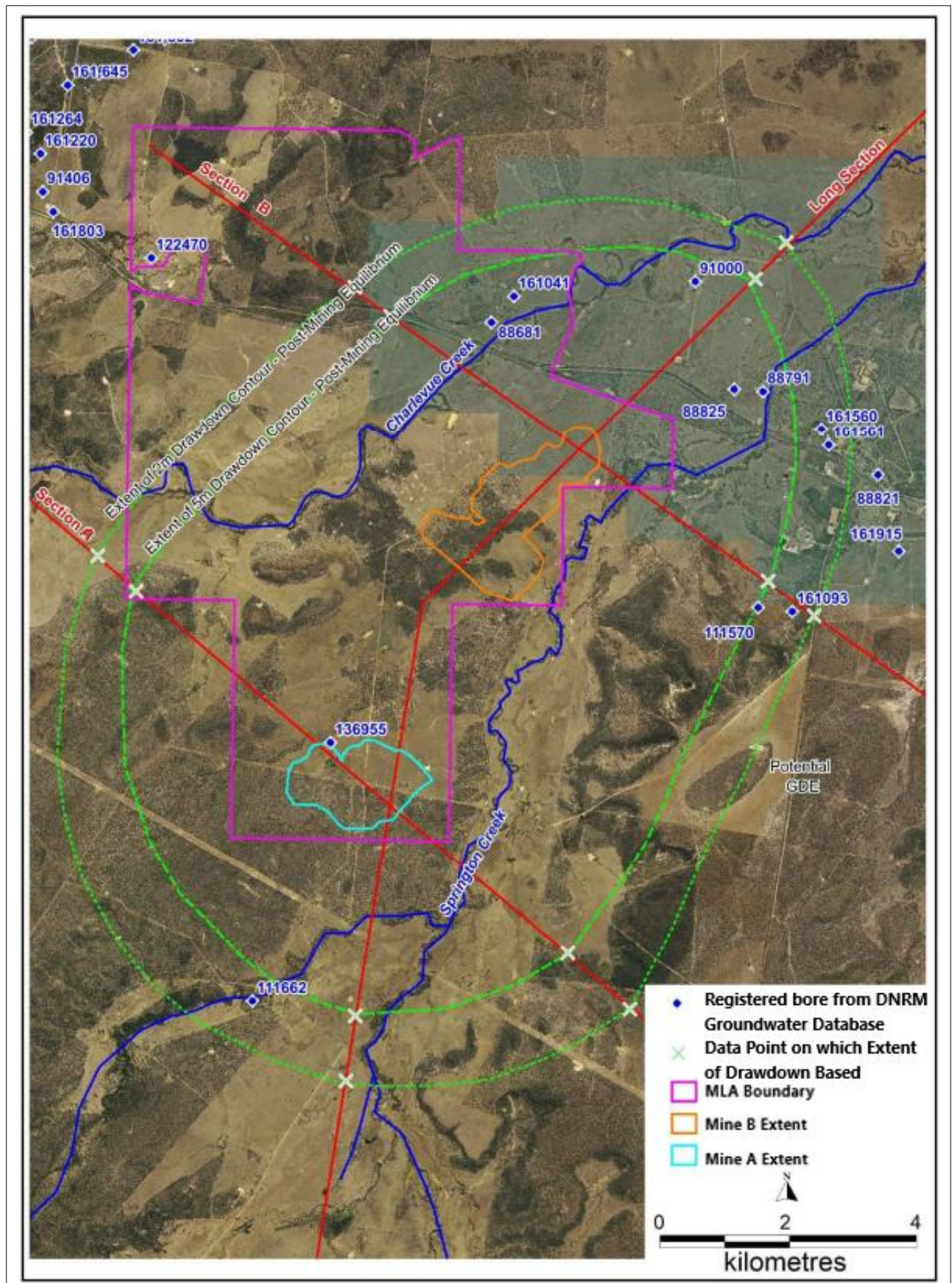


Figure 46: Drawdown Post-mining equilibrium

3.5.6.6 Flooding

Flood modelling (Appendix E, WRM 2020a) was undertaken to assess the flood risks associated with the Gemini Project final landform. XP-RAFTS flood model was used to estimate design discharges for the 50%, 10%, 2%, 1% and 0.1% AEP as well as the probable maximum flood (PMF) design discharge using an ensemble of design temporal patterns. In the absence of gauged streamflow data, the resulting peak discharges were validated against the Rational Method and Regional Flood Frequency Estimation (RFFE) estimates

The XP-RAFTS modelling was then adopted as inflows to the TUFLOW hydraulic model to estimate flood extents and depths along the channel and floodplain of Charlevue Creek and Springton Creek for the nominated design events (Figure 47)

The final void will be located and designed such that it is not inundated by flooding in the probable maximum flood. Accordingly, no flood levee will be required to prevent inundation of the final void. The levee constructed to protect the operational pit would not be required post-mining, and would therefore be decommissioned or form part of the rehabilitated dump.

There are four locations where (based on the flood model results) floodwaters could potentially come into contact with the overburden dumps

- the north-eastern end of Mine A; due to flow backing up to the west of the haul road crossing of the engineered drainage feature. Modelled flow velocities in this area are less than 0.4 m/s in the 0.1% AEP design flood and would, therefore, not cause the migration of sediment from the final landform;
- the western side of Mine B; due to water backing up a minor tributary of Charlevue Creek. Flow velocities in this area are expected to be less than 0.2 m/s, and therefore the likelihood of migration of sediment from these dumps is minimal;
- the eastern side of Mine B; due to flow on the left (western) floodplain of Springton Creek. Flow velocities against the final landform are modelled to be less than 1.2 m/s in the 0.1% AEP flood, and therefore the likelihood of erosion of the dump toe is minimal; and
- the southern side of Mine B; due to water overflowing from the unnamed tributary of Springton Creek upstream of the inlet to the engineered drainage feature. During operations, this section of the dump would be protected by a temporary levee, which would be incorporated into the final landform profile on closure. In events up to the 0.1% AEP design flood, modelled flow velocities are less than 1 m/s along most of the length of the proposed levee. Such flows would be non-erosive – and especially given the relatively short flow durations in this small catchment, the risk of sediment migration in floodwaters would be minimal. During the detailed design of the engineered drainage feature, provisions will be made to ensure that flows will be non-erosive along the final landform post-closure.

Graphical representation of post closure predicted flood extent and flood velocity are provided in Figure 48 and Figure 49 respectively.

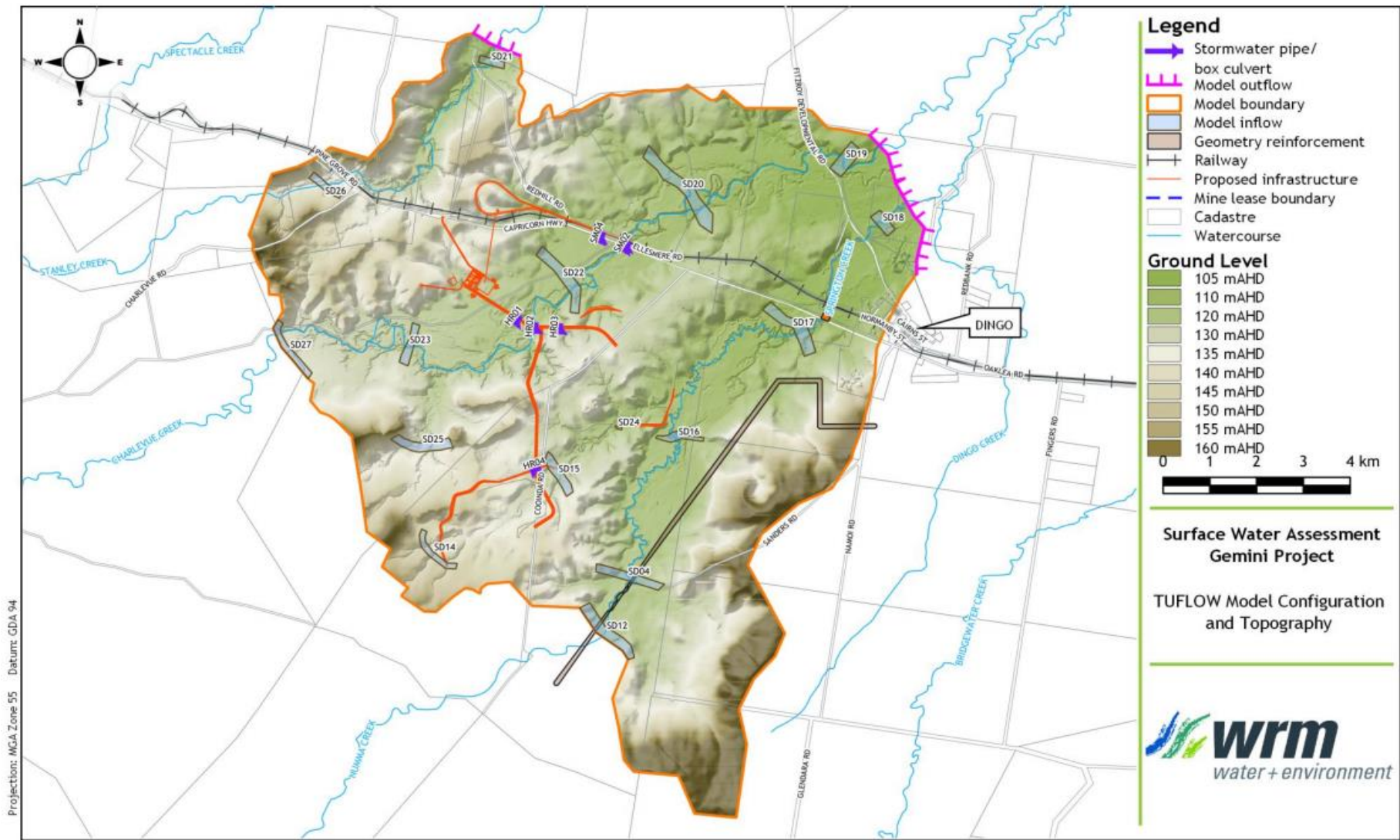


Figure 47: TUFLOW model configuration

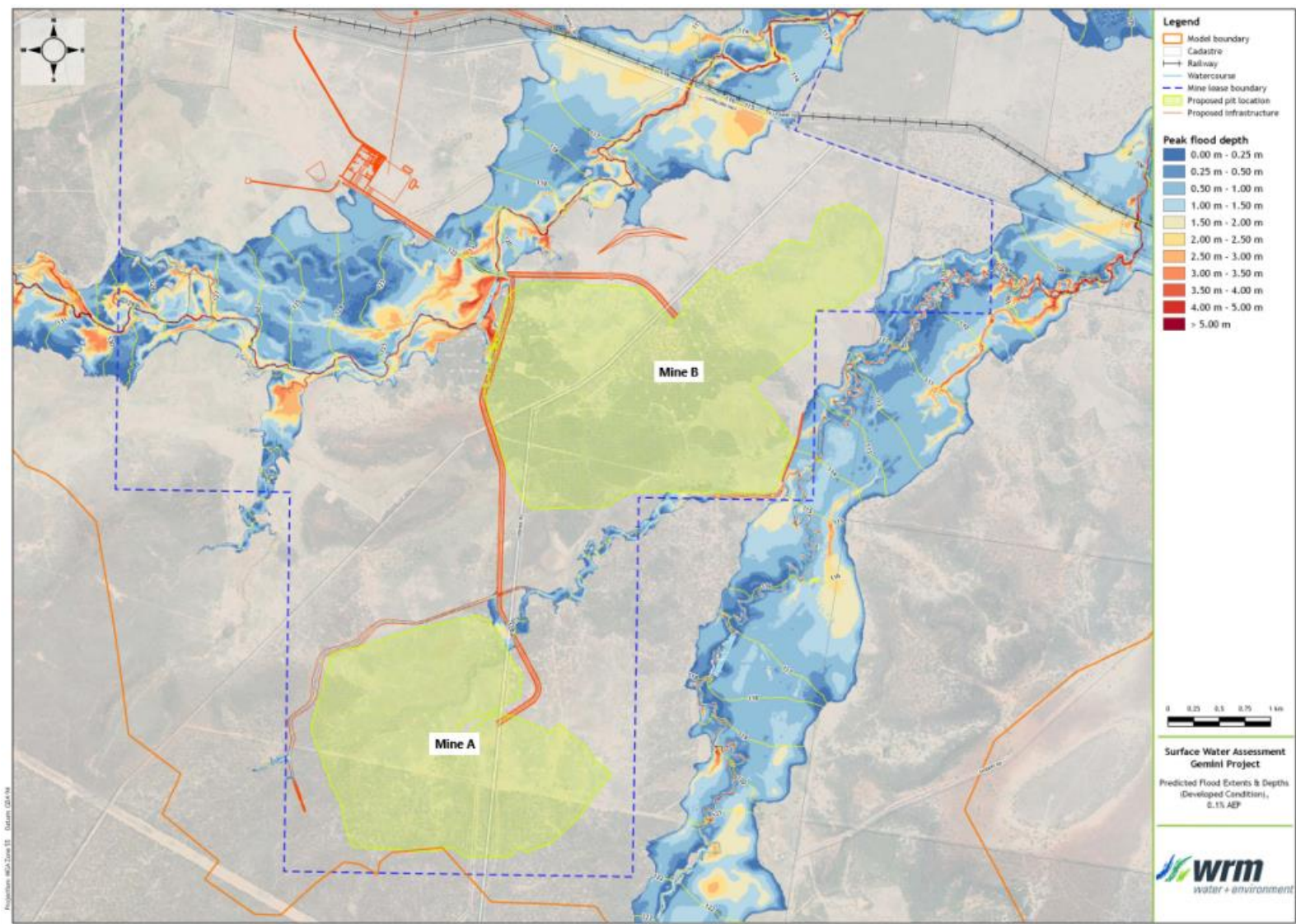


Figure 48: Post closure predicted flood extents & depths (0.1% AEP)

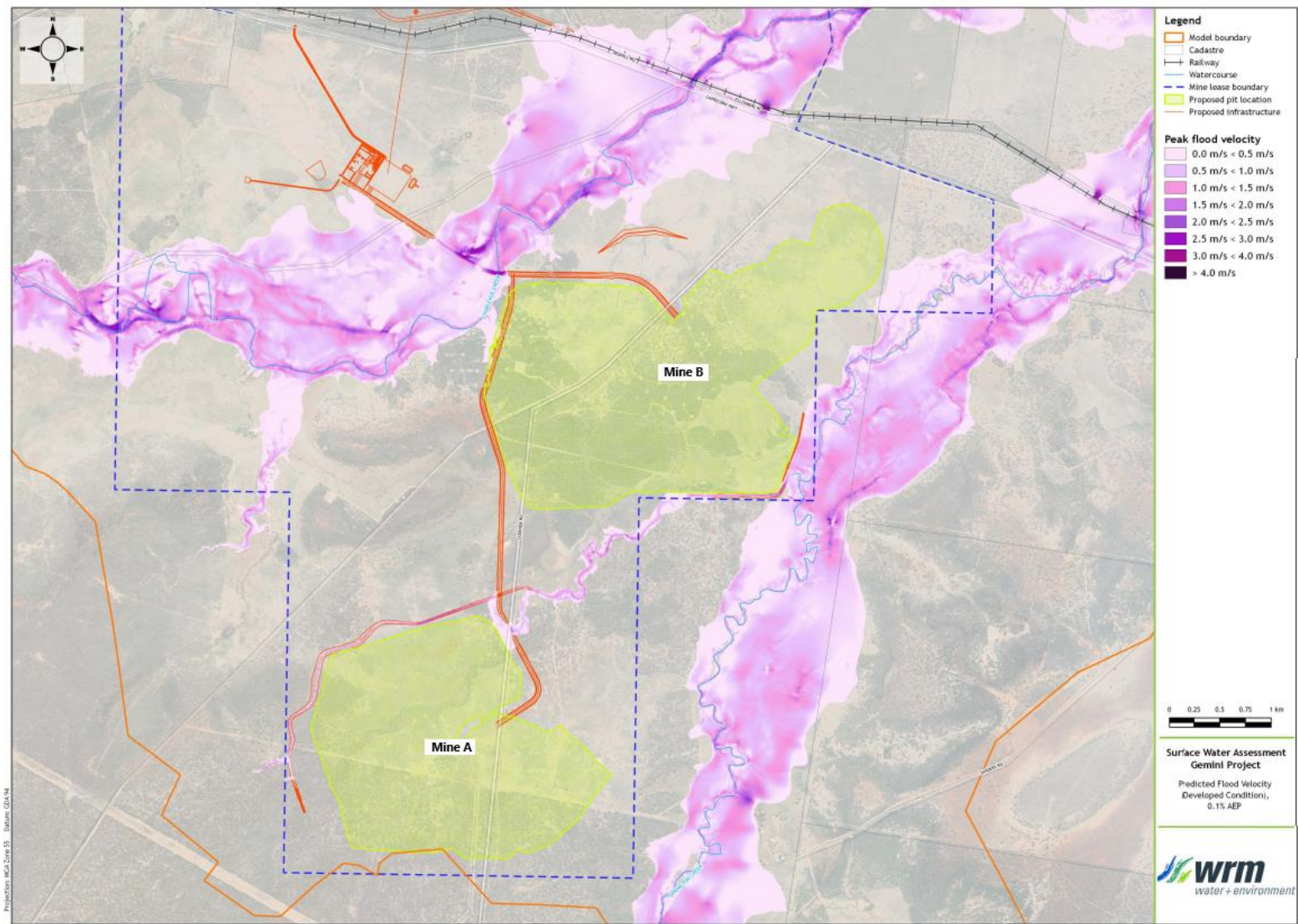


Figure 49: Post closure predicted flood velocity 0.1% AEP

3.5.6.7 Final void study

A GOLDSIM model (separate to the OPSIM model used for the operational modelling) was used to assess the likely long-term behaviour of the final void pit lakes. The historical rainfall and evaporation sequences were repeated 5 times to create a long-term climate record for use in the model. The potential effects of climate change were assessed using climate-change-adjusted SILO climate data developed as part of the Consistent Climate Scenarios (CCS) project by the Queensland Government.

Key water inputs for the final void balance include rainfall on pit lake water surfaces, runoff from pit faces and rehabilitated upstream catchment areas, and groundwater interception. Depending on the configuration of the waste rock dump, rainfall may also infiltrate through in pit waste rock. Groundwater investigations by JBT (Appendix E, JBT 2019) Consulting indicate that due to partial backfilling of the voids, groundwater inflows to the final voids are expected to be negligible.

Sources of salt include salts dissolved in groundwater and catchment runoff. In the absence of any seepage or surface outflows to the environment, there is generally no removal of salt from the system, and thus, salts are expected to accumulate over time. The Gemini Project voids are to be partially backfilled to prevent the interchange of water between the coal seams and the lakes – resulting in lower water levels and salinities than would otherwise be the case. These lower salinities are considered suitable for the establishment of native habitat conditions for the void.

Final voids were modelled to remain as a groundwater sink and do not present a risk of overtopping. The maximum modelled water level for Mine B is 57.6 mAHD, which is approximately 54 m below the void overflow level/natural surface elevation (112 mAHD). Similarly, the maximum modelled water level for Mine A is around 73.5 mAHD, which is 54.4 m below the void surface overflow level/natural surface elevation of approximately 128 mAHD. Modelled water levels in the voids are presented in Table 43.

Table 43: Final void pit lake modelled levels

Water Level	Mine A (mAHD)	Mine B (mAHD)
Long term equilibrium water levels	70.3	52.9
Maximum long-term water levels	73.5	57.6
Minimum long-term water levels	66.0	47.4
Overflow level at natural surface	128.0	112.0

Modelling of long-term water levels in the final void under existing (SILO) climate change scenarios indicates that equilibrium water level is lower than the existing climate scenario (refer Figure 50 and Figure 51).

Figure 52 and Figure 53 show the results of the salt balance. Salt accumulates within both voids over time. Under the existing climate conditions scenario, the void lake salinity exceeds a TDS of 30,000 mg/L after approximately 500 years of simulation. During the first 200 years, apart from short periods when inflows are very low, and salt concentrations temporarily increase rapidly due to evaporation, lake salinities are predicted to be less than 10,000 mg/L.

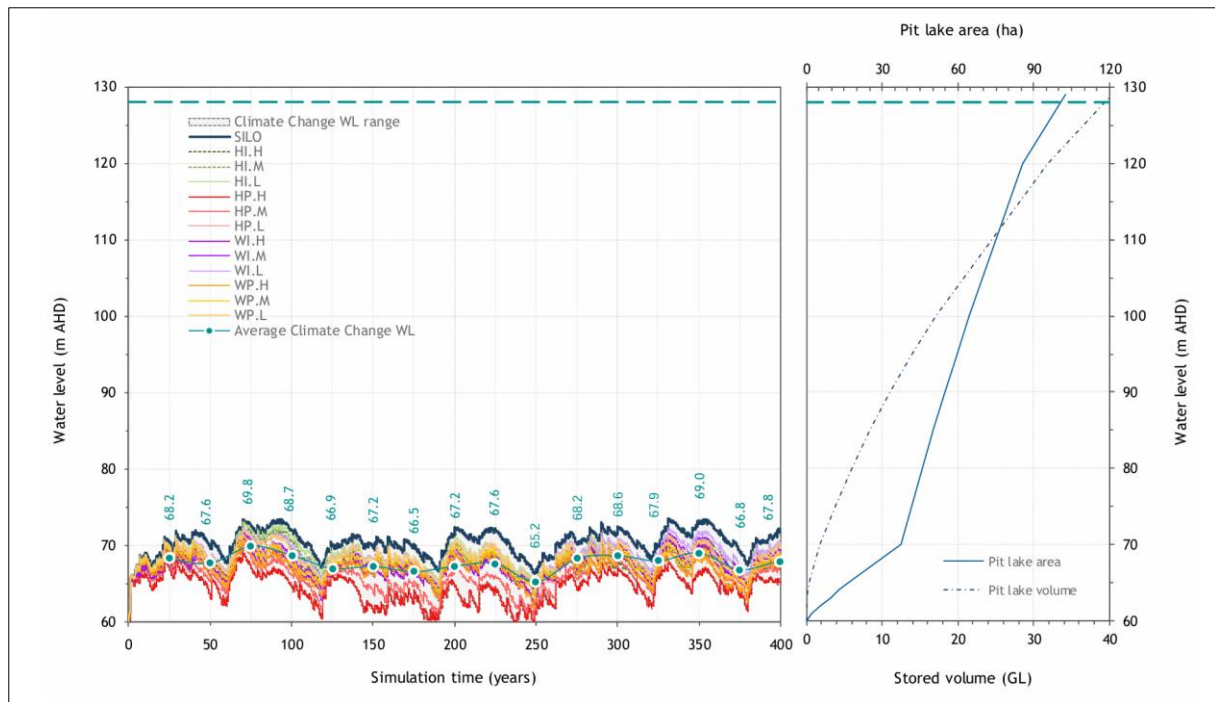


Figure 50: A Void post mining water level

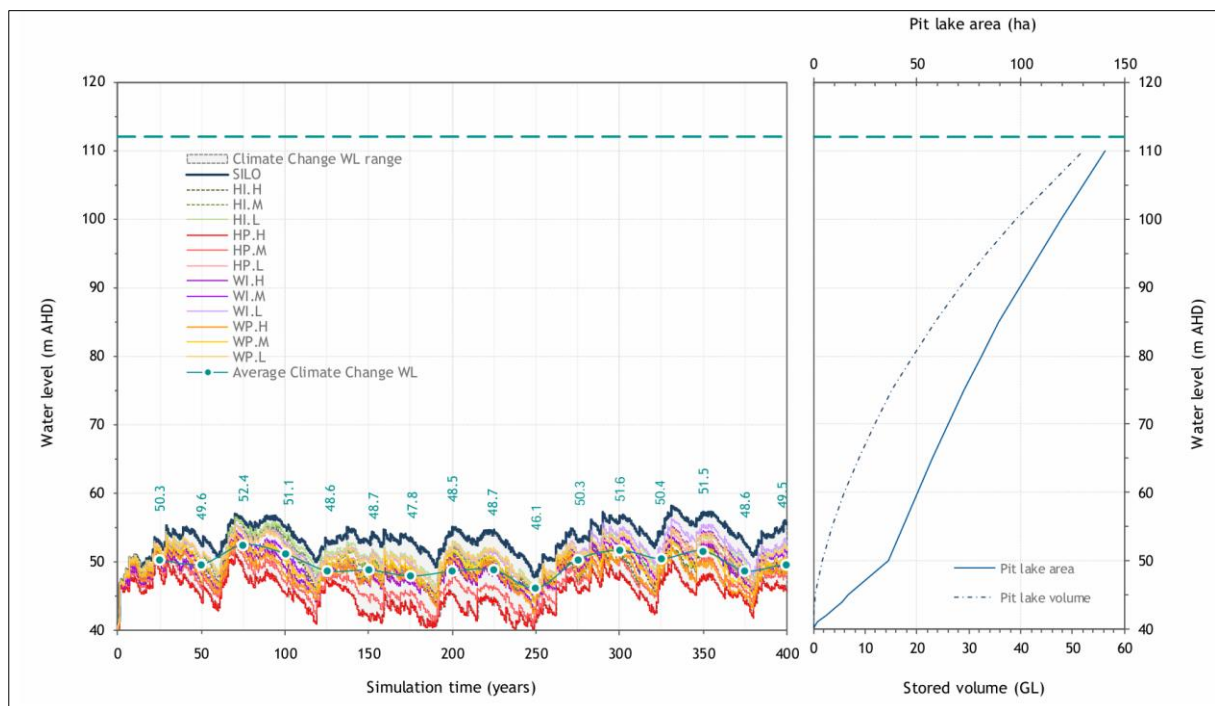


Figure 51: B void post mining water level

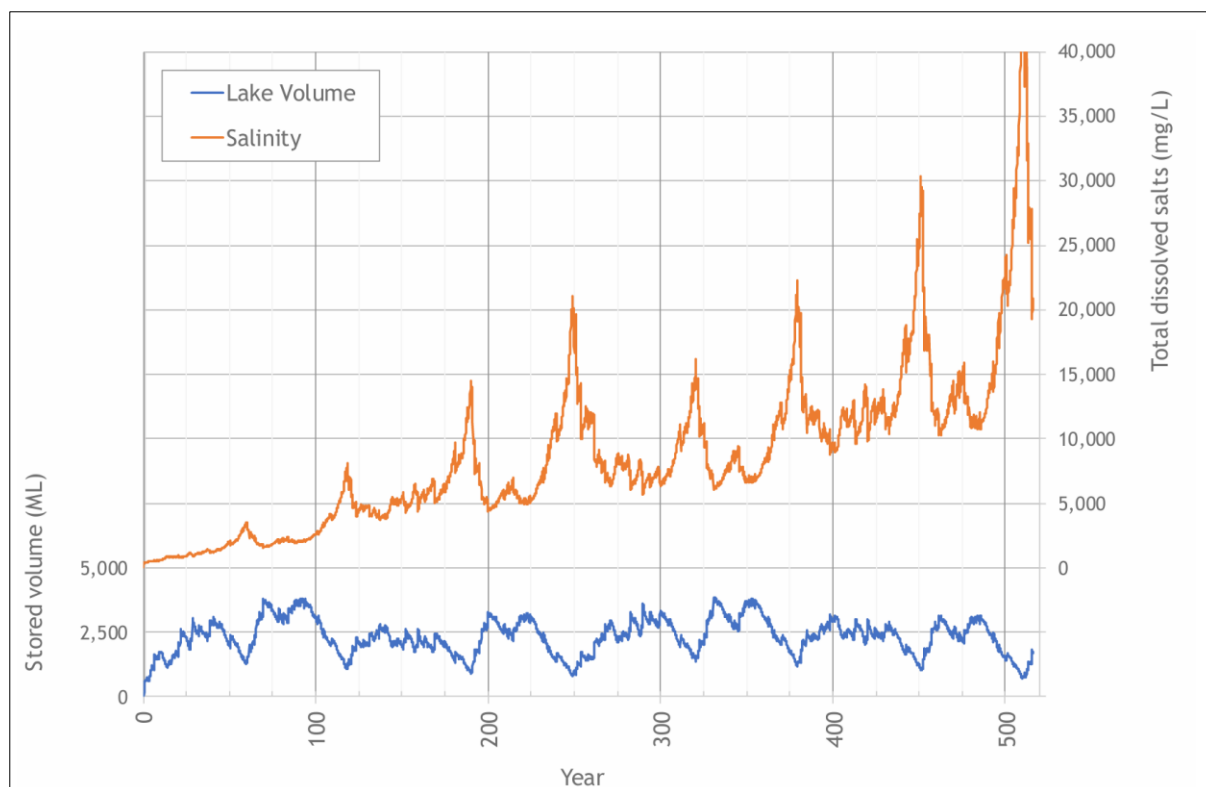


Figure 52: A Void post mining salinity

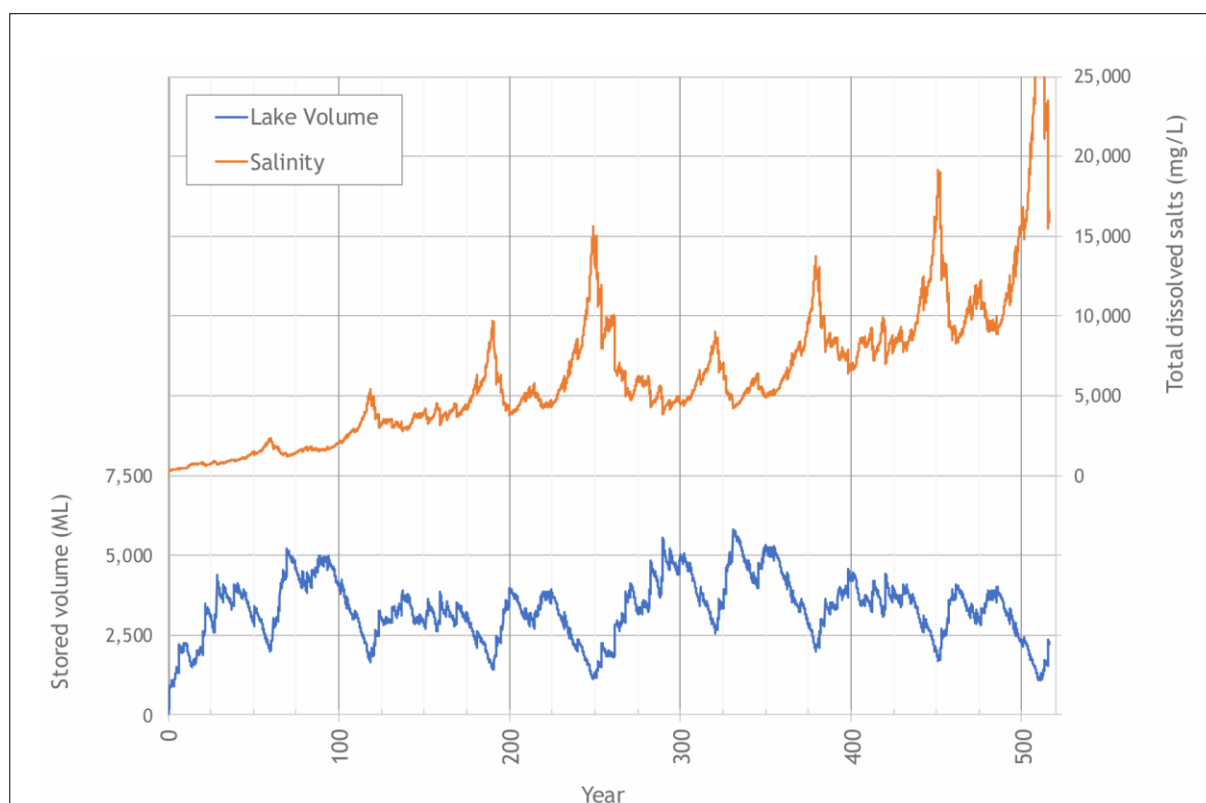


Figure 53: B Void post mining salinity

3.5.6.8 Water management

Operational water management

Operational water management will be undertaken in accordance with a Site Water Management Plan. The plan will include a Site Water Management System (SWMS) developed for the Project by WRM Water and Environment Pty Ltd (Appendix E, WRM 2019).

The SWMS for the Gemini Project is based on the following key principles:

- divert clean catchment water around mining works to the extent practicable;
- use/recycle lesser quality water in preference to higher quality water;
- use potentially contaminated water in preference to imported raw water or uncontaminated water;
- release water from site only in accordance with the conditions of the EA, such that the released water will not significantly impact on the values of the receiving waters or downstream properties;
- manage water storages and transfers within the site in order to:
 - maximise onsite storage to meet reasonably anticipated periods of wet and dry weather; and
 - minimise disruption to mining operations.

The proposed strategy for managing surface water at the Project is based on the separation of water from different sources based on anticipated water quality. The SWMS separates water into two segregated management systems:

- **Mine affected water (MAW) system:** manages runoff and seepage from the mine pits, CHPP, coal stockpiles, and MIA. This is a closed system designed to prevent releases of MAW to the environment.
- **Sediment water system:** runoff from overburden dumps will be managed under an *Erosion and Sediment Control Plan* (ESCP) which is to be implemented throughout the Project, such that sediment generated and transported by runoff will be settled in a sediment dam. As overburden runoff quality is expected to be relatively benign (refer Appendix E, RGS 2020) the sediment dams will potentially discharge directly into the environment (after the settlement of suspended sediment), and as such, will not affect the mine water balance. However, the water balance assessment has assumed sediment dams will be pumped back to the CHPP for reuse.

Clean water flows from undisturbed areas are generally diverted around the areas of disturbance. A raw water supply pipeline is proposed to supply all site water requirements prior to dam construction, and supplement site water supplies throughout the life of the Project. Raw water will be delivered to a dedicated raw water dam (located adjacent to the MIA), which will also intercept clean water from its local upstream catchment.

Water management infrastructure proposed for the Project is shown in Figure 54 and includes:

- a temporary flood protection levee to protect Mine B from potential flood waters;
- permanent clean water drains to divert runoff from undisturbed catchments around areas disturbed by mining activities;
- sediment water drains to divert water from waste rock emplacements and areas yet to be rehabilitated;
- sediment water dams to store water from waste rock emplacements and allow settlement of sediment loads before discharging treated water or recycling back to the CHPP;
- mine water drains to divert water from MIA, CHPP and coal stockpile areas into the MAW system; and
- mine water dams to store water pumped out of the pits, and collect water from the MIA, CHPP and coal stockpile areas.

All water storage dams, structures and facilities will be designed, constructed and managed in accordance with the 'Manual for assessing consequence categories and hydraulic performance of structures' (DES 2016a). The

Project's water management system is designed such that any unplanned overflows from mine water dams would overtop into the pit preventing any uncontrolled releases from the MAW system to receiving waters.

Closure water management

All water storage dams will be rehabilitated to the grazing/native vegetation post-mining land use, except those structures that are to be retained for agricultural purposes as agreed with the landholder. Where dams are to be retained, water quality will be monitored against the criteria for livestock drinking water defined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) to ensure suitability until ownership of the dam has been transferred.

The permanent diversion of an unnamed tributary of Springton Creek will be constructed in two locations to divert clean water around the final landform dumps and voids. The diversions will be constructed during operations, providing for long-term monitoring of stability and rehabilitation success during the operational mine life.

The final designs will be decided as per best practice by an AQP prior to constructions to achieve:

- design 1 in 50 AEP depths are up to 1.3 m, and peak velocities range between 1.0 m/s and 2.0 m/s
- Mine B drain:
 - design 1 in 50 AEP depths are up to 3.7 m, and peak velocities range up to 2.5 m/s;

The final landform design of all waste rock dumps aims to avoid concentration of water runoff. Flat benches will be maintained in waste rock slopes to reduce runoff velocities. Constructed drains and drop structures are not proposed for the final landform design. Sediment control dams and drains will remain in place to capture sediment, until rehabilitation monitoring verifies the stability of rehabilitated slopes on all dumps.

Flood levees required for operations will be temporary, required only until the final overburden profile is achieved. The final voids are located and designed such that they are not inundated by flooding in the probable maximum flood. Accordingly, no flood levee will be required to prevent inundation of the final void. The levee constructed to protect the operational pit would not be required post-mining and will be incorporated into rehabilitated dump as it progresses during operations.

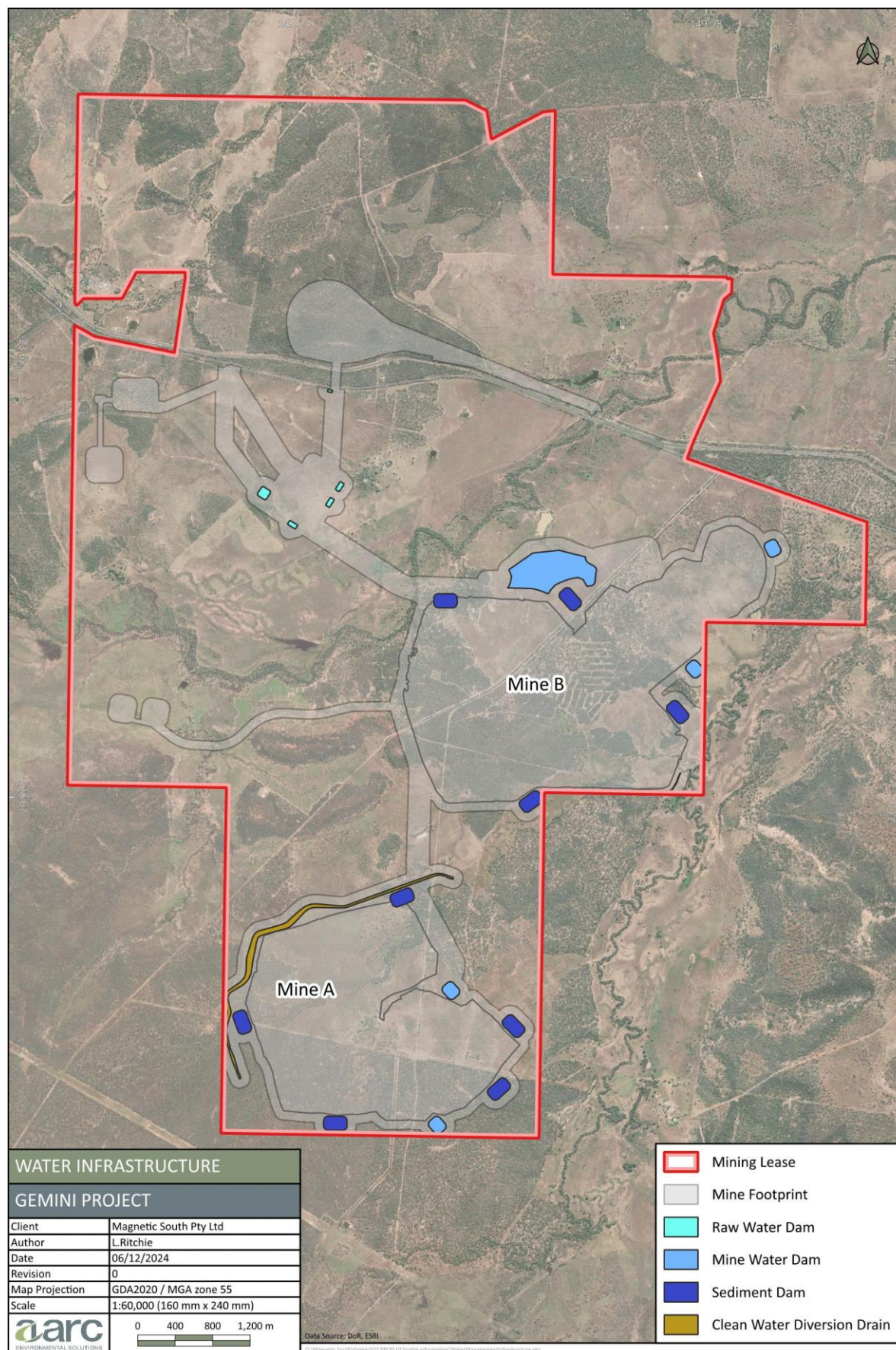


Figure 54: Water management infrastructure

3.6 Risk assessment

3.6.1 Risk assessment requirements

Section 126C(1)(f) of the EP Act requires the PRCP to identify the risks, for each PMLU, of a stable condition not being achieved and how the applicant intends to manage or minimise the risk.

The corresponding management of environmental risk was informed by both expert opinion and the Project specific technical studies detailed within this EA application.

A risk assessment has been carried out in accordance with the following standards:

- *AS/NZS ISO 31000:2018 Risk management - Guidelines*; and
- *HB203:2012 Managing environment-related risk*.

This risk assessment has informed the scope of the planning part of this PRCP, as well as the development of comprehensive rehabilitation success criteria. Where higher risks were identified for the Project, the scope of the PRCP was expanded to provide confidence in the rehabilitation methods to achieve the objectives and milestones proposed.

3.6.1.1 Built infrastructure

At the end of the Project life, all remaining infrastructure will be decommissioned and removed, with the exception of infrastructure that is subject to a future landholder retention agreement.

The CHPP, rail loop and the majority of associated buildings and equipment will be dismantled and removed upon the cessation of mining operations and rehabilitated to pasture. Roads, carparks, and hardstands will be removed, reprofiled, topsoiled and seeded.

The following components are located within the MIA footprint and will need to be decommissioned and removed, unless they are otherwise subject to a landholder retention agreement at closure:

- mine offices, bathhouse, crib rooms, warehouses and storage areas, workshops and potable water storage;
- fuel storage and refuelling facilities;
- sewage, effluent and liquid waste storage;
- tyre bay and laydown area;
- Go-line, wash bay, and other associated amenities;
- Sediment dams and water storage areas;
- ROM coal stockpile and associated infrastructure, including coal haulage loading area;
- raw water, clean water and mine water dams (discussed in section 3.5.6.8).
- substation and electricity distribution infrastructure;
- diesel backup generator;
- sewage treatment plant; and
- other associated minor ancillary infrastructure.

For any roads or additional infrastructure to be retained, a written agreement will be entered into with the underlying landowner that transfers liability for the structure and its use to the landowner.

3.6.2 Risk assessment process

Any risk assessment needs to be undertaken in consideration of the scope, context and criteria relevant to the assessment. For this risk assessment, the following scope and purpose was discussed and agreed to:

“The purpose of this risk assessment is to identify and analyse any risks arising because of the Project that may impact on environmental aspects, including socioeconomic aspects; at the local, regional and state levels and across the construction, operational and closure stages of the Project.”

For this risk assessment, risk scenarios (or ‘threats’) were identified and considered for each rehabilitation area associated with the Project. The causes attributable to each risk scenario were documented as well as the potential impacts. Existing controls were noted, defined as those reasonably expected to be in place for a Project of this nature and having appropriate and contemporary management systems. Each risk scenario was then assessed with respect to health, safety, the environment and compliance against the risk assessment schema outlined in section 3.6.3.

3.6.3 Risk assessment scheme

Risks specific to the rehabilitation of the Gemini Project were classified using the risk classification schema, which is described below. The risk assessment schema used is comparable to those used widely within the mining industry and comprises the following components:

- a control effectiveness ranking (Table 44) used for assessing the operational controls expected to be in place for a project of this type;
- a likelihood classification descriptor (Table 45) and;
- a consequence classification descriptors table (Table 46) intended to guide a consistent assessment of consequences.

Following a consensus determination of likelihood and consequence, the risk level was determined using the matrix shown in Table 47. For any risks classified as ‘significant’ or above, mitigation and management measures were identified and documented. Mitigation and management measures were also documented for lower-level risk components.

Table 44: Control effectiveness ranking

Control Rank	Description	Guidance
C1	Substantially effective/adequate design	Controls considered adequate and operating effectively on almost all occasions
C2	Mostly effective/adequate design	Controls considered adequate and operating effectively on most occasions
C3	Inadequate design/partially effective	Controls considered inadequate or only operating to partial effectiveness on most occasions
C4	No controls/ineffective	There are no controls, or the existing controls are operating ineffectively on all occasions

Table 45: Likelihood of Exposure to the hazard

Likelihood	Description	Probability	Frequency
Highly Likely	The event is expected to occur in most circumstances	> 25%	The event and consequence is expected to occur at least twice per year
Likely	The event will probably occur in most circumstances	10%–25%	The event and consequence is expected to occur once to twice per year
Possible	The event could occur at some time	1%–10%	The event and consequence is expected to occur at least once in 1 to 10 years
Unlikely	Not expected but the event may occur at some time in the future	0.1%–1%	The event and consequence is expected to occur at least once in 10 to 100 years
Rare	The event may occur only in exceptional circumstances	< 0.1%	The event and consequence is expected to occur less than once in every 100 years

Table 46: Severity and consequence classification

Severity level	Consequence				
	Very Low	Low	Moderate	High	Very High
Human Health and Safety	No treatment of first aid	Reversible impairment requiring medical treatment (medical treatment injury)	Significant reversible impairment to one or more persons (lost time injury, disabling injury)	Single fatality, significant irreversible impairment to a person	Multiple fatalities, significant irreversible impairment to multiple persons
Natural Environment	Negligible/minor effects on biological or physical environment	Moderate, short-term effects but not affecting ecosystem functions	Serious medium-term environmental effects	Very serious, long-term environmental impairment of ecosystem functions	Very severe, long-term environmental impairment of ecosystem functions
Community/Cultural Heritage	Minor medium-term social impacts on local population. Mostly repairable	Ongoing social issues. Permanent damage to items of cultural significance	Ongoing serious social issues. Significant damage to structures/items of cultural significance	Ongoing severe social issues. Significant damage to structures/items of cultural significance	N/A

Table 47: Risk level classification matrix

Likelihood	Consequence				
	Very low	Low	Moderate	High	Very High
Almost Certain	Class II	Class III	Class IV	Class IV	Class IV
Likely	Class II	Class III	Class III	Class IV	Class IV
Possible	Class I	Class II	Class III	Class IV	Class IV
Unlikely	Class I	Class I	Class II	Class III	Class IV
Rare	Class I	Class I	Class II	Class III	Class III

3.6.4 Risk assessment outcomes and management

In total, 85 risk scenarios or hazards have been identified across the ten Rehabilitation areas. These have been assessed against the risk assessment framework. Of the 85 risk scenarios assessed, one (1) was classified as 'high', 15 were classified as 'moderate', 42 were classed as 'low' and the remainder as 'very low'.

The risk assessment outcomes for each rehabilitation area are detailed in Table 48 below. The detailed risk assessment outcomes are included in Appendix F.

Table 48: Summary of risk assessment outcomes by rehabilitation areas

Rehabilitation area	Risk Classification					
	Very low	Low	Moderate	High	Very High	Total
In-pit and out-of-pit waste emplacements, including dry rejects disposal areas	3	8	0	0	0	11
Temporary waste emplacements	5	6	0	0	0	11
Residual void lakes	2	1	5	1	0	9
Residual void high walls	0	3	7	0	0	10
Residual void low walls	2	8	0	0	0	10
Water management infrastructure Rehabilitated dams	6	2	0	0	0	8
Retained dams	4	1	0	0	0	5
Diversion drains	1	4	3	0	0	8
Mine infrastructure areas	3	6	0	0	0	9
Retained infrastructure	1	3	0	0	0	4
Total	27	42	15	1	0	85

The risk scenarios identified as 'moderate' or 'high' risk were associated with the residual void lake, residual void high walls and diversion drains. The most significant risk identified was the risk of the residual void lake not achieving the fauna habitat PMLU due to unsuitable water quality. Erosional and geotechnical stability risks were identified with respect to the residual void lake and high walls as well as the retained drainage diversion.

- Residual void lake –
 - Class IV (high) risk classification: applied to one (1) risk scenario whereby the pit lake water quality may present a serious risk to the achievement of the fauna habitat PMLU.
 - Class III (Moderate) risk classification: applied to five (5) risk scenarios in association with the erosional and geotechnical stability of the high walls at or below the lake water level
- Residual void high walls –
 - Class III (Moderate) risk classification: applied to seven (7) risk scenarios in association with the erosional and geotechnical stability of high walls
- Diversion drains –
 - Class III (Moderate) risk classification: applied to three (3) risk scenarios relating to the geotechnical and erosional stability of the diversion drains.

Any identified Class III or Class IV risks were then reassessed to identify if additional controls could be introduced to lower the risk ranking. As a consequence of this further assessment, the Class IV risk could be reduced to Class III risk through routine pit water quality monitoring to allow for the early detection of salinity trends to inform management practices and rehabilitation methods. Management options may include intensive planting of halophytes to enhance natural salt removal or bioremediation (e.g. the introduction of salt-tolerant microbes, algae or phytoplankton). For the most part, Class III risks could be re-ranked to Class II through ongoing monitoring and maintenance of rehabilitation areas. Class III risks relating to the high wall and residual void high wall sections remain as Class III risks due to physical rehabilitation limitations.

3.7 Monitoring and maintenance

Rehabilitation monitoring for the Project aims to assess the rehabilitation objectives and agreed completion criteria. Monitoring data will be used to track the progress of revegetated areas and determine requirements for intervention, such as weed control or supplementary planting. Additionally, rehabilitation monitoring will specifically aim to:

- evaluate coverage and application of topsoil prior to seeding;
- monitor drains and assess water quality to determine whether substantial silting of invert and/or any localised failure of drain embankments has occurred;
- evaluate topsoiled areas following rainfall events (particularly on slopes) to assess whether significant rill development or loss of topsoil has occurred;
- evaluate the behaviour of placed topsoil over time (erosion or dispersion, compaction, salting or hard setting);
- assess the germination success in revegetated areas (including recording of diversity and abundance);
- monitor revegetation success over time (e.g., survival rate, plant growth, species diversity, weed content, fauna usage);
- evaluate potential threats to rehabilitated areas (e.g., weed invasion, pest species, dispersive soils or potentially acid forming (PAF) low-capacity materials, erosion); and
- record key rehabilitation information (e.g., photographic records, surveys, file notations).

Rehabilitation will be monitored on an annual basis, with the survey period occurring post-wet season, as monitoring at this time allows for more accurate identification of the species present and a clearer understanding of species richness on-site. Where sufficient data is acquired that demonstrates that rehabilitation is clearly on a trajectory to achieve milestone criteria, the frequency of monitoring may be reviewed.

Rehabilitation transects will generally be monitored for a minimum of five years or longer until the rehabilitation area has achieved the final milestone criteria. The results will then be used to continually inform and assess the effectiveness of rehabilitation strategies and methodologies and enable movement towards progressive certification. Where new monitoring techniques and technologies are identified, these will be adopted as appropriate.

To monitor the success of progressive rehabilitation, permanently marked transects will be established. The following methods will be employed at each monitoring site:

- permanent vegetation monitoring transects (monitoring of tree and shrub canopy cover, ground cover and species richness);
- photographic monitoring;
- erosion monitoring; and
- topsoil characterisation (upon commencement of monitoring and every 5 years thereafter).

The rehabilitation monitoring program aims to achieve data collection at sufficient spatial and temporal resolution to ensure statistically valid results.

3.7.1 Monitoring methodology

A transect-based approach consistent with the BioCondition methods outlined in the *Method for the Establishment and Survey of Reference Sites for BioCondition* (Eyre et al. 2017) will be utilised for rehabilitation monitoring. This approach aims to provide a measure of the capacity of a terrestrial ecosystem to maintain biodiversity values at a local or property scale and allows a comparative assessment of pre- and post-mining ecosystems.

BioCondition monitoring assesses a suite of parameters at different landscape positions on each site, namely on flats, slopes and troughs. Repeated edaphic (soil properties) and biological measurements are taken over time for various parameters that indicate changes in ecosystem function as rehabilitation proceeds. In general, the method involves monitoring two groups of sites:

- **analogue / reference sites:** selected to best reflect the pre-mining land use (i.e., cleared pasture for cattle grazing) as recommended by an AQP and will aim to obtain relevant and realistic rehabilitation criteria as close as the matching PMLU. Analogue sites will be chosen as close as possible to the rehabilitated area so that the same climatic and environmental conditions exist at both sites to the extent possible; and
- **rehabilitated sites:** monitored for rehabilitation performance, successful or otherwise.

Multiple analogue/reference sites will be established on and around the Project that best represent the pre-mining ecosystems. For the Project, reference sites will represent the pre-mining condition relevant to the nominated PMLU and reference transects will be established before the commencement of rehabilitation monitoring at the Project. In general, reference sites will be representative of the following vegetation communities:

- low-intensity grazing areas comprising improved pastures;
- low-intensity grazing areas comprising mixed communities of improved pastures and native vegetation; and
- the native vegetation community identified as VC2 (3.1.7.1).

Structured, periodic monitoring of reference sites will provide an understanding of the pre-mining landscape, assisting in the future planning and refinement of rehabilitation strategies relevant to site specific, as well as providing data for the determination of completion criteria when assessing rehabilitation success.

It is also recommended that the frequency and timing of monitoring of reference sites coincide with the monitoring of rehabilitation areas. Each transect is to be located in an area that is accessible to ensure sampling repeatability over the life of the monitoring program. Results from reference sites will be compared to monitoring results obtained from rehabilitated site transects.

Rehabilitation transect sites will also be established within rehabilitated landforms post-mining. The following parameters will be monitored annually, at each site (where appropriate):

- aspect and slope;
- tree density and shrub density (measured as trees/ha or shrubs/ha) in areas comprising a native vegetation PMLU component;
- herb/grass density (grasses/ha);
- groundcover (%);
- species composition;
- chemical and physical indicators of soil;
- erosion indicators (depth of rills or erosion lines, surface crusting, slopes); and
- photographic records of the site.

In addition to rehabilitation transect monitoring, other related site environmental monitoring will continue throughout and following the life of the mine (e.g. surface water monitoring). These data sets will also work to further inform future assessments of rehabilitation success.

Per current standards, rehabilitation monitoring will ultimately aim to demonstrate that domain-specific completion criteria have been continuously met for a period of three years or greater.

The rehabilitation monitoring methodologies proposed to be adopted for the Project are detailed below.

3.7.1.1 Sampling locations

Rehabilitation monitoring locations will be determined prior to the commencement of rehabilitation activities. Sites will be selected randomly within the rehabilitation area, with the orientation of the transect based on the physical parameters of the landform, to ensure all observations are statistically independent. GPS coordinates for monitoring locations will be collected, and physical markers will be installed to identify the transect start and end points.

3.7.1.2 Vegetation monitoring

A transect-based approach (consistent with the BioCondition methodology) will be utilised for vegetation monitoring. This approach aims to provide a measure of the capacity of a terrestrial ecosystem to maintain biodiversity values at a local or property scale and allows a comparative assessment of pre- and post-mining ecosystems.

Vegetation monitoring involves the collection of quantitative data such as ground cover, species richness, canopy cover, woody stem density, recruitment and weeds within each plot within the monitoring site.

At each monitoring site, a 50 m tape is extended and the coordinates of each end are recorded to establish a permanent 50 m transect. A star picket is installed at each end of the transect to consistently and precisely identify the transect location during each monitoring period. The transect area extends 5 m on either side of the 50 m tape, creating a plot size of 50 m x 10 m, or 500 m².

In each quadrat, the percentage cover of rock, bare ground, organic litter, and each plant species present is recorded. Species are classified into one of the following six groups for reporting purposes:

- native pasture species;
- exotic pasture species;
- trees;
- shrubs;
- forbs;
- noxious weeds.

The survey methodologies outlined below have been adapted from the Queensland Herbarium survey technique (Neldner et al. 2019) and the *Method for the Establishment and Survey of Reference Sites for BioCondition* (Eyre et al. 2017).

Results from this survey will be used to compare plant communities between analogue and rehabilitated sites, including the metrics for species diversity and ground cover.

Where available, permanent monitoring transects should be established in rehabilitation and unmined (analogue or reference) areas. The permanent location of these monitoring transects will be decided during the first sample periods, with coordinates to be included in the *Rehabilitation Management Plan* before the next annual monitoring occurs.

Examples of field sheets to be used to collect rehabilitation survey data are provided in Appendix G.

Monitoring of vegetation will preferably be undertaken after the wet season to ensure the presence of ephemeral herbaceous plants and to assist with identification of species that require the presence of flowers/fruitleting material for accurate identification.

Monitoring of vegetation should be undertaken annually in the first 5 years following seeding to focus on the establishment of vegetation and to direct early reparation efforts. Monitoring then will be undertaken every two years for 10 years or upon achievement of completion criteria.

3.7.1.3 Ground cover

Ground cover monitoring involves the collection of quantitative data on average ground cover (percent) where the percentage of all types of ground cover within ten 1 m x 1 m quadrats is determined. Similar to the transect above, the quadrat shall be placed every 5 m on alternating sides of the transect, commencing at 0 m on the right and the final quadrat at 45 m. In each quadrat the total percentage ground foliage cover of each plant species and the percentage cover of bare soil, rock and organic litter is recorded.

Ground foliage cover incorporates native perennial grass cover, native annual grass cover, native forbs and other species, native shrubs (< 1m height), non-native grass, non-native forbs and shrubs, litter, rock, bare ground and cryptogams. An example of datasheet for the collection of data is provided in Appendix G and to ensure consistency a guide to estimating the percentage ground cover is also included Figure 55.

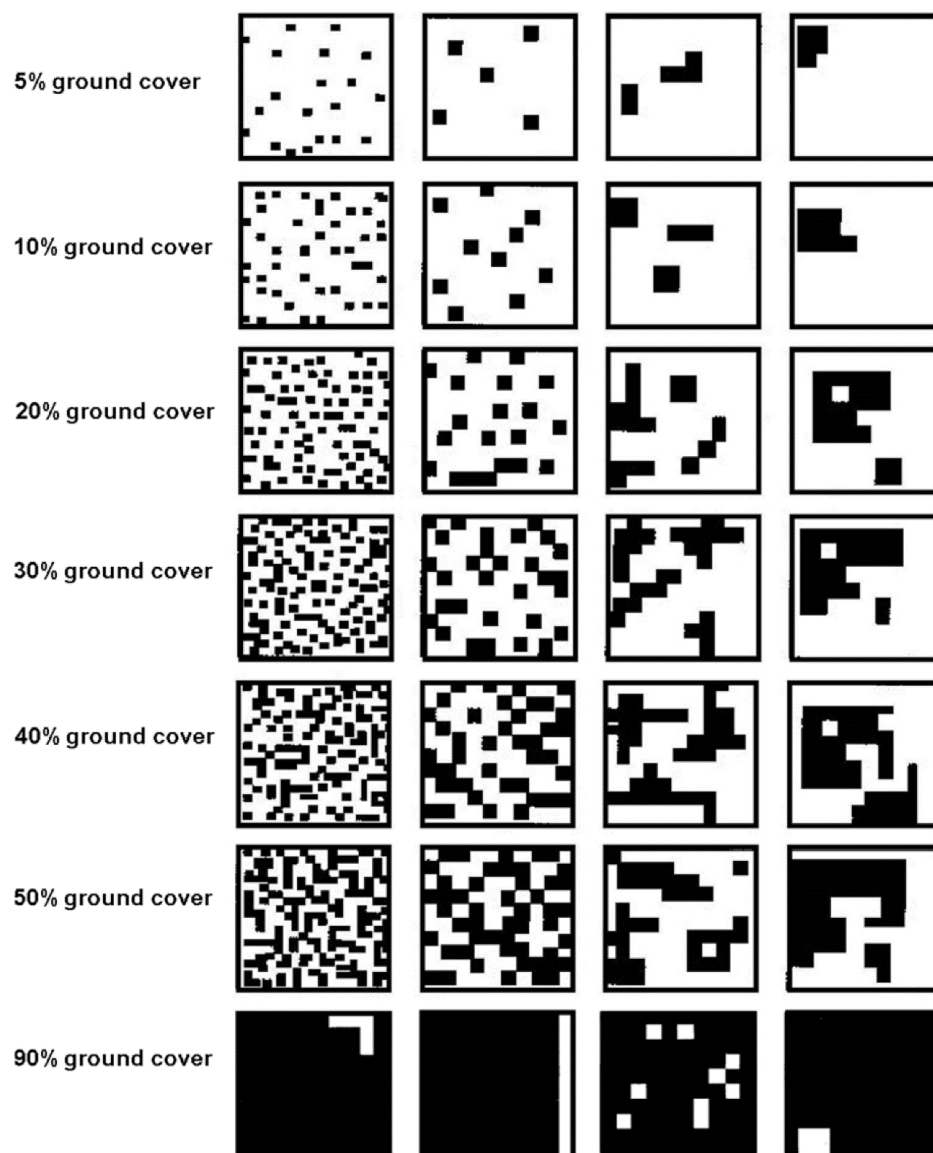


Figure 55: Guide to estimating ground cover percentage (Eyre et al. 2017)

3.7.1.4 Species richness

Species richness is assessed using the method outlined in Eyre et al. (2017) where all vascular plants that occur within a 10 m x 50 m plot area are recorded. The surveyor is to walk along each side of the 50 m transect centreline and record all trees, shrubs, forbs/other species and grasses occurring within 5 m of either side of the centreline. Species that cannot be identified within the field are collected for later identification or sent to the Queensland Herbarium for identification.

3.7.1.5 Stem density

Woody stem density is calculated using methodology adapted from the '*Method for the Establishment and Survey of Reference Sites for BioCondition*' (Eyre et al. 2017). All woody stems for each tree and shrub species are counted within the 10 m x 50 m plot area (i.e. 5 m either side of each 50 m transect). From this data, both total woody stem density as well as the density of each individual tree or shrub species is calculated. The density of species and growth forms on the monitoring sites is then calculated using the following equation:

$$\text{Density per hectare (ha)} = \text{Number of stems recorded within the transect} \times 20$$

3.7.1.6 Recruitment

Recruitment is assessed using methodology adapted from Eyre et al. (2015) whereby recruitment is assessed over the 10 m x 50 m plot (5 m either side of each 50 m transect). Within this plot, the proportion of dominant species found to be regenerating are counted. A regenerating individual is identified as a woody stem species with a diameter at breast height of <5 cm. For each dominant canopy species present, at least one individual must be present as a sapling or seedling for the species to be considered as regenerating. The presence of all dominant species in the regenerative state would make up 100% recruitment.

3.7.1.7 Canopy cover

Tree canopy cover can be used to characterise stand productivity and the distribution and abundance of biomass (Eyre et al. 2017). It refers to the estimation of the percentage canopy cover of the living, native tree layer along a 50 m transect, using the line intercept method (Greig-Smith 1964). For this attribute, the vertical projection of tree canopy cover of the species making up the tree canopy cover is assessed. The vertical projection of the tree canopy over the 50 m transect is recorded as illustrated in Figure 56. The total length of the projected canopy of each layer is then divided by the total length of the tape to give an estimate of percentage canopy cover on the site.

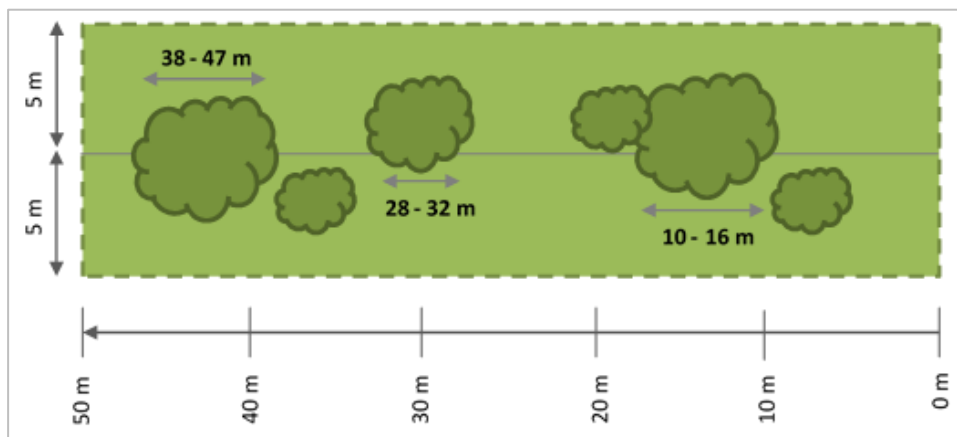


Figure 56: Guide to monitoring canopy cover (after Eyre et al. 2017)

3.7.1.8 Photographic monitoring

Photographic monitoring provides a visual record of the vegetation, ground cover, erosion and general appearance of each analogue and rehabilitation site, allowing these sites to be compared over time (Eyre et al. 2015). A digital camera is used to take the photos so that a permanent record can be kept for each site. The process of taking the monitoring photos is as follows:

- the site, date the photo was taken and the direction the photo was taken should be recorded for each photograph taken. A data board included in the photograph can be useful for this purpose;
- the person taking the photograph stands at the star picket which marks the beginning of the 50 m.
- the camera is then aimed directly toward the end of the 50 m transect and a single photograph is taken.

- the person then stands at the star picket which marks the end of the 50 m transect.
- the camera is then aimed directly toward the start of the 50 m transect and a single photograph is taken.

The digital photographs are then downloaded and stored for future reference.

3.7.1.9 Satellite-derived fractional vegetation cover

Fractional vegetation cover (FVC) is defined as that fraction of a satellite imagery pixel representing ground condition across three ground cover classes being:

- photosynthetic vegetation;
- non-photosynthetic vegetation; and
- bare ground

A median value of FVC can be determined for all satellite imagery pixels within a defined polygon area (or set of combined polygons). Subject to certain limitations, a median FVC value can be determined for polygons enclosing a rehabilitation area which is then able to be compared with polygons enclosing a reference/analogue area that is representative of unmined land having similar landform, land cover and land use.

Satellite-derived indices will be reported annually based on an appropriate monitoring frequency. The frequency of satellite data acquisition will also be influenced by cloud cover or cloud shadow that occludes the study area.

FVC is reported in graphical form with median and interquartile ranges for each rehabilitation polygon and combined reference area polygons. In addition, dates and duration of failure to achieve the target are reported in tabular form with mapping information for sources of non-compliance.

Source data

Satellite imagery from the Sentinel 2 global earth observation mission acquires imagery on a five-to-12-day interval at wavelengths between 400-2,500 nm. Reflectance indices based on the spectral reflectance profiles of photosynthetic vegetation, non-photosynthetic vegetation and bare ground is calculated and directly correlated with field-collected data to calculate fractional vegetation cover for each rehabilitation and reference polygon. Field calibration and validation are required to be re-established if a significant disturbance occurs (e.g. fire/drought).

Calibration and validation

Satellite imagery from the Sentinel 2 global earth observation mission acquires imagery on a five-to-12-day interval at wavelengths between 400-2,500 nm. Reflectance indices based on the spectral reflectance profiles of photosynthetic vegetation, non-photosynthetic vegetation and bare ground is calculated and directly correlated with field-collected data to calculate fractional vegetation cover for each rehabilitation and reference polygon. Field calibration and validation are required to be re-established if a significant disturbance occurs (e.g. fire/drought).

Limitations

Currently, this method is only to be utilised for relatively low slopes (i.e. not defined waste emplacement batter slopes).

Rehabilitation area polygons should be:

- selected with a sufficient buffer to exclude edge effects compromising the outcome; and
- selected to exclude engineered structures, e.g. internal drainage basins and spine drains.

Reference areas should be:

- areas having the same target land use as the rehabilitation area;
- the equivalent extent in hectares to target rehabilitation polygon areas; and
- a selection of at least four non-contiguous polygons.

3.7.1.10 Fauna habitat assessment

A fauna habitat assessment will be completed within the Fauna Habitat RAs (RA3) to assess the ability of the final landform to support the proposed land use. The monitoring program for the Fauna Habitat PMLU areas will incorporate the following monitoring methods:

- an assessment of fringing aquatic vegetation, bank condition and habitat availability;
- fauna observations;
- macroinvertebrate monitoring; and
- water quality monitoring (refer to the methodology outlined section 3.7.3).

Observations of any fauna species present within or near all rehabilitation areas will also be noted as part of the rehabilitation monitoring program.

3.7.1.11 Emerging monitoring technologies

Where emerging technologies can be implemented as a cost-effective means of assessing rehabilitation success, these will be reviewed and introduced as appropriate. An example of such technology is the determination of a normalised difference vegetation index based on aerial imagery; which can be used to assess vegetation cover and vegetative health.

3.7.2 Soil monitoring

Soil monitoring involves the collection of topsoil samples from a maximum depth of 10 cm to obtain quantitative data on the chemical and physical properties of soil. Soil sampling methodology has been adapted from '*Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009*' (DES 2018b). Soil sampling is conducted by collecting approximately 200 g samples with a clean non-metallic shovel and bucket every 10 m along the 50 m transect. The first sample is collected at 0 m. These five samples are mixed in the bucket. The final 200 g soil sample is taken from the mix and placed into plastic sample bag. Samples are sent to a National Association of Testing Authorities (NATA) certified laboratory for analysis of indicators of soil nutrition and land contamination.

3.7.2.1 Topsoil characteristics

Topsoil sampling is not considered to be an annual requirement of the rehabilitation monitoring program. It is, however, to be undertaken upon commencement of monitoring, biennially until year 5 and every 5 years thereafter to monitor the development of the soil profile or to address any deficiencies in the chemical composition of the soil that may be detrimental to vegetation health. Topsoil analysis will typically include the following suite of parameters:

- pH;
- EC/chloride concentration;
- exchangeable sodium percentage;
- cation exchange capacity;
- soil carbon;

- macronutrients (nitrogen, phosphorus, potassium and sulphur); and
- micronutrients.

Soil moisture content shall be measured for interpretive purposes only and will not be assessed in determining rehabilitation performance.

Topsoil data collected as part of the monitoring program will ultimately be compiled into a land suitability assessment of the rehabilitated land.

Ideally, rehabilitation site data should reflect that of analogue sites, though data indicating a trajectory to meet performance criteria may be sufficient in supporting the chosen post-mining land use.

Field-based erosion monitoring

An erosion monitoring methodology has been developed by experienced AARC ecologists with consideration to relevant guidelines and research (Neldner et al. 2019, Eyre et al. 2017 and DSITI 2015). Erosion monitoring is to be conducted across all analogue and rehabilitation monitoring locations, simultaneously with vegetation monitoring in the first 3 years post-revegetation. Following 3 years post revegetation, erosion monitoring will primarily be undertaken using LiDAR monitoring. However, ground-truthing may be required (using the following methodology) upon assessment of LiDAR data.

Rehabilitation areas will be inspected to assess the extent of erosion features and an erosion rating for each site will be determined. Erosion features or indicators may include wind or sheet erosion, erosion rills, gullies or tunnels, or signs of slumping.

Erosion at the survey sites is monitored through visual assessment over time. Assessment is undertaken by traversing the 50 m transects and recording the number and average depth of any erosion features or rill lines. Observations of erosion shall be recorded and classified in accordance with Table 49. The overall classification of the erosion on each transect is determined by the higher classification attributed to either the number of rills/gullies or the average depth. For example, a transect may present only one or two rills, but if these are recorded as being 25 cm deep, the transect will be classified as presenting a Moderate erosion classification. Obvious cases of localised settlement that are not causing any subsequent erosion are not counted as instances of erosion. Erosion along revegetated sites will be compared to the landscape scale erosion data captured in the LiDAR monitoring program.

Table 49: Erosion classification

Erosion classification	Minor	Moderate	Severe
Sheet erosion	Shallow soil deposits downslope	Partial exposure of roots; moderate soil deposits downslope, etc	Loss of surface horizon; root exposure; moderate substantial soil deposits downslope
Rill erosion	<0.3m deep<15 rills/transect*	<0.3m deep 15-30 rills/transect*	<0.3m deep>30 rills/transect*
Gully erosion	Absent	>0.3m deep Gullies are linear, continuous, and restricted to primary or minor drainage lines	>0.6m deep Gullies are continuous or discontinuous, and either tend to branch away from primary drainage lines and on to foot slopes, or have multiple branches within drainage lines
Tunnel erosion	Absent	Absent	Present
Mass movement	Absent	Absent	Present

Source: NCST (2009)

* Transect linear 100 m across the contour (Source: Tongway and Hindley (2005))

It should be noted that the placement of the permanent transects may not be representative of the level of erosion across the entire rehabilitation area landforms. To compensate for this, general observations undertaken during the survey are also utilised to assess rehabilitation performance. The location of any severe erosion outside the transect (i.e. tunnels, mass wasting, large gullies) is also recorded and marked with a handheld Global Positioning System (GPS).

The following information is recorded at each site:

- GPS reading of location;
- general description of the type of erosion (gully [> 30 cm], rill line [<30 cm], circular failure, tunnelling etc.) and possible causes, refer to the glossary of terms for definitions of erosion types;
- depth of erosion;
- width of erosion;
- length of erosion;
- where eroded material is being deposited; and
- whether the erosion line is being stabilised by vegetation.

3.7.3 Surface water and groundwater monitoring

Surface water and groundwater sampling will be carried out in accordance with the methodology of the Queensland Monitoring and Sampling Manual (DES 2018). In-situ measurements of pH, dissolved oxygen (DO), oxygen reduction potential (ORP), EC, salinity, total dissolved solids (TDS), and temperature will be recorded with a multi-parameter water quality meter calibrated to the manufacturer's specifications.

Surface water monitoring locations will include:

- The toe of the rehabilitated waste rock emplacements;
- within recreated drainage features such as mine water dam and process water dam;

- Charlevue Creek and Springton Creek (at the locations defined in EA Table F1 – Receiving water upstream background sites and downstream monitoring sites); and
- water within the residual void lakes (RA3).

Measurements will be taken during the wet season and/or after a significant rainfall event that enables surface water runoff to be collected from the surface of rehabilitated waste rock material.

Surface water grab samples will be collected at a depth of 10 to 20 cm where sufficient water is available. Two water samples, one total (unfiltered) and one dissolved (field filtered) will be collected at each site. Water quality samples will be analysed under laboratory testing conditions for the following parameters as outlined in Attachment 6 (Table 30) in section 3.5.4:

- | | | |
|----------------------------|---------------|---------------------|
| • pH; | • aluminium; | • nickel; |
| • electrical conductivity; | • boron; | • selenium; |
| • total dissolved solids; | • chromium; | • zinc; and |
| • turbidity; | • cobalt; | • Total Recoverable |
| • total suspended solids; | • copper; | Hydrocarbons (C6-C9 |
| • sulphate; | • manganese; | and (C10-C36). |
| • nitrate | • molybdenum; | |

Groundwater monitoring will be completed at the monitoring bore locations identified in EA Table E1 – Groundwater monitoring locations and frequency (Figure 20) for the parameters identified in Table E2 – Groundwater quality limits, including:

- | | | |
|----------------------------|--------------|-----------------|
| • pH; | • chromium; | • Molybdenum; |
| • electrical conductivity; | • cobalt; | • Nickel; |
| • sulphate; | • copper; | • Selenium; and |
| • aluminium; | • Manganese; | • Zinc. |
| • arsenic; | | |

Field readings of pH, EC and TDS will be compared against the milestone criteria for RM13. Measurements will also be taken from retained dams and compared against the milestone criteria for RM13. Data for each monitoring event will be compiled and used to identify trends in water quality over time.

3.7.4 Data Analysis, Interpretation and Reporting

3.7.4.1 Laboratory analysis

All soil and water samples collected during rehabilitation monitoring will be sent to a NATA certified laboratory for analysis of the recommended parameters.

In the event that any plants cannot be identified in the field, samples will be sent to the Queensland Herbarium for identification.

3.7.4.2 Progress reporting

A rehabilitation report will be prepared annually (until completion) following the collection of monitoring data to provide a detailed analysis of monitoring results and evaluate rehabilitation progress towards completion criteria. This ongoing evaluation will enable the early detection of unfavourable trends in measured indicators and identify any requirements for adaptive management practices to ensure rehabilitation success and certification in the long term.

3.7.4.3 Interpretation

Rehabilitation monitoring results will be analysed both categorically and temporally. Results obtained from rehabilitation sites will be compared to analogue sites from the same final land use vegetation community. Rehabilitation monitoring results will also be compared with historical data where possible to detect any trends over time. Common variables such as climatic conditions, seasonal variation and other event specific circumstances will also be considered in the analysis of rehabilitation data.

3.7.4.4 Statistical analysis

Given the small disturbance footprint of the Project, statistical analysis will involve the comparison of vegetation and soil monitoring characteristics recorded from analogue sites at the same point in time. The analysis of rehabilitation monitoring results will involve comparing rehabilitation sites generally across the Project using the following analytical methods where appropriate:

- between sample means. To determine any significant differences ($\alpha = 0.05$) between the means of rehabilitation characteristics recorded across analogue and rehabilitation sites, it is recommended that rehabilitation performance be assessed using a t-test (where a minimum of three sites are available, providing sufficient statistical replication) or a similar nonparametric test where the data is not normally distributed. Variables measured at analogue and rehabilitation sites are considered statistically comparable where no significant difference between the means is detected.
- in relation to vegetation and soil quality characteristics, the mean values ± 1 standard deviation will be calculated for comparison of analogue and rehabilitation site data; and
- temporal variation will be presented graphically for vegetation and soil quality variables as required to identify any outliers or ongoing trends.

3.7.5 Maintenance

Significant rainfall events, floods, fire, drought, pest species outbreaks or other factors may result in a requirement to undertake additional maintenance on rehabilitated areas. Maintenance of rehabilitated areas or reparations may also be required where visual observations of rehabilitation and/or rehabilitation monitoring results (refer section 3.5.4) indicate that the expected trajectory towards achieving successful rehabilitation is not being met. Depending on the underlying cause of failed rehabilitation, rectification activities may include:

- earthworks repair of erosion areas;
- re-seeding / replanting failed or unsatisfactory areas;
- supplementary planting of tube stock;
- pest and weed control;
- irrigation of plants;
- additional fertiliser or other ameliorant application to control pH and improve soil structure; or
- repair or alteration of drainage structures.

In the event that maintenance is required, a maintenance plan will be developed that properly assesses the risks of re-entering a rehabilitated area with earthmoving equipment, the sourcing of soils and topsoil, impacts on planned drainage of the site, erosion controls and revegetation methods.

Table 50: Rehabilitation milestone and monitoring measures

Rehabilitation milestone	Description / criteria	Methodology	Proposed management/ monitoring measure(s)
RM1: Infrastructure Decommissioning and Removal	Applicable to RA9 Considered to be met when the area can be transitioned to RM4 where applicable.	Visual inspection following decommissioning and removal	- Infrastructure decommissioned / removed at closure will be subject to strict environment and safety planning requirements including completion inspections to determine if any future maintenance/repair action is required. - These inspections shall include visual monitoring and inspection to determine decommissioning requirements.
RM2: Remediation of Contaminated Land	Applicable to RA9, RA10 Considered to be met when a site suitability statement by a suitably qualified person confirms the uses or activities for which the land is suitable, align to the approved PMLUs of the site.	Visual inspection to identify potential areas of land contamination and/or certify land as free of contaminants or contaminating materials.	- A preliminary site investigation will be completed by a suitably qualified person. Following a detailed site investigation report, any potential contaminated materials will be removed, and the site will be remediated. Validation testing will confirm contamination removal or remediation has occurred. - Provide certification from an AQP¹ that contaminated land assessment has been undertaken, and site investigation report prepared and submitted, if required.
RM3: Landform Development and Reshaping/Profiling ((RA1, RA2 and RA5)	Applicable to RA1, RA2 and RA5 Considered to be met when all bulk earthworks are completed, and former infrastructure area is assessed as geotechnically stable by a suitably qualified person.	- Visual inspection and document activities. - Provide certification from an appropriately qualified person that design criteria have been met. - Provide certification from an appropriately qualified person that long-term stability has been achieved for relevant landform.	- On completion of construction and reprofiling of the final landform, inspection and reporting will be undertaken to ensure the landform development and reshaping have been undertaken per design specifications. - Additionally, visual inspections will be done to determine if any future maintenance/repair action is required
RM4: Landform development of diversion drains (RA8)	Applicable to RA8 . Considered to be met when all bulk earthworks are completed, and	- Visual inspection and document activities. - Provide certification from an appropriately qualified person that design criteria have been met.	On completion of construction and reprofiling of the final landform, inspection and reporting will be undertaken to ensure the landform development and reshaping have been undertaken per design specifications.

Rehabilitation milestone	Description / criteria	Methodology	Proposed management/ monitoring measure(s)
	former infrastructure area is assessed as geotechnically stable by a suitably qualified person.	Provide certification from an appropriately qualified person that long-term stability has been achieved for relevant landform.	Additionally, visual inspections will be done to determine if any future maintenance/repair action is required
RM5: Landform development of infrastructure areas (RA9) and rehabilitated dams (RA6)	Applicable to RA6, RA9 Considered to be met when all bulk earthworks are completed, and former infrastructure area is assessed as geotechnically stable by a suitably qualified person.	- Visual inspection and document activities. - Provide certification from an appropriately qualified person that design criteria have been met. - Provide certification from an appropriately qualified person that long-term stability has been achieved for relevant landform.	- On completion of construction and reprofiling of the final landform, inspection and reporting will be undertaken to ensure the landform development and reshaping have been undertaken per design specifications. - Additionally, visual inspections will be done to determine if any future maintenance/repair action is required
RM6: Landform development of residual void lake (RA3)	Applicable to RA3 Considered to be met when all bulk earthworks are completed, and former infrastructure area is assessed as geotechnically stable by a suitably qualified person..	- Visual inspection and document activities. - Provide certification from an appropriately qualified person that design criteria have been met. - Provide certification from an appropriately qualified person that long-term stability has been achieved for relevant landform.	- On completion of construction and reprofiling of the final landform, inspection and reporting will be undertaken to ensure the landform development and reshaping have been undertaken per design specifications. - Additionally, visual inspections will be done to determine if any future maintenance/repair action is required
RM7: Landform development of residual void high wall (RA4)	Applicable to RA4 Considered to be met when all bulk earthworks are completed, and former infrastructure area is assessed as geotechnically stable by a suitably qualified person.	- Visual inspection and document activities. - Provide certification from an appropriately qualified person that design criteria have been met. - Provide certification from an appropriately qualified person that long-term stability has been achieved for relevant landform.	- On completion of construction of the final landform, inspection and reporting will be undertaken to ensure the landform development and reshaping have been undertaken per design specifications. - Additionally, visual inspections will be done to determine if any future maintenance/repair action is required

Rehabilitation milestone	Description / criteria	Methodology	Proposed management/ monitoring measure(s)
RM8: Surface preparation	Applicable to RA1, RA2, RA3, RA5, RA6, RA8 and RA9 Includes topdressing, contour ripping and soil amelioration (if required) that will increase the possibilities of healthy vegetation establishment. Considered to be met when according to specific criteria from section 3.5.4.	- Record of soil health and suitability assessment undertaken by an appropriately qualified person. - Document placement of topsoil or suitable substitute across reshaped areas. Records to include source, analysis results and any pre-treatments applied - Visually inspection and documentation of contour ripping including depth, spacing and machinery used - Documentation of ameliorants application across reshaped areas. Records to include types, rates and timing of applications.	Regular meetings to track progress of surface preparation and its suitability to transition to the revegetation stage. The following monitoring actions will be undertaken in order to maximize vegetation establishment and minimize any potential soil erosion: - analysis of pH, electrical conductivity (EC), and exchangeable sodium percentage (ESP); - determination if any type of amelioration is needed (e.g gypsum) based on the results of the aforementioned parameters; and - hay mulch application to the rehabilitated (or repaired) area until it reaches a sustained groundcover. A soil health and suitability assessment will be undertaken to determine any amelioration requirements if soil quality characteristics require improvement measures. Ongoing rehabilitation activities to manage and achieve a successful surface preparation will include - repair of erosion prone areas; - application of supplementary topdressing materials, where required; and weed management and control.
RM9: Surface preparation and revegetation of residual void high wall (RA4)	Applicable to RA4 Includes Hydromulch to be placed over the upper high wall (18° slope) and exposed benches	- Visually inspection and documentation of contour ripping including depth, spacing and machinery used - Documentation of ameliorants application across reshaped areas. Records to include types, rates and timing of applications.	- In addition to binders, soil ameliorants and fertiliser can be included as part of the hydromulch composition to improve vegetation growth. - Ameliorants may be required to improve cohesion with the subsoil / topsoil and given local variability in soil quality it is considered appropriate for recommendations to be made following testing of the material to be used in rehabilitation prior to use. - Records to demonstrate that seeding has been undertaken in accordance with the rehabilitation objectives set out in the PRCP.
RM10: Revegetation for grazing	Applicable to RA1, RA2, RA5, RA9 Considered to be met when minimum sowing rates are achieved, with the understanding that	- Document seeding and planting rates/densities - Species richness is assessed using the method outlined in Eyre et al. (2017) where all vascular plants that occur within a 10 m x 50 m plot area are recorded.	Regular meetings will be held to track the revegetation progress. Ongoing rehabilitation activities to manage and achieve successful revegetation will include: repair of erosion prone areas;

Rehabilitation milestone	Description / criteria	Methodology	Proposed management/ monitoring measure(s)
	further works may be necessary to meet rehabilitation standards if any remedial works and/or additional planting is needed.	The surveyor is to walk along each side of the 50 m transect centreline and record all trees, shrubs, forbs/other species and grasses occurring within 5 m of either side of the centreline	- application of hay mulching (or similar technique) to control erosion at the early stages of seeding (window of erosional risk); - weed management and control; and - re-seeding and/or additional planting when required. Monitoring of new revegetated areas should be conducted annually for the first 5 years and/or until milestone is achieved.
RM11: Revegetation for fauna habitat	Applicable to RA4 Considered to be met when minimum sowing rates are achieved, with the understanding that further works may be necessary to meet rehabilitation standards if any remedial works and/or additional planting is needed.	Document seeding and planting rates/densities	Regular meetings will be held to track the revegetation progress. Ongoing rehabilitation activities to manage and achieve successful revegetation will include: - repair of erosion prone areas; - application of hay mulching (or similar technique) to control erosion at the early stages of seeding (window of erosional risk); - weed management and control; and - re-seeding and/or additional planting when required. Monitoring of new revegetated areas should be conducted annually for the first 5 years and/or until milestone is achieved.
RM12: Revegetation for grazing/native vegetation	Applicable to RA6 and RA8 Considered to be met when minimum sowing rates are achieved, with the understanding that further works may be necessary to meet rehabilitation standards if any remedial works and/or additional planting is needed.	Document seeding and planting rates/densities	Regular meetings will be held to track the revegetation progress. Ongoing rehabilitation activities to manage and achieve successful revegetation will include: - repair of erosion prone areas; - application of hay mulching (or similar technique) to control erosion at the early stages of seeding (window of erosional risk); - weed management and control; and - re-seeding and/or additional planting when required. Monitoring of new revegetated areas should be conducted annually for the first 5 years and/or until milestone is achieved.

Rehabilitation milestone	Description / criteria	Methodology	Proposed management/ monitoring measure(s)
RM13: Achievement of surface requirements (grazing)	Applicable to RA1, RA2, RA5 and RA9 Considered to be met when the area has achieved its corresponding land suitability class and has controlled erosion as per the completion criteria described in section 3.5.5.	• Satellite imagery (refer section 3.7.1.9 <i>Satellite derived fractional vegetation monitoring</i>) • Species inventory and richness to be recorded at revegetation monitoring sites 3.7.1.2 • Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer section 3.7.2)	Regular meetings will be held to track progress towards the achievement of surface requirements. Ongoing rehabilitation activities to manage and achieve successful revegetation will include: • repair of erosion prone areas • application of hay mulching (or similar technique) to control erosion at the early stages of seeding (window of erosional risk) • weed management and control: and • re-seeding and/or additional planting when required. Erosion monitoring to identify and control severe or extreme rill and gully erosion as defined in section 3.5.5. Field survey monitoring will be supplemented with remote sensing to improve data analysis and provide a more accurate measures to determine if rehabilitation objectives are being met. Methodologies for successful revegetation are further explained in sections They include the following • vegetation surveys (composition, diversity • erosion rates, invasive plant species) • soil erosion monitoring • photographic monitoring; and • remote sensing
RM14: Achievement of surface requirements (native vegetation supporting fauna habitat)	Applicable to RA4. Includes groundcover targets to be met as follows: Establishment of native ecosystem to resemble a requirement as per section 3.5.4 Considered to be met when the area has	• Species inventory and richness to be recorded at revegetation monitoring sites (refer section 3.7.1.2) • Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP. Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports) • Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer section 3.7.2)	Regular meetings will be held to track progress towards the achievement of surface requirements. Ongoing rehabilitation activities to manage and achieve successful revegetation will include: • repair of erosion prone areas; • application of hay mulching (or similar technique) to control erosion at the early stages of seeding (window of erosional risk); • weed management and control; and • re-seeding and/or additional planting when required. Erosion monitoring to identify and control severe or extreme rill and gully erosion as defined in section 3.5.4

Rehabilitation milestone	Description / criteria	Methodology	Proposed management/ monitoring measure(s)
	achieved its corresponding land suitability class, surface water quality complies with completion criteria limits and has controlled erosion as per the completion criteria described in section 3.5.5.		Field survey monitoring will be supplemented with remote sensing to improve data analysis and provide a more accurate measures to determine if rehabilitation objectives are being met
RM15: Achievement of surface requirements (grazing/native vegetation)	Applicable to RA6 and RA8 Considered to be met when the area has achieved its corresponding land suitability class, surface water quality complies with completion criteria limits and has controlled erosion as per the completion criteria described in section 3.5.4.	- Species inventory and richness to be recorded at revegetation monitoring sites (refer section 3.7.1.2) - Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP. Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports) - Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer section 3.7.2)	Regular meetings will be held to track the revegetation progress. Ongoing rehabilitation activities to manage and achieve successful revegetation will include: - repair of erosion prone areas - application of hay mulching (or similar technique) to control erosion at the early stages of seeding (window of erosional risk); - weed management and control; and - re-seeding and/or additional planting when required. Monitoring of new revegetated areas should be conducted annually for the first 5 years and/or until milestone is achieved.
RM16: Achievement of surface requirements (fauna habitat)	Applicable to RA3	- Species inventory and richness to be recorded at revegetation monitoring sites (refer section 3.7.1.2) - Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP. Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports) - Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer section 3.7.2)	Regular meetings will be held to track the revegetation progress. Ongoing rehabilitation activities to manage and achieve successful revegetation will include: - repair of erosion prone areas - application of hay mulching (or similar technique) to control erosion at the early stages of seeding (window of erosional risk); - weed management and control; and - re-seeding and/or additional planting when required.

Rehabilitation milestone	Description / criteria	Methodology	Proposed management/ monitoring measure(s)
			Monitoring of new revegetated areas should be conducted annually for the first 5 years and/or until milestone is achieved.
RM17: Achievement of Stable PMLU – Grazing	Applicable to RA1, RA2, RA5, RA9 Considered to be met when the area has achieved its corresponding land suitability class, surface water quality complies with completion criteria limits and has controlled erosion as per the completion criteria described in section 3.5.5.	- Species inventory and richness to be recorded at revegetation monitoring sites (refer 3.7.1.2) - Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP. Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports) - Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer section 3.7.2) - Surface water and groundwater sampling will be carried out in accordance with the Queensland Monitoring and Sampling Manual (DES 2018). Field readings of pH and EC will be recorded and results will be assessed against relevant milestone criteria.	A combination of field surveys, drone and satellite imagery monitoring will be utilised. Remote sensing is to be used annually until the achievement of the PMLU by monitoring groundcover composition, size and extent of erosion features, and extent of weeds and pests The following assessments will be undertaken to demonstrate that the land has achieved RM17: - closure post-mining soil and land suitability assessments - vegetation, erosion and weed assessments to be provided in a final rehabilitation report - assessment of carrying capacity that demonstrates sustainable grazing - certification that the void low walls are stable and no migration of contaminants to groundwater has or will occur; and Methodologies for monitoring of surface water and soil quality to be applied at this rehabilitation milestone are further explained in 3.7.1
RM18: Achievement of Stable PMLU – Grazing/Native vegetation	Applicable RA6 and RA8 Considered to be met when the area has achieved its corresponding land suitability class, surface water quality complies with completion criteria limits and has controlled erosion as per the completion criteria described in section 3.5.5.	- Species inventory and richness to be recorded at revegetation monitoring sites (refer section 3.7.1.2) - Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP. Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports) - Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer section 3.7.2) - Surface water and groundwater sampling will be carried out in accordance with the Queensland Monitoring and Sampling Manual (DES 2018). Field	A combination of field surveys and satellite imagery monitoring will be utilised. The following assessments will be undertaken to demonstrate that the land has achieved RM18: - closure post-mining soil and land suitability assessments - vegetation, erosion and weed assessments to be provided in a final rehabilitation report - assessment of carrying capacity that demonstrates sustainable grazing/native vegetation Methodologies for monitoring of surface water and soil quality to be applied at this rehabilitation milestone are further explained in 3.7.1.

Rehabilitation milestone	Description / criteria	Methodology	Proposed management/ monitoring measure(s)
		readings of pH and EC will be recorded and results will be assessed against relevant milestone criteria.	
RM19: Achievement of Stable PMLU – Native vegetation supporting fauna habitat	Applicable to RA4. Considered to be met when the area has evidence of flora recruitment, native fauna rehabilitation and has controlled erosion as per the completion criteria in section 3.5.5	- Species inventory and richness to be recorded at revegetation monitoring sites (refer section 3.7.1.2) - Monitoring of weed species and percentage foliage cover is to be conducted at rehabilitation sites as described in the PRCP. Record of weed management activities undertaken (where recommended in rehabilitation monitoring reports) - Erosion monitoring to be conducted at rehabilitation sites and general observations of 'Severe' erosion across each RA are to be recorded (refer section 3.7.2) - Surface water and groundwater sampling will be carried out in accordance with the Queensland Monitoring and Sampling Manual (DES 2018). Field readings of pH and EC will be recorded and results will be assessed against relevant milestone criteria.	A combination of field surveys, drone and satellite imagery monitoring will be utilised. The following assessments will be undertaken to demonstrate that the land has achieved RM19 - closure post-mining soil and land suitability assessments - vegetation, erosion and weed assessments to be provided in a final rehabilitation report - assessment of carrying capacity that demonstrates sustainable native vegetation to support fauna habitat - certification that the void high walls are stable and no migration of contaminants to groundwater has or will occur; and Methodologies for monitoring of surface water and soil quality to be applied at this rehabilitation milestone are further explained in 3.7.1
RM20: Achievement of Stable PMLU – Fauna habitat	Applicable to RA3. Considered to be met when the area has evidence of flora recruitment, native fauna rehabilitation and has controlled erosion as per the completion criteria in section 3.5.5	Surface water and groundwater sampling will be carried out in accordance with the Queensland Monitoring and Sampling Manual (DES 2018). Field readings of pH and EC will be recorded, and results will be assessed against relevant milestone criteria.	- A combination of field surveys, drone and satellite imagery monitoring will be utilised - Certification that void waterbody is stable and no migration of contaminants to groundwater has or will occur.
RM21: Achievement of Stable PMLU – retained dams	Applicable to RA7	Water quality samples will be collected from retained water storage(s) and sent to a NATA certified laboratory for analysis of water quality parameters specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). Results for relevant parameters will be	- Water quality data to be compared to guideline levels for livestock drinking water quality (ANZG 2018). - Landholder agreements

Rehabilitation milestone	Description / criteria	Methodology	Proposed management/ monitoring measure(s)
		assessed against livestock drinking water guideline values. - Visual inspection to be conducted throughout rehabilitation areas to identify erosion as per Section . 3.7.2 - Hazard and safety assessment report to conclude that the PMLU is safe for its intended used.	
RM22: Achievement of Stable PMLU—retained infrastructure	Applicable to RA10	Hazard and safety assessment report to conclude that the PMLU is safe for its intended used.	N/A
RM23: Surface water and groundwater demonstrate non-polluting landform	Applicable to all RA's. Considered to be met when surface water and groundwater monitoring data confirms all RA's meet the specific objectives as per the completion criteria in section 3.5.5.	Surface water and groundwater sampling will be carried out in accordance with the Queensland Monitoring and Sampling Manual (DES 2018). Field readings of pH and EC will be recorded, and results will be assessed against relevant milestone criteria	An assessment of the long-term monitoring data collected for surface water quality, groundwater quality, and groundwater levels demonstrates all rehabilitated areas achieve the relevant receiving environment objectives outlined in the completion criteria.

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Appendix A. PRCP Schedule

Post-mining land uses (PMLU)										
Rehabilitation area				RA1						
Relevant activities				In-pit and out-of-pit waste emplacements						
Total rehabilitation area size (ha)				720.7						
Commencement of first milestone:RM1				10/12/2028						
PMLU				Grazing						
Date area is available by	10/12/2028	10/12/2030	10/12/2034	10/12/2038	10/12/2044					
Cumulative area available (ha)	67.1	454.8	553.5	625.9	720.7	720.7	720.7	720.7	720.7	720.7
Milestone completed by	10/12/2030	10/12/2034	10/12/2038	10/12/2044	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)									
RM3	67.1	454.8	553.5	625.9	720.7	720.7	720.7	720.7	720.7	720.7
RM8	17.1	213.0	526.8	610.1	634.8	720.7	720.7	720.7	720.7	720.7
RM10	17.1	39.7	392.7	585.9	625.8	720.7	720.7	720.7	720.7	720.7
RM13			39.7	454.8	553.4	625.8	720.7	720.7	720.7	720.7
RM17				39.7	213.0	553.4	610.1	634.8	720.7	720.7
RM23										720.7

Post-mining land uses (PMLU)						
Rehabilitation area	RA2					
Relevant activities	Temporary waste emplacement					
Total rehabilitation area size (ha)	17.5					
Commencement of first milestone: RM1	10/12/2043					
PMLU	Grazing					
Date area is available by	10/12/2044					
Cumulative area available (ha)	17.5	17.5	17.5	17.5	17.5	17.5
Milestone completed by	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)					
RM3	17.5	17.5	17.5	17.5	17.5	17.5
RM8		17.5	17.5	17.5	17.5	17.5
RM10		17.5	17.5	17.5	17.5	17.5
RM13			17.5	17.5	17.5	17.5
RM17				17.5	17.5	17.5
RM23						17.5

Post-mining land uses (PMLU)								
Rehabilitation area			RA3					
Relevant activities			Residual void lake					
Total rehabilitation area size (ha)			76.3					
Commencement of first milestone:RM1			10/12/2033					
PMLU			Fauna Habitat					
Date area is available by	10/12/2034	10/12/2038	10/12/2044					
Cumulative area available (ha)	35.8	35.8	76.3	76.3	76.3	76.3	76.3	76.3
Milestone completed by	10/12/2038	10/12/2044	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)							
RM6	35.8	35.8	76.3	76.3	76.3	76.3	76.3	76.3
RM8		35.8	35.8	76.3	76.3	76.3	76.3	76.3
RM11		35.8	35.8	76.3	76.3	76.3	76.3	76.3
RM16			35.8	35.8	76.3	76.3	76.3	76.3
RM20				35.8	35.8	35.8	76.3	76.3
RM23								76.3

Post-mining land uses (PMLU)								
Rehabilitation area			RA4					
Relevant activities			Residual void high wall					
Total rehabilitation area size (ha)			132.8					
Commencement of first milestone:RM1			10/12/2033					
PMLU			Native Vegetation Supporting Fauna Habitat					
Date area is available by	10/12/2034	10/12/2038	10/12/2044					
Cumulative area available (ha)	69.0	69.0	132.8	132.8	132.8	132.8	132.8	132.8
Milestone completed by	10/12/2038	10/12/2044	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)							
RM7	69.0	69.0	132.8	132.8	132.8	132.8	132.8	132.8
RM9	69.0	69.0	69.0	132.8	132.8	132.8	132.8	132.8
RM14			69.0	69.0	132.8	132.8	132.8	132.8
RM19					69.0	69.0	69.0	132.8
RM23								132.8

Post-mining land uses (PMLU)								
Rehabilitation area			RA5					
Relevant activities			Residual void low wall					
Total rehabilitation area size (ha)			186.9					
Commencement of first milestone:RM1			10/12/2033					
PMLU			Native Vegetation Supporting Fauna Habitat					
Date area is available by	10/12/2034	10/12/2038	10/12/2044					
Cumulative area available (ha)	59.9	59.9	186.8	186.9	186.9	186.9	186.9	186.9
Milestone completed by	10/12/2038	10/12/2044	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)							
RM3	59.9	59.9	186.8	186.8	186.8	186.8	186.8	186.8
RM8	59.9	59.9	131.2	186.8	186.8	186.8	186.8	186.8
RM10		59.9	59.9	186.8	186.8	186.8	186.8	186.8
RM13			59.9	59.9	186.8	186.8	186.8	186.8
RM17				59.9	59.9	131.2	186.8	186.8
RM23								186.8

Post-mining land uses (PMLU)						
Rehabilitation area	RA6					
Relevant activities	Water management infrastructure					
Total rehabilitation area size (ha)	35.8					
Commencement of first milestone:RM1	10/12/2043					
PMLU	Grazing/Native vegetation					
Date area is available by	10/12/2044					
Cumulative area available (ha)	35.8	35.8	35.8	35.8	35.8	35.8
Milestone completed by	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)					
RM5	35.8	35.8	35.8	35.8	35.8	35.8
RM8		35.8	35.8	35.8	35.8	35.8
RM12		35.8	35.8	35.8	35.8	35.8
RM15				35.8	35.8	35.8
RM18						35.8
RM23						35.8

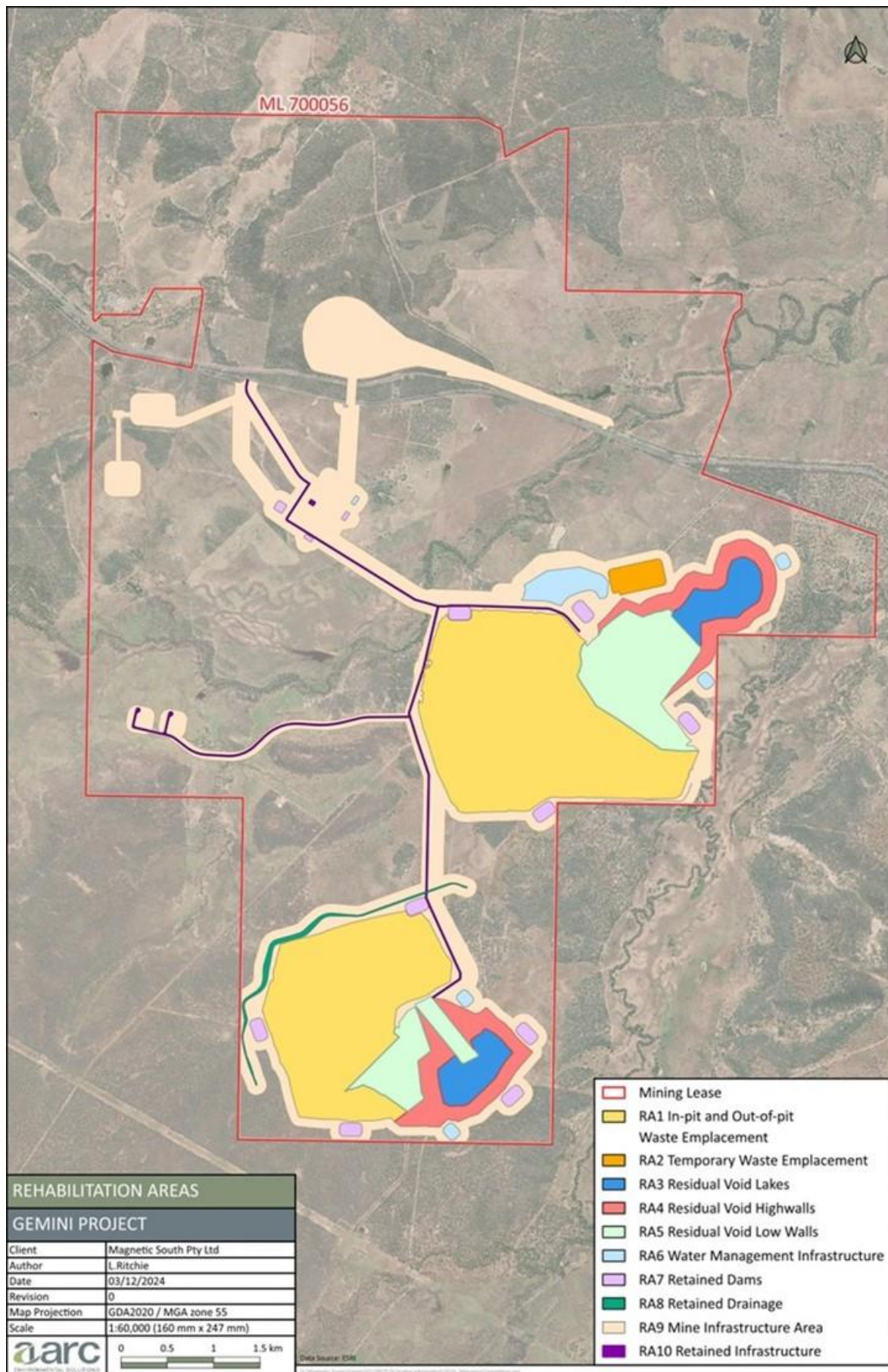
Post-mining land uses (PMLU)						
Rehabilitation area			RA7			
Relevant activities			Retained dams			
Total rehabilitation area size (ha)			34			
Commencement of first milestone:RM1			10/12/2043			
PMLU			Native Vegetation Supporting Fauna Habitat			
Date area is available by	10/12/2044					
Cumulative area available (ha)	34.0	34.0	34.0	34.0	34.0	34.0
Milestone completed by	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)					
RM2	34.0	34.0	34.0	34.0	34.0	34.0
RM22	34.0	34.0	34.0	34.0	34.0	34.0
RM23						34.0

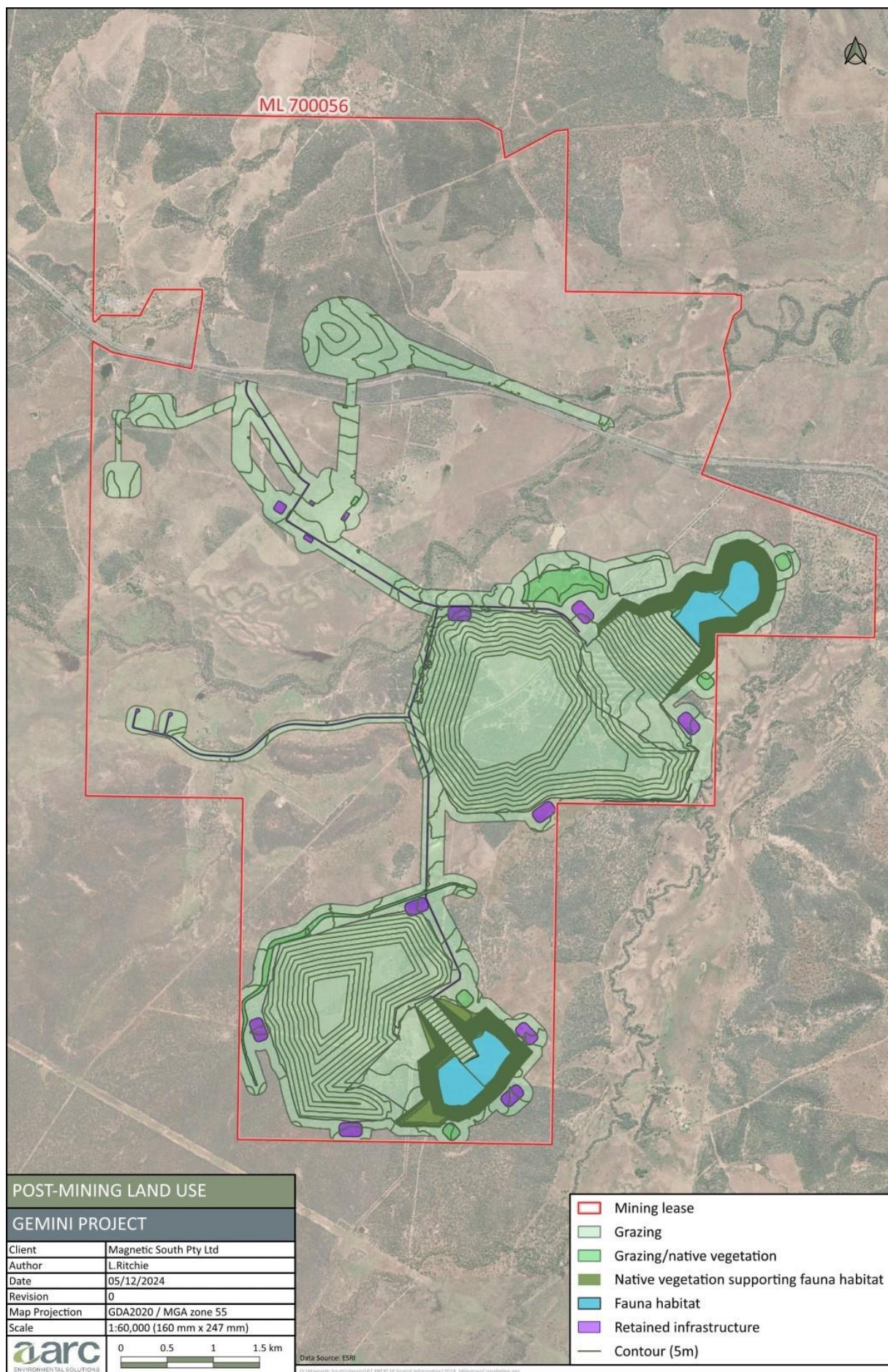
Post-mining land uses (PMLU)						
Rehabilitation area			RA8			
Relevant activities			Diversion drains			
Total rehabilitation area size (ha)			14.3			
Commencement of first milestone:RM1			10/12/2043			
PMLU			Native Vegetation Supporting Fauna Habitat			
Date area is available by	10/12/2044					
Cumulative area available (ha)	14.3	14.3	14.3	14.3	14.3	14.3
Milestone completed by	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)					
RM4	14.3	14.3	14.3	14.3	14.3	14.3
RM8		14.3	14.3	14.3	14.3	14.3
RM12		14.3	14.3	14.3	14.3	14.3
RM15				14.3	14.3	14.3
RM18						14.3
RM23						14.3

Post-mining land uses (PMLU)						
Rehabilitation area	RA9					
Relevant activities	Mine Infrastructure areas					
Total rehabilitation area size (ha)	735.9					
Commencement of first milestone: RM1	10/12/2043					
PMLU	Grazing					
Date area is available by	10/12/2044					
Cumulative area available (ha)	735.9	735.9	735.9	735.9	735.9	735.9
Milestone completed by	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)					
RM1	735.9	735.9	735.9	735.9	735.9	735.9
RM2		735.9	735.9	735.9	735.9	735.9
RM5		735.9	735.9	735.9	735.9	735.9
RM8			735.9	735.9	735.9	735.9
RM10			735.9	735.9	735.9	735.9
RM13				735.9	735.9	735.9
RM17					735.9	735.9
RM23						735.9

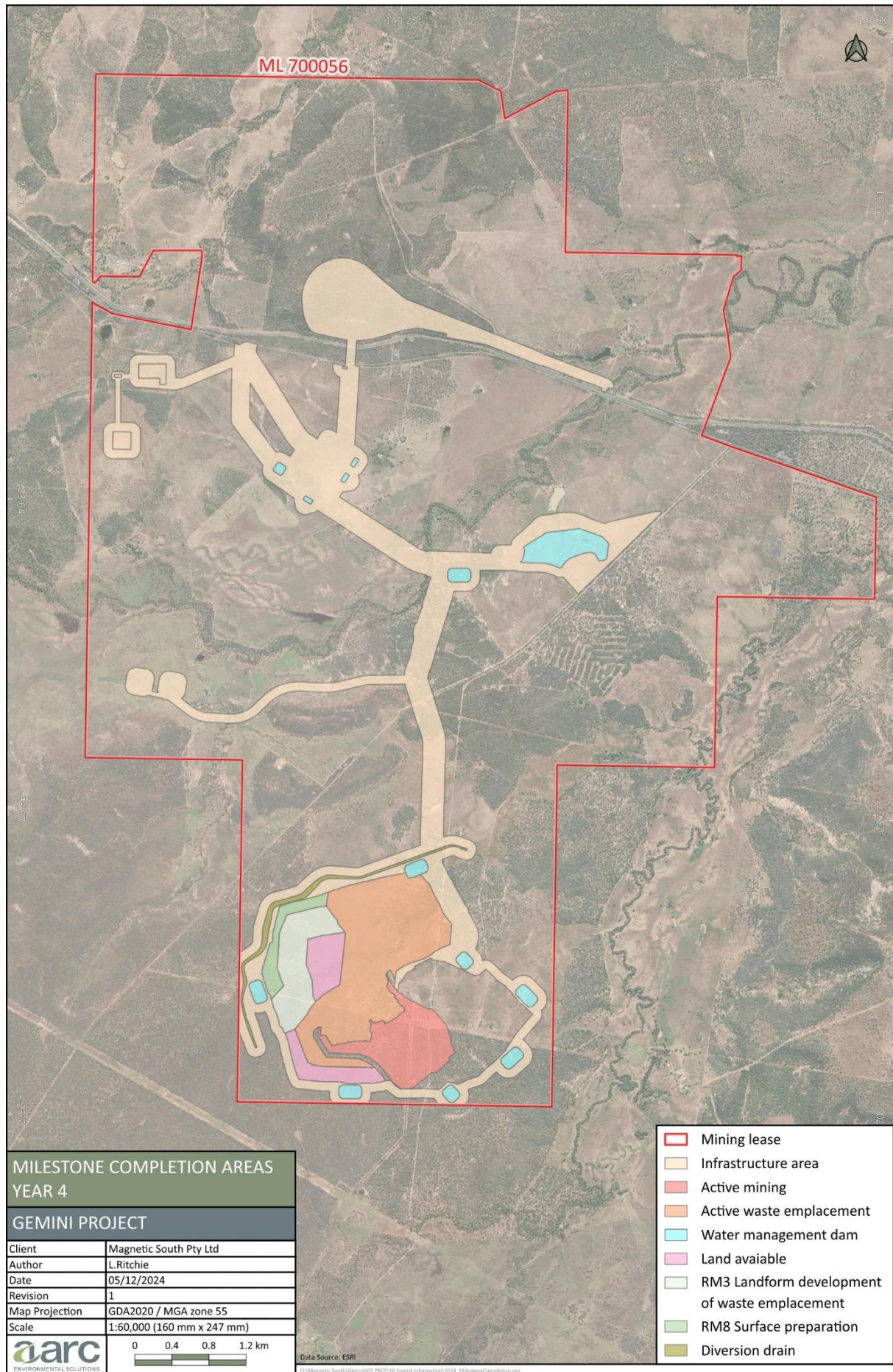
Post-mining land uses (PMLU)						
Rehabilitation area			RA10			
Relevant activities			Retained infrastructure			
Total rehabilitation area size (ha)			13.8			
Commencement of first milestone:RM1						
PMLU			Native Vegetation Supporting Fauna Habitat			
Date area is available by	10/12/2044					
Cumulative area available (ha)	13.8	13.8	13.8	13.8	13.8	13.8
Milestone completed by	10/12/2048	10/12/2052	10/12/2056	10/12/2060	10/12/2064	10/12/2066
Milestone Reference	Cumulative area achieved (ha)					
RM2	13.8	13.8	13.8	13.8	13.8	13.8
RM22		13.8	13.8	13.8	13.8	13.8
RM23						13.8

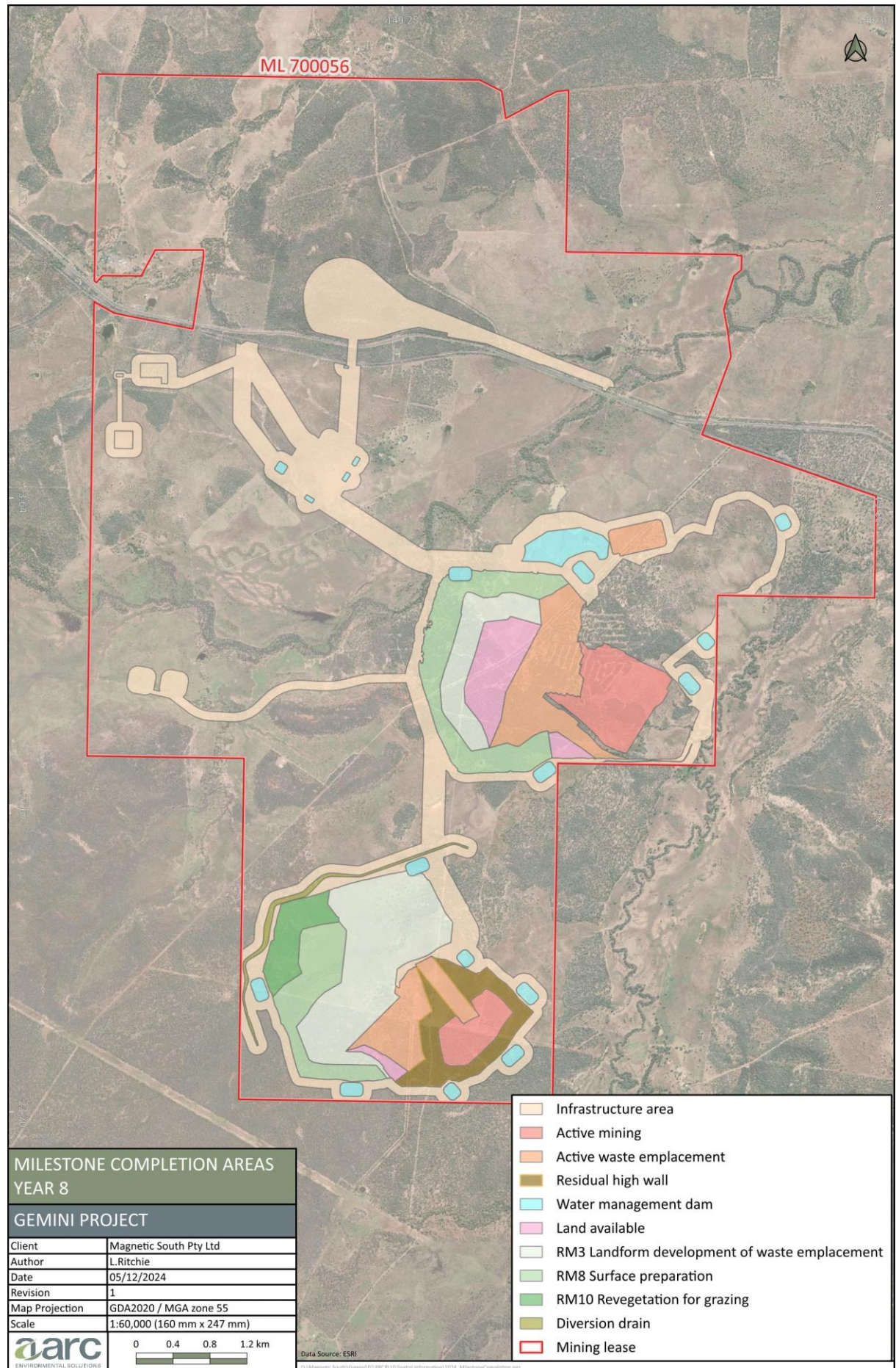
Appendix B. PRCP Reference Map and Final Site Design

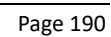


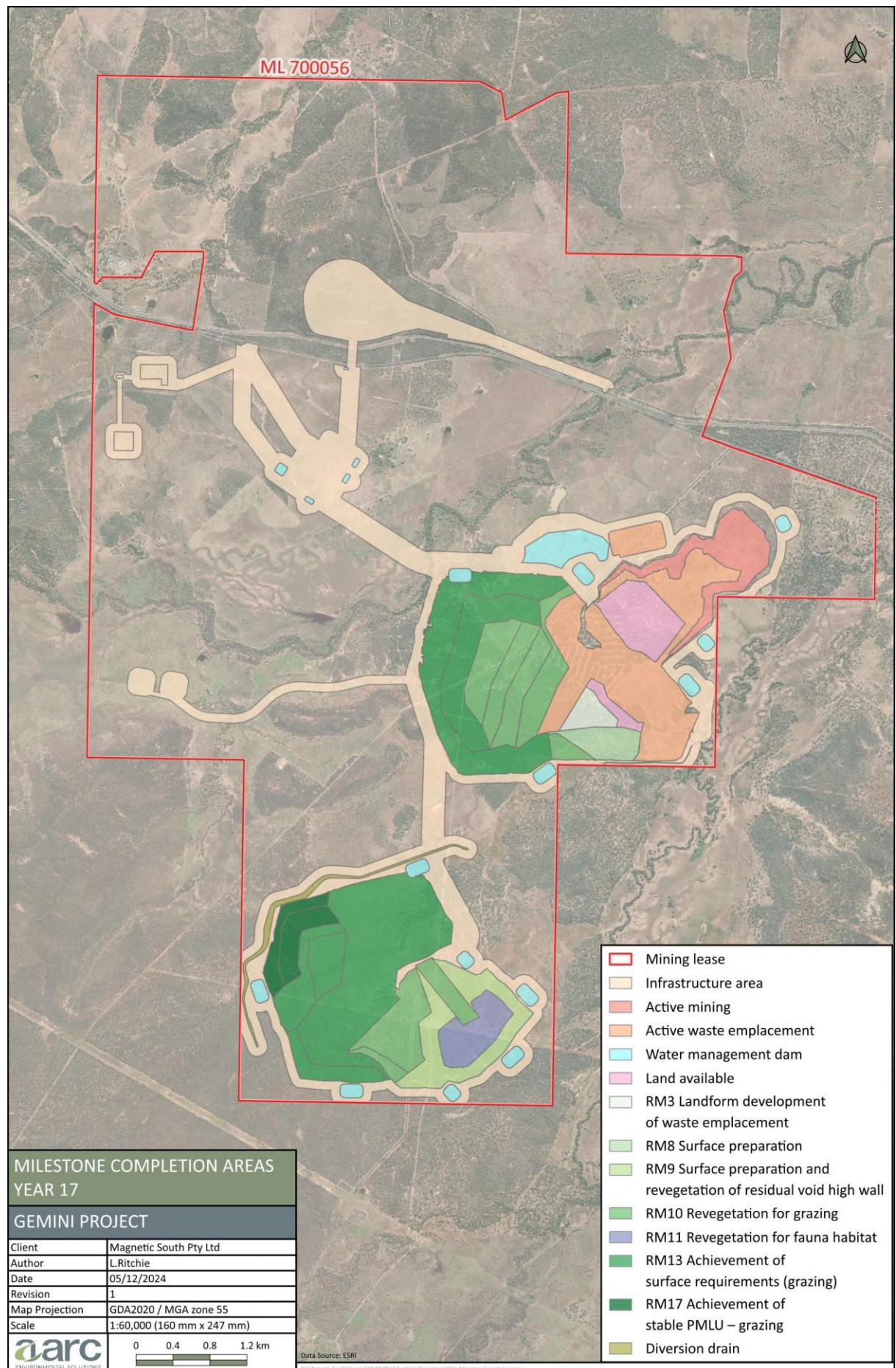


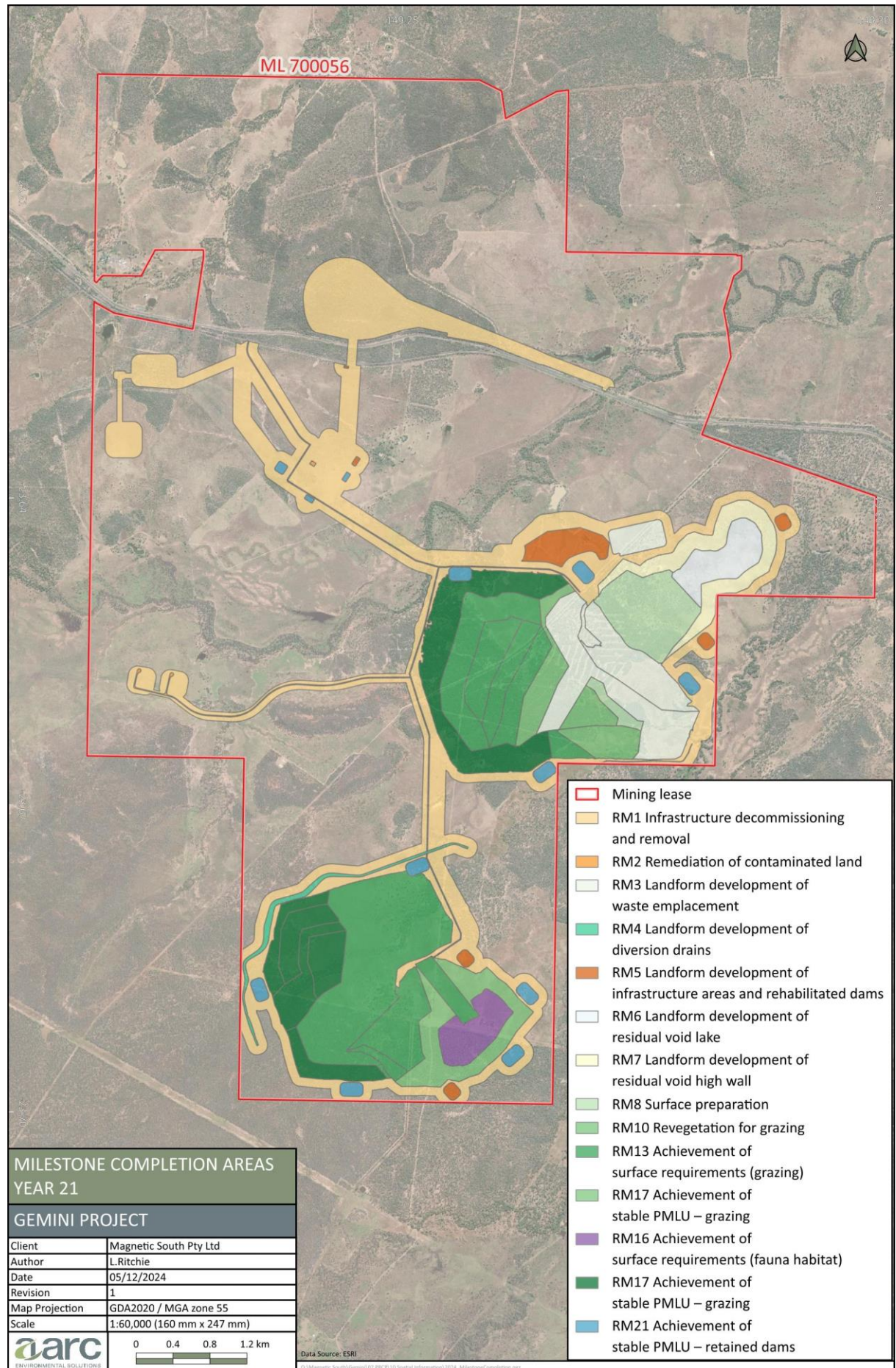
Appendix C. Schedule stage plans

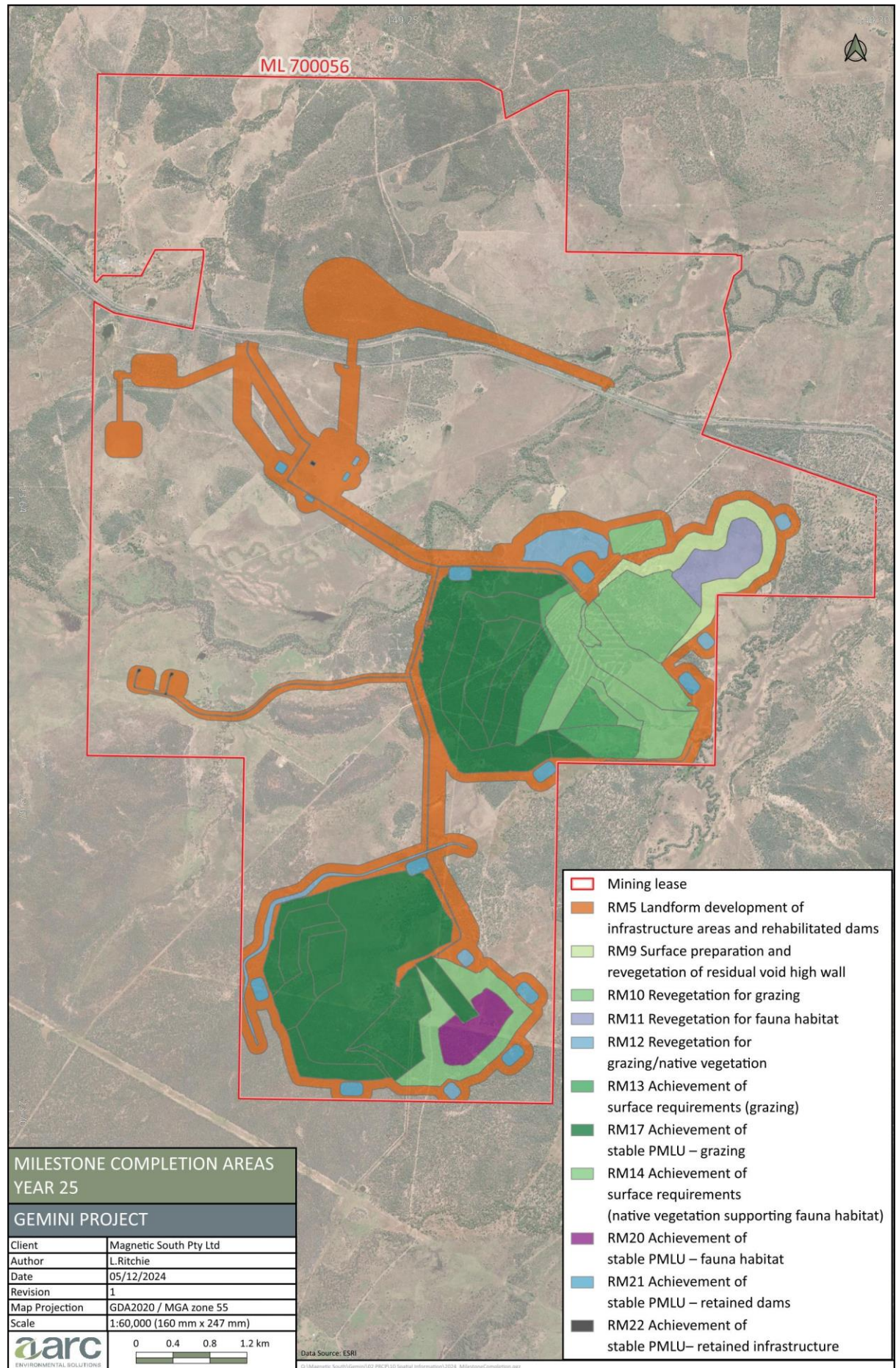


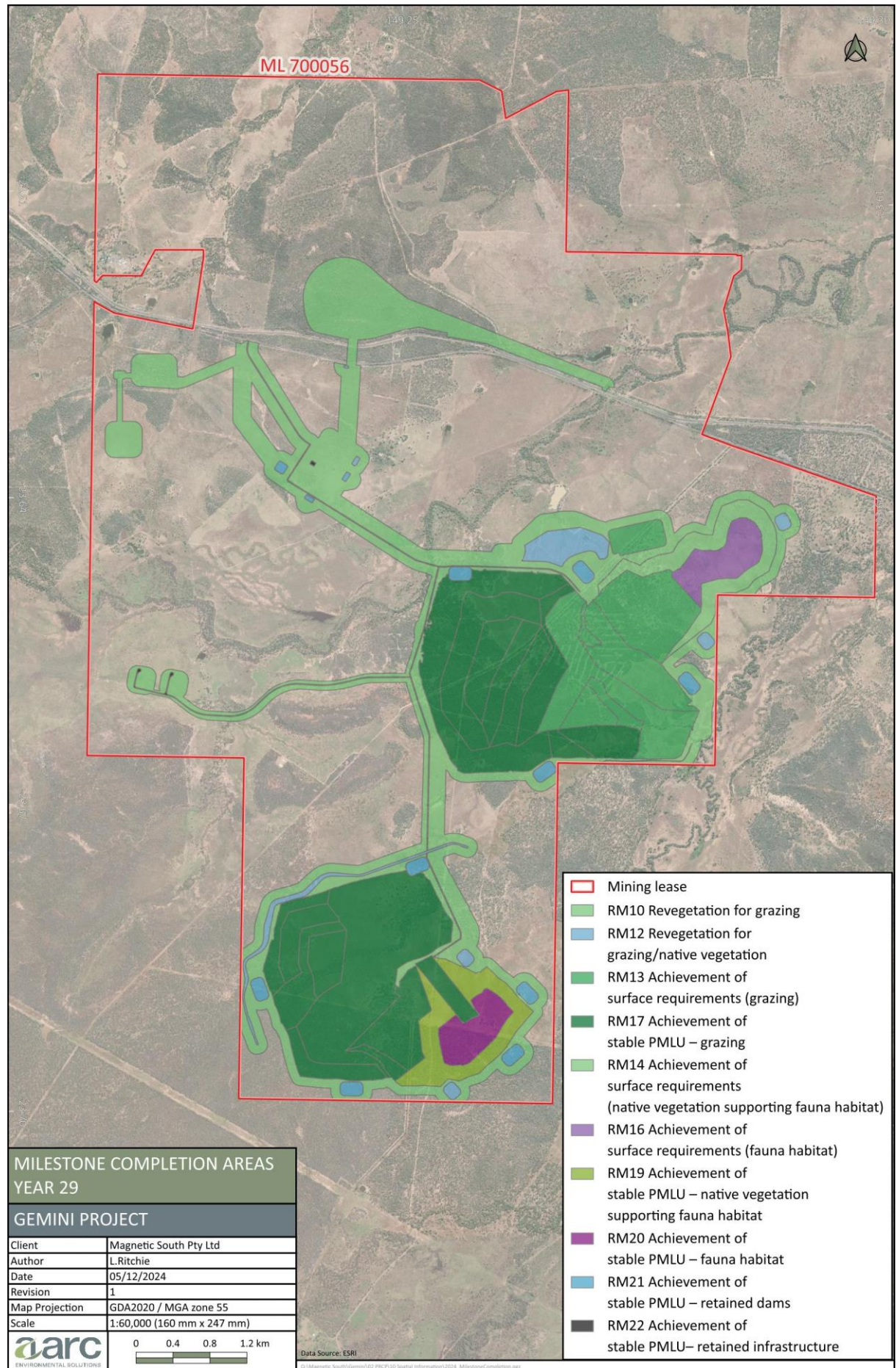


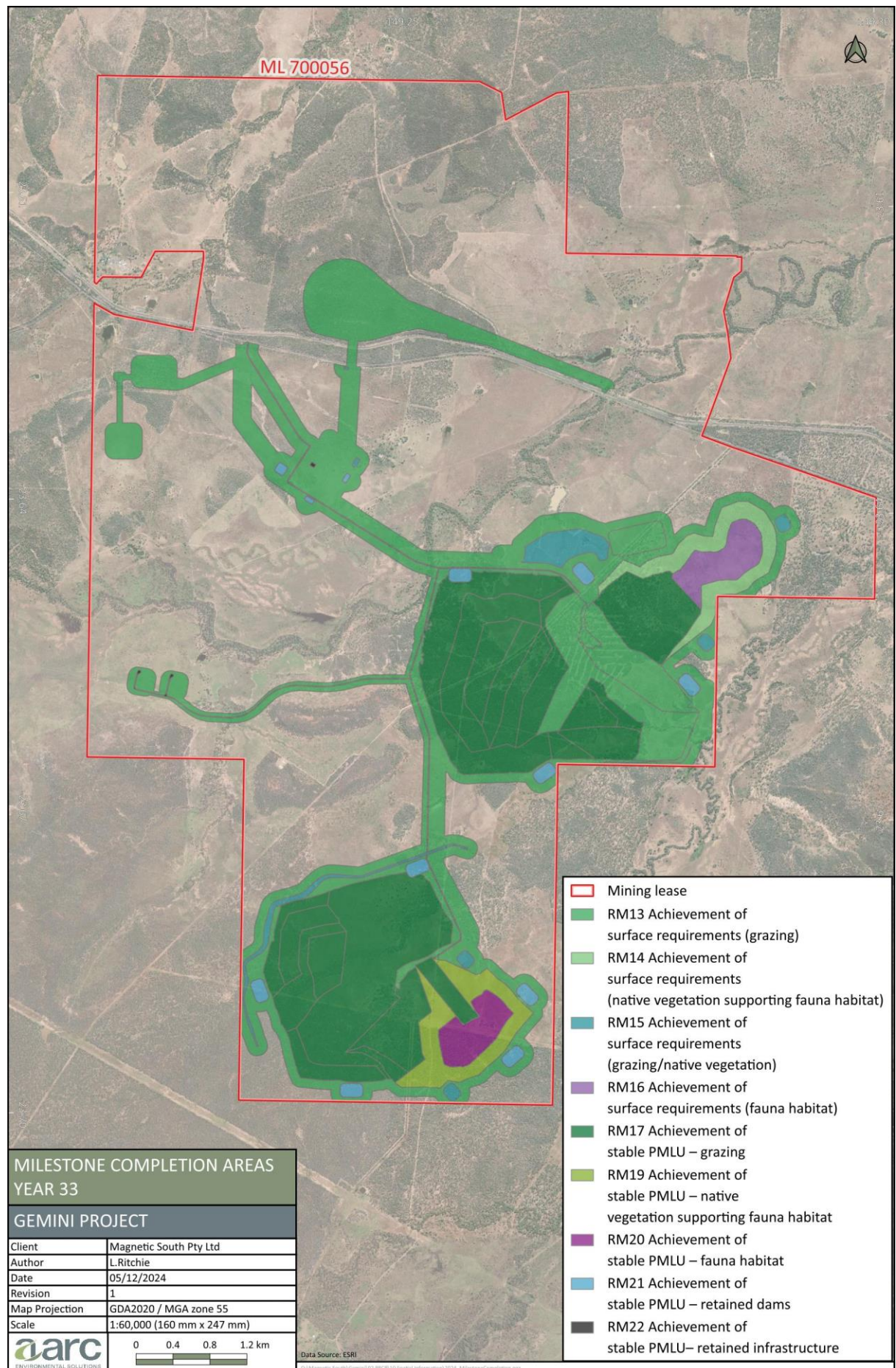


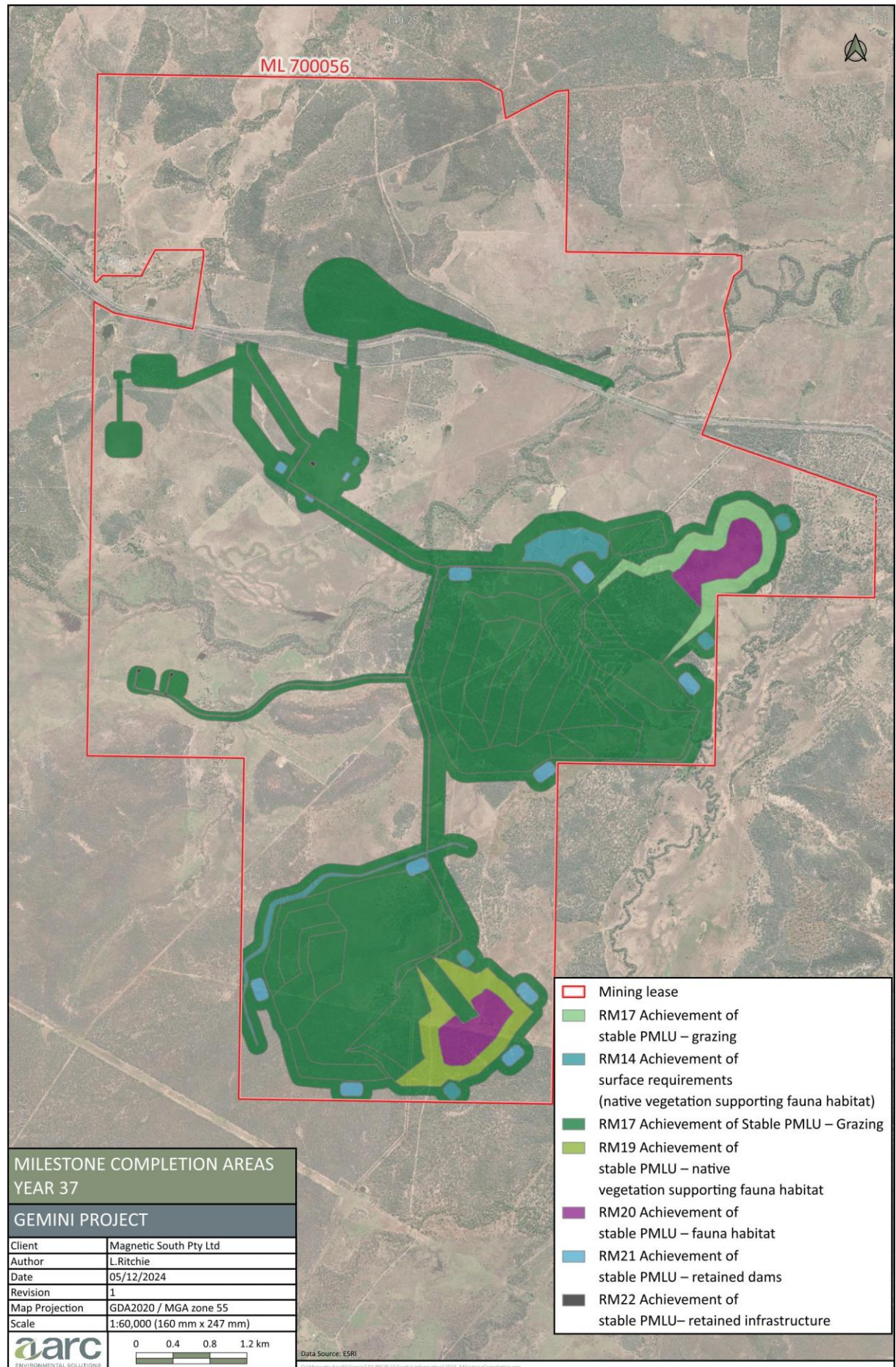


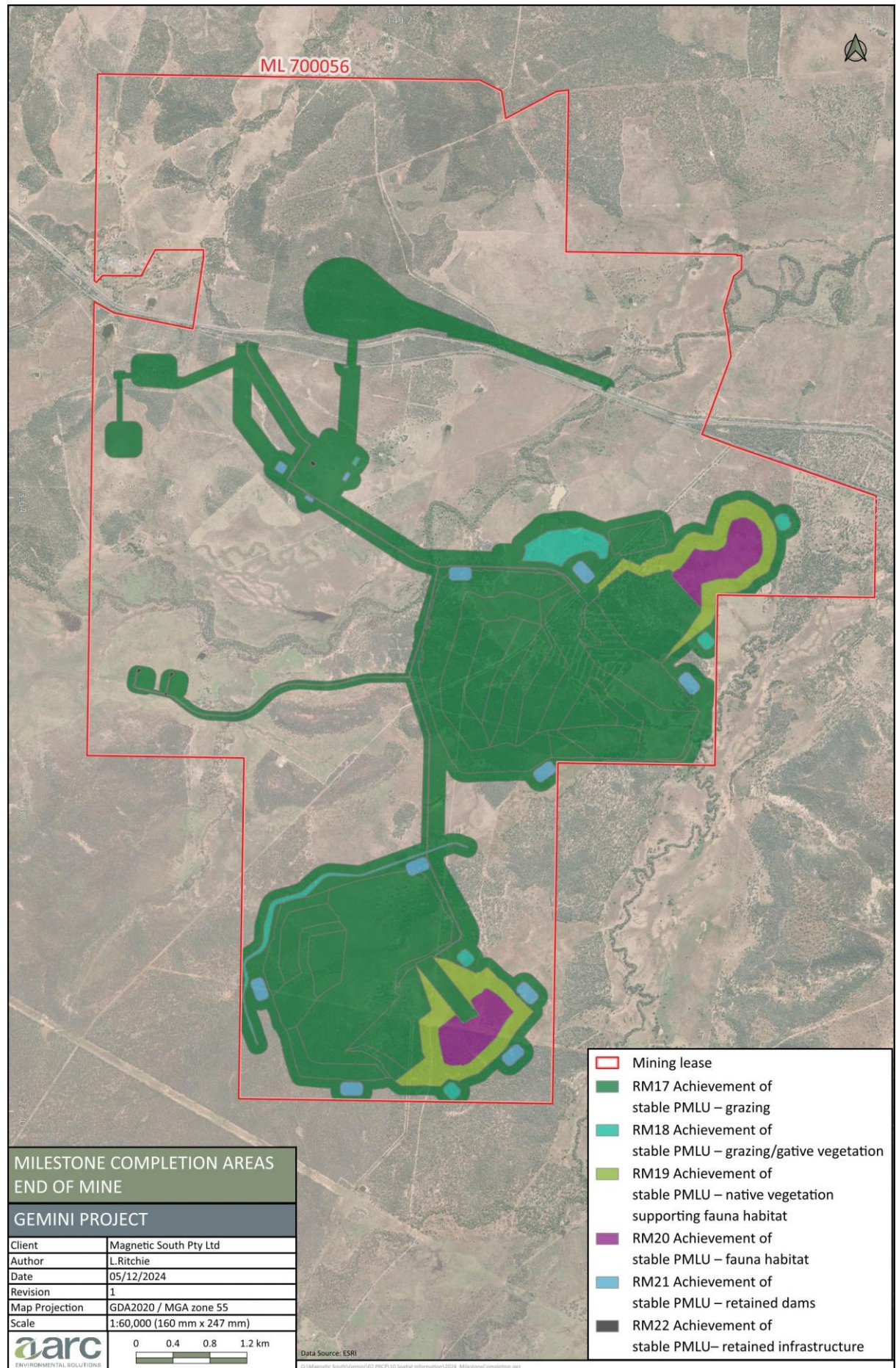












Appendix D. Stakeholder Engagement Framework

Appendix E. Provided technical studies

AARC Environmental Solutions Pty Ltd (AARC) 2019, *Soil and Land Suitability Assessment*, prepared for Magnetic South Pty Ltd.

AARC Environmental Solutions Pty Ltd (AARC) 2020a, *Aquatic Ecology Assessment*, prepared for Magnetic South Pty Ltd.

AARC Environmental Solutions Pty Ltd (AARC) 2020b *Gemini Project: Offset Strategy*, prepared for Magnetic South Pty Ltd.

AARC Environmental Solutions Pty Ltd (AARC) 2020c *Gemini Project: Site-specific EA Application: Revised Supporting Information*, prepared for Magnetic South Pty Ltd.

AARC Environmental Solutions Pty Ltd (AARC) 2020d, *Terrestrial Ecology Assessment*, prepared for Magnetic South Pty Ltd.

Cartledge Mining and Geotechnics 2021, *Gemini Mine Feasibility Study: Stability Analysis of Final Void Sedimentary Sequence for Response to DES*, MAG010001-01_Rev0, Brisbane.

JBT Consulting Pty Ltd (JBT) 2019, *Groundwater Impact Assessment*, prepared for Magnetic South Pty Ltd.

John T. Boyd Company (BOYD) 2019, *Assessment of Final Landform Options*, prepared for Magnetic South Pty Ltd.

RGS Environmental Pty Ltd (RGS) 2019, *Geochemical Assessment of Mining Waste Materials*, prepared for Magnetic South Pty Ltd.

RGS Environmental Pty Ltd (RGS) 2020, *Geochemical assessment of coal reject material*, prepared for Magnetic South Pty Ltd.

WRM Water & Environment Pty Ltd (WRM) 2020a, *Flood Impact Assessment*, prepared for Magnetic South Pty Ltd.

WRM Water & Environment Pty Ltd (WRM) 2020b, *Surface Water Impact Assessment*, prepared for Magnetic South Pty Ltd.

AARC Environmental Solutions Pty Ltd (AARC) 2021, *Gemini Project EA Application: Response to Secondary Information Request*, prepared for Magnetic South Pty Ltd.

JBT Consulting Pty Ltd (JBT) 2021, *Response to DES comments on the EA submission – Gemini Project*, prepared for Magnetic South Pty Ltd.

3D Environmental 2020, *Groundwater Dependent Ecosystems Assessment*, prepared for Magnetic South.

Appendix F. Rehabilitation Risk Assessment

Ref.	Risk Type (T=Threat) Category Subcategory Item	Risk Description				Control Effectiveness	Risk Evaluation		Risk Rating			Count				Final Risk Rating	Management Effectiveness
		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls	Likelihood - Frequency Likelihood - Probability		Health			Health Safety Environment Compliance	Health Safety Environment Compliance						
							Health	Safety	Environment Compliance								
T A		In Pit and Out pit waste															
T A	01	Safe															
T A	01 01	Surface roughness (rockiness, depressions) in excess of that expected for the PMLU	Erosion gullies etc due to subsoil/ topsoil characteristics/availability, inadequate surface preparation, poor early germination, localised settlement, rock used for erosion control	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), monitoring, maintenance controls (pre-closure), risk assess controls when designed and placed and modify as required, post-closure monitoring.	C2	P		L		II		0	0	1	0	II
T A	01 02	Slope steepness in excess of that expected for the PMLU	Inappropriate landform design, landform design restrictions	Safety hazard for personnel, stock and wildlife	Landform design criteria appropriate to PMLU, operational slope controls	C1		U	L		I		0	0	0	1	I
T A	02	Stable - geotechnical risk															
T A	02 01	Significant slope failure	Excessive slope steepness, physical material properties, poor drainage, adverse rainfall event	Localised land impacts and downstream water quality impacts	Geotechnical analysis undertaken where appropriate, slope moderation, adequate drainage design constructed, rapid revegetation	C2		U	M	M	II	II	0	0	2	0	II
T A	03	Stable - erosional risk															
T A	03 01	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Dispersive topsoils and subsoils, adverse weather events	Localised land impacts and downstream water quality impacts	Soil sampling and analysis prior to rehabilitation. Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required, sediment controls during establishment.	C2	U		M		II		0	0	1	0	II
T A	03 02	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Inadequate rehabilitation drainage capacity and/or design	Localised land impacts and downstream water quality impacts	Drainage network design with acceptable design standards for drainage structures, avoidance of flow concentration, subcatchment delineation, sufficient water storage structures, engineered flow channels, effective revegetation techniques, rehabilitation monitoring and management as required	C2	U		M		II		0	0	1	0	II
T A	03 03	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts and downstream water quality impacts	Existing rehabilitation of waste emplacements, downstream sedimentation controls, prompt revegetation, monitoring of drainage performance, maintenance and remediation as required.	C2	U		M		II		0	0	1	0	II
T A	03 04	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Rehabilitation failure/ vegetation disease/loss, climatic events, other	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring, management and remediation as required.	C2	U		M		II		0	0	1	0	II

Ref.	Risk Type (T=Threat) Category Subcategory Item	Risk Description			Control Effectiveness	Risk Evaluation			Risk Rating			Count				Final Risk Rating	Management Effectiveness
		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency Likelihood - Probability	Health Safety Environment Compliance	Health Safety Environment Compliance	Health Safety Environment Compliance	Count	Count	Count	Count				
T A 04		Non-polluting - geochemical risk															
T A 04 01		Acid and saline drainage generation	Adverse waste rock geochemistry	Revegetation performance impacts, water quality in pit lake and downstream receiving environment, and dependent ecosystem impacts, groundwater impacts (incl.GDEs)	Out of pit waste emplacement to be constructed to design specifications as prepared by an AQP. Negative NAPP waste rock materials, low propensity for saline drainage. Coal rejects to be encapsulated deep within waste emplacements. Routine confirmatory geochemical testing. Regular monitoring and assessment of runoff and pit lake water quality.	C2	P		L		II		0	0	1	0	II
T A 05		Non-polluting - other environmental harm															
T A 05 01		Not applicable												0	0	0	0
T A 06		Sustainable - PMLU															
T A 06 01		Insufficient pasture density/diversity and recruitment	Weather, poor soil characteristics, poor management practices impacting germination, vegetation establishment and PMLU density metrics, and shortage of topsoil resources	Insufficient pasture productivity	Improving rehabilitation methodologies, rehabilitation area monitoring and assessment, undertake repairs and maintenance works as required	C1	U		L		I		0	0	0	1	I
T A 06 02		Insufficient topsoil resources onsite available to undertake rehabilitation activities	Poor management practices, shortage of topsoil resources	Poor vegetation establishment, insufficient habitat suitable for native fauna, insufficient pasture productivity	Adequate topsoil stockpiling and management strategies, annual review of topsoil inventory	C2	U		M		II		0	0	1	0	II
T A 06 03		Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate.	C1	U		L		I		0	0	0	1	I
T B		Temporary waste emplacement															
T B 01		Safe															
T B 01 01		Surface roughness (rockiness and depressions) in excess of that expected for the PMLU	Erosion gullies etc due to some dispersive subsoils/ topsoils, inadequate surface preparation, localised settlement	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), maintenance controls (pre-closure), rehabilitation monitoring and assessment, undertake repairs and maintenance as required	C2	P		L		II		0	0	1	0	II
T B 01 02		Slope steepness in excess of that expected for the PMLU	Landform not constructed to design	Safety hazard for personnel, stock and wildlife	Dump and slope survey controls, reshaping to design	C1	U		L		I		0	0	0	1	I

Ref.	Risk Description				Control Effectiveness	Risk Evaluation		Risk Rating		Count				Final Risk Rating	Management Effectiveness			
	Risk Type (T=Threat)	Category	Subcategory	Item		Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety			Environment	Compliance	
T	B	02	Stable - geotechnical risk				C2	U	M	M	II	II	0	0	2	0	II	
			01	Significant slope failure	Landform not constructed to design, excessive slope steepness, physical material properties, inadequate drainage controls, adverse rainfall event													
					Localised land impacts and downstream water quality impacts													
					Slope moderation, maximum slopes subject to engineered design by geotechnical analysis, provision of adequate drainage infrastructure, rapid revegetation, rehabilitation monitoring and assessment, undertake repairs and maintenance as required													
T	B	03	Stable - erosional risk				C1	U	L		I		0	0	0	1	I	
			01	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Dispersive topsoils and subsoils, adverse weather events													
					Localised land impacts and downstream water quality impacts													
					Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, sediment controls during vegetation establishment, revegetation monitoring, revegetation maintenance and repairs as required, modify revegetation methods and techniques and other contributing factors to improve the likelihood of revegetation success on rehabilitated slopes where required													
T	B	03	02	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Inadequate rehabilitation drainage capacity and/or design	C1	U	L		I		0	0	0	1	I		
					Localised land impacts and downstream water quality impacts													
					Drainage network design with acceptable design standards for drainage structures, avoidance of flow concentration, subcatchment delineation, sufficient water storage structures, engineered flow channels, effective revegetation techniques, rehabilitation monitoring, regular (typically annual) review of water management design parameters, monitoring of drainage network performance, prompt remediation and causal feedback loop to water management system review													
T	B	03	03	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Adverse climatic events and/or climatic sequences beyond design capacity	C2	P	L		II		0	0	1	0	II		
					Localised land impacts and downstream water quality impacts													
					Existing rehabilitation of waste rock emplacements, downstream sedimentation controls, prompt revegetation, regular (typically annual) review of water management design parameters, monitoring of drainage network performance, undertake repairs and maintenance as required, prompt remediation and causal feedback loop to water management system review													
T	B	03	04	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas (medium-long term risk)	Rehabilitation failure/ vegetation disease/loss, climatic events (drought), other	C2	P	L		II		0	0	1	0	II		
					Localised land impacts and downstream water quality impacts													
					Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, modify revegetation methods and techniques and other contributing factors to improve the likelihood of revegetation success on rehabilitation slopes, rehabilitation area monitoring and assessment, undertake repairs and maintenance as required.													

Ref.	Risk Type (T=Threat) Category Subcategory Item	Risk Description				Control Effectiveness	Risk Evaluation				Risk Rating				Count				Final Risk Rating	Management Effectiveness
		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls			Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance				
T B '04		Non-polluting - geochemical risk																		
T B 04 01		Acid and saline drainage generation	Adverse waste rock geochemistry	Revegetation performance impacts, downstream receiving environment water quality and dependent ecosystem impacts	Negative NAPP waste rock materials, low propensity for saline drainage generation. All waste material to be removed and followed by confirmatory geochemical testing of exposed subsoil. Monitoring and assessment of runoff water quality.	C1	U			L			I			0	0	0	1	I
T B '05		Non-polluting - other environmental harm																		
T B 05 01		Not applicable														0	0	0	0	
T B '06		Sustainable - PMLU														0	0	0	0	
T B 06 01		Insufficient pasture density/diversity and recruitment	Weather, poor soil characteristics, poor management practices impacting and PMLU density metrics, and shortage of topsoil resources	Insufficient pasture productivity	Improving rehabilitation methodologies, rehabilitation area monitoring and assessment, undertake repairs and maintenance works as required	C2	P			L			II			0	0	1	0	II
T B 06 02		Insufficient topsoil resources onsite available to undertake rehabilitation activities	Poor management practices, shortage of topsoil resources	Poor vegetation establishment, insufficient habitat suitable for native fauna, insufficient pasture productivity	Adequate topsoil stockpiling and management strategies, annual review of topsoil inventory	C2	U			M			II			0	0	1	0	II
T B 06 03		Pests and weeds	Poor local, regional or site property management practices	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C1	U			L			I			0	0	0	1	I
T C		Residual void lakes																		
T C '01		Safe																		
T C 01 01		Void overtopping	Extreme rainfall events beyond design capacity, insufficient water level monitoring	Increased hazard to humans and animals	Long term groundwater modelling and final void water balance confirms the final void will remain as a sink with no risk of overtopping. Void walls and base constructed to design criteria.	C1	R			L			I			0	0	0	1	I
T C 01 02		Cattle, humans or wildlife access to the residual void	Insufficient warnings, barriers preventing access to hazardous areas, fencing/bunding breaks, unauthorised access	Falls, slips, trips impacting humans, livestock and wildlife. Livestock accessing void water for drinking	Signage, physical barriers, slope moderation, conduct a risk assessment of controls when designed and placed. Modify as required. Post closure monitoring.	C2	U			M			II			0	0	1	0	II

Ref.	Risk Type (T=Threat) Category Subcategory Item	Risk Description			Control Effectiveness	Risk Evaluation				Risk Rating			Count				Final Risk Rating	Management Effectiveness	
		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency Likelihood - Probability	Health Safety Environment Compliance	Health Safety Environment Compliance	Health Safety Environment Compliance	Count									
T C 02		Stable - geotechnical risk																	
T C 02 01		Final void walls subject to significant slope failure	Excessive slopes, inadequate design, not constructed to design, inadequate drainage controls, adverse weather event	Localised impacts to land (highwall) and residual void water quality	Slope moderation, final landform design, maximum slopes subject to engineered design, assessment of construction materials by a suitably qualified person, provision of adequate drainage infrastructure, geotechnical assessment undertaken at closure. Certification by a suitably qualified expert that the final landform is stable and constructed according to design criteria.	C3	P	M	M		III	III		0	2	0	0	III	M3
T C 03		Stable - erosional risk																	
T C 03 01		Initial/ongoing gully, pipe and/or sheet erosion of the void walls	Faults and fractures in the underlying geology, adverse weather events	Localised land impacts, water quality impacts (water contained within the pit)	Landform design in accordance with geotechnical assessment of the site, monitoring and management as required.	C3	P	L	M		II	III		0	1	1	0	III	M3
T C 03 02		Initial/ongoing gully, pipe and/or sheet erosion of the void walls	Inadequate design, erodible topsoil and subsoils	Localised land impacts, water quality impacts (water contained within the pit)	Landform including highwalls and site drainage network to be constructed as designed. Monitoring of drainage network performance, prompt remediation. Certification by a suitably qualified person that the final landform is stable and constructed according to design criteria	C3	P	L	M		II	III		0	1	1	0	III	M3
T C 03 03		Initial/ongoing gully, pipe and/or sheet erosion of the void walls	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts, water quality impacts (water contained within the pit)	Final void designed to prevent excessive runoff from entering the final void during rainfall events. Prompt remediation, post-weather event monitoring of final void water quality, high walls and low wall	C3	P		M			III		0	1	0	0	III	M3
T C 03 04		Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas (medium-long term risk)	Rehabilitation failure/ vegetation disease/loss, climatic events (drought), other	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, modify revegetation methods and techniques and other contributing factors to improve the likelihood of revegetation success on rehabilitation slopes, rehabilitation area monitoring and assessment, undertake repairs and maintenance as required	C3	P		M			III		0	1	0	0	III	M3
T C 04		Non-polluting - geochemical risk																	
T C 04 01		Release of void water to the receiving environment	Void long term water level lies above natural groundwater level, overtopping, floodwater ingress.	Adverse impacts to downstream surface water quality, groundwater quality and dependent ecosystems (including GDEs).	Long term groundwater modelling and final void water balance confirms the final void will remain as a sink with no risk of overtopping. Final voids are located outside PMF levels. Monitoring of pit water quality to be undertaken and assessed against model predictions. Geotechnical/geochemical assessment, groundwater monitoring program	C1	R		L			I		0	0	0	1	I	

Ref.	Risk Type (T=Threat) Category Subcategory Item	Risk Description			Control Effectiveness	Risk Evaluation					Risk Rating			Count				Final Risk Rating	Management Effectiveness
		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency Likelihood - Probability	Health	Safety	Environment Compliance	Health Safety Environment Compliance	Health Safety Environment Compliance	Health Safety Environment Compliance	Health Safety Environment Compliance	Count	Count	Count	Count		
T C 02		Stable - geotechnical risk																	
T C 02 01		Final void walls subject to significant slope failure	Excessive slopes, inadequate design, not constructed to design, inadequate drainage controls, adverse weather event	Localised impacts to land (highwall) and residual void water quality	Slope moderation, final landform design, maximum slopes subject to engineered design, assessment of construction materials by a suitably qualified person, provision of adequate drainage infrastructure, geotechnical assessment undertaken at closure. Certification by a suitably qualified expert that the final landform is stable and constructed according to design criteria.	C3	P		M	M		III	III	0	2	0	0	III	M3
T C 03		Stable - erosional risk																	
T C 03 01		Initial/ongoing gully, pipe and/or sheet erosion of the void walls	Faults and fractures in the underlying geology, adverse weather events	Localised land impacts, water quality impacts (water contained within the pit)	Landform design in accordance with geotechnical assessment of the site, monitoring and management as required.	C3	P		L	M		II	III	0	1	1	0	III	M3
T C 03 02		Initial/ongoing gully, pipe and/or sheet erosion of the void walls	Inadequate design, erodible topsoil and subsoils	Localised land impacts, water quality impacts (water contained within the pit)	Landform including highwalls and site drainage network to be constructed as designed. Monitoring of drainage network performance, prompt remediation. Certification by a suitably qualified person that the final landform is stable and constructed according to design criteria	C3	P		L	M		II	III	0	1	1	0	III	M3
T C 03 03		Initial/ongoing gully, pipe and/or sheet erosion of the void walls	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts, water quality impacts (water contained within the pit)	Final void designed to prevent excessive runoff from entering the final void during rainfall events. Prompt remediation, post-weather event monitoring of final void water quality, high walls and low wall	C3	P			M		III		0	1	0	0	III	M3
T C 03 04		Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas (medium-long term risk)	Rehabilitation failure/ vegetation disease/loss, climatic events (drought), other	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, modify revegetation methods and techniques and other contributing factors to improve the likelihood of revegetation success on rehabilitation slopes, rehabilitation area monitoring and assessment, undertake repairs and maintenance as required	C3	P			M		III		0	1	0	0	III	M3
T C 04		Non-polluting - geochemical risk																	
T C 04 01		Release of void water to the receiving environment	Void long term water level lies above natural groundwater level, overtopping, floodwater ingress.	Adverse impacts to downstream surface water quality, groundwater quality and dependent ecosystems (including GDEs).	Long term groundwater modelling and final void water balance confirms the final void will remain as a sink with no risk of overtopping. Final voids are located outside PMF levels. Monitoring of pit water quality to be undertaken and assessed against model predictions. Geotechnical/geochemical assessment, groundwater monitoring program	C1	R			L		I		0	0	0	1	I	

Ref.	Risk Description	Causes (Triggers / Indicators)	Impacts (Consequences)	Controls	Control Effectiveness	Likelihood - Frequency Likelihood - Probability	Health Safety Environment Compliance	Risk Rating	Count	Final Risk Rating	Management Effectiveness
Risk Type (T=Threat) Category Subcategory Item											
T C 05	Non-polluting - other environmental harm										
T C 05 01	Not applicable								0 0 0 0		
T C 06	Sustainable - PMLU										
T C 06 01	Water quality not meeting requirements to support fauna habitat PMLU	Leaching of salts contained in in-pit waste rock materials, ingress of saline groundwater and concentration of salts by evaporation	Increased hazard to animal health and aquatic ecosystem health, confined to pit lake, water quality prevents pit lake from achieving fauna habitat PMLU	Long term groundwater modelling and final void water balance confirms the final void will remain as a sink with no risk of overtopping. Void walls and base constructed to design criteria to minimise the inflow of saline groundwater. Water quality monitoring program to allow early detection and management of poor water quality. Littoral zone to be seeded with aquatic flora species tolerant of saline conditions. Low wall treatments to include seeding and the placement of rocks and logs to provide fauna habitat and organic enrichment.	C4	P	H	IV	1 0 0 0	IV	M3
T D	Residual void highwalls										
T D 01	Safe										
T D 01 01	Surface roughness (rockiness and depressions) in excess of that expected for the PMLU	Erosion gullies etc due to some dispersive subsoils/ topsoils, inadequate surface preparation, localised settlement	Safety hazard for personnel, stock and wildlife (terrestrial and aquatic)	Surface preparation measures (initial), maintenance controls (pre closure), rehabilitation monitoring and assessment, undertake repairs and maintenance as required, adequate safety bunding and fencing installed around highwall perimeter.	C3	P	M M	III III	0 2 0 0	III	M3
T D 01 02	Slope steepness in excess of that expected for the PMLU	Landform not constructed to design	Safety hazard for personnel, stock and wildlife	Slope survey controls, reshaping to design, adequate safety bunding and fencing installed around highwall perimeter.	C3	P	M M	III III	0 2 0 0	III	M3
T D 02	Stable - geotechnical risk										
T D 02 01	Final void highwalls subject to significant slope failure	Excessive slopes, inadequate design, not constructed to design, inadequate drainage controls, adverse weather event	Localised land impact	Slope moderation, final landform design, maximum slopes subject to engineered design, assessment of construction materials by a suitably qualified person, provision of adequate drainage infrastructure, geotechnical assessment undertaken at closure. Certification by a suitably qualified expert that the final landform is stable and constructed according to design criteria.	C3	P	M M	III III	0 2 0 0	III	M3
T D 03	Stable - erosional risk										
T D 03 01	Initial/ongoing gully, pipe and/or sheet erosion of the high walls	Faults and fractures in the underlying geology, adverse weather events	Localised land impacts, water quality impacts (water contained within the pit lake)	Landform design in accordance with geotechnical assessment of the site, adequate safety bunding and fencing installed around highwall perimeter, monitoring and management as required.	C3	P	L M	II III	0 1 1 0	III	M3

Risk Type (T=Threat) Category Subcategory Item	Ref.	Risk Description				Control Effectiveness	Risk Evaluation			Risk Rating			Count				Final Risk Rating	Management Effectiveness		
							Likelihood - Frequency	Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance				
T D 03 02		Initial/ongoing gully, pipe and/or sheet erosion of the high walls	Causes (Triggers / Indicators) Inadequate design, erodible topsoil and subsoils	Impacts (Consequences) Localised land impacts, water quality impacts (water contained within the pit lake)	Controls Highwalls and site drainage network to be constructed as designed. Monitoring of drainage network performance, prompt remediation. Certification by a suitably qualified person that the final landform is stable and constructed according to design criteria and FOS	C3	P			M			III		0	1	0	0	III	M3
T D 03 03		Initial/ongoing gully, pipe and/or sheet erosion of the high walls	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts, water quality impacts (water contained within the pit lake)	Final void designed as to prevent excessive runoff from entering the final void during rainfall events. Prompt remediation, postweather event monitoring of final void water quality and high walls	C3	P			M			III		0	1	0	0	III	M3
T D 03 4		Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas (medium-long term risk)	Rehabilitation failure/ vegetation disease/loss, climatic events (drought),other	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, modify revegetation methods and techniques and other contributing factors to improve the likelihood of revegetation success on rehabilitation slopes, rehabilitation area monitoring and assessment, undertake repairs and maintenance as required	C3	P			M			III		0	1	0	0	III	M3
T D 04		Non-polluting - geochemical risk																		
T D 04 01		Acid and saline drainage generation	Adverse waste rock geochemistry	Revegetation performance impacts, impacts to water contained within pit lake	Confirmed negative-NAPP materials and low risk of saline drainage.High wall rehabilitation to include reprofiling and topsoiling. Regular void water quality monitoring and assessment	C2	P			L			II		0	0	1	0	II	
T D 05		Non-polluting - other environmental harm																		
T D 05 01		Not applicable													0	0	0	0		
T D 06		Sustainable - PMLU																		
T D 06 01		Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C2	P			L			II		0	0	1	0	II	
T D 06 03		Insufficient pasture density/diversity and recruitment	Weather, poor soil characteristics, poor management practices impacting germination, vegetation establishment and PMLU density metrics, and shortage of topsoil resources	Insufficient pasture productivity	Improving rehabilitation methodologies, rehabilitation area monitoring and assessment, undertake repairs and maintenance works as required	C2	P			L			II		0	0	1	0	II	

Ref.	Risk Type (T=Threat) Category Subcategory Item	Risk Description				Control Effectiveness	Risk Evaluation		Risk Rating			Count				Final Risk Rating	Management Effectiveness				
		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls	Likelihood - Frequency		Likelihood - Probability	Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance						
T E		Residual void low walls																			
T E	01	Safe																			
T E	01 01	Surface roughness (rockiness and depressions) in excess of that expected for the PMLU	Erosion gullies etc due to some dispersive subsoils/ topsoils, inadequate surface preparation, localised settlement	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), maintenance controls (pre closure), rehabilitation monitoring and assessment, undertake repairs and maintenance as required	C2	U		L	M		I	II		0	0	1	1	II		
T E	01 02	Slope steepness in excess of that expected for the PMLU	Landform not constructed to design	Safety hazard for personnel, stock and wildlife	Dump and slope survey controls, reshaping to design	C2	U		L	M		I	II		0	0	1	1	II		
T E	02	Stable - geotechnical risk																			
T E	02 01	Final void low walls subject to slope failure	Excessive slopes, inadequate design, not constructed to design, inadequate drainage controls, adverse weather event	Localised land impact	Slope moderation, final landform design, maximum slopes subject to engineered design, assessment of construction materials by a suitably qualified person, provision of adequate drainage infrastructure, geotechnical assessment undertaken at closure. Certification by a suitably qualified expert that the final landform is stable and constructed according to design criteria.	C1	R			L			I		0	0	0	1	I		
T E	03	Stable - erosional risk																			
T E	03 01	Initial/ongoing gully, pipe and/or sheet erosion of the low walls and high walls	Faults and fractures in the underlying geology, adverse weather events	Localised land impacts, water quality impacts (water contained within the pit)	Landform design in accordance with geotechnical assessment of the site, monitoring and management as required.	C2	P			L	L		II	II		0	0	2	0	II	
T E	03 02	Initial/ongoing gully, pipe and/or sheet erosion of the low walls and high walls	Inadequate design, erodible topsoil and subsoils	Localised land impacts, water quality impacts (water contained within the pit)	Landform including highwalls and site drainage network to be constructed as designed. Monitoring of drainage network performance, prompt remediation. Certification by a suitably qualified person that the final landform is stable and constructed according to design criteria	C1	U		L	L			I	I		0	0	0	2	I	
T E	03 03	Initial/ongoing gully, pipe and/or sheet erosion of the low walls and high walls	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts, water quality impacts (water contained within the pit)	Final void designed as to prevent excessive runoff from entering the final void during rainfall events. Prompt remediation, postweather event monitoring of final void water quality, high walls and low wall	C2	P			L				II		0	0	1	0	II	
T E	03 04	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas (medium-long term risk)	Rehabilitation failure/ vegetation disease/loss, climatic events (drought), other	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, modify revegetation methods and techniques and other contributing factors to improve the likelihood of revegetation success on rehabilitation slopes, rehabilitation area monitoring and assessment, undertake repairs and maintenance as required	C2	P			L				II		0	0	1	0	II	

Ref.	Risk Type (T=Threat) Category Subcategory Item	Risk Description			Risk Evaluation		Risk Rating		Count		Final Risk Rating	Management Effectiveness
		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls	Control Effectiveness	Likelihood - Frequency	Likelihood - Probability	Health Safety Environment Compliance	Health Safety Environment Compliance	Count		
T E 04	04	Non-polluting - geochemical risk										
T E 04	01	Acid and saline drainage generation	Adverse waste rock geochemistry; leaching of salts contained in overburden materials to void surface water and concentration of salts by evaporation	Revegetation performance impacts, impacts to pit lake water quality	In pit waste emplacement to be constructed to design specifications as prepared by an AQP. Negative NAPP waste rock materials, low propensity for saline drainage. Coal rejects to be encapsulated deep within waste emplacements. Routine confirmatory geochemical testing to inform rehabilitation. Regular monitoring and assessment of pit lake water quality.	C2	P	L	II	0 0 1 0	II	
T E 05	05	Non-polluting - other environmental harm								0 0 0 0		
T E 06	06	Sustainable - PMLU										
T E 06	01	Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C2	P	L	II	0 0 1 0	II	
		Insufficient pasture density/diversity and recruitment	Weather, poor soil characteristics, poor management practices impacting germination, vegetation establishment and PMLU density metrics, and shortage of topsoil resources	Insufficient pasture productivity	Improving rehabilitation methodologies, rehabilitation area monitoring and assessment, undertake repairs and maintenance works as required	C2	P	L	II			
T F	F	Rehabilitated dams										
T F 01	01	Safe										
T F 01	01	Surface roughness (rockiness and depressions) in excess of that expected for the PMLU	Erosion gullies etc due to some dispersive subsoils/ topsoils, inadequate surface preparation, localised settlement	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), maintenance controls (pre closure), rehabilitation monitoring and assessment, undertake repairs and maintenance as required	C1	U	L	I	0 0 0 1	I	
T F 02	02	Stable - geotechnical risk										
T F 02	01	Not applicable										
T F 03	03	Stable - erosional risk										
T F 03	01	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Dispersive topsoils and subsoils, adverse weather events	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required, sediment controls during establishment	C1	U	L	I	0 0 0 1	I	

Ref.	Risk Type (T=Threat) Category Subcategory Item	Risk Description				Control Effectiveness	Risk Evaluation			Risk Rating			Count				Final Risk Rating	Management Effectiveness
		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls	Likelihood - Frequency Likelihood - Probability		Health Safety Environment Compliance	Health Safety Environment Compliance	0	0	0	1						
T	F 03 02	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Inadequate rehabilitation drainage capacity and/or design	Localised land impacts and downstream water quality impacts	Drainage network design with acceptable design standards for drainage structures, avoidance of flow concentration, subcatchment delineation, sufficient water storage structures, engineered flow channels, adequate and effective revegetation techniques, rehabilitation monitoring and management as required	C1	U		L		I	0	0	0	1	I		
T	F 03 03	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts and downstream water quality impacts	Downstream sedimentation controls, revegetation, monitoring and maintenance	C2	P		L		II	0	0	1	0	II		
T	F 03 04	Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Rehabilitation failure/ vegetation disease/loss, climatic events (drought)	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt and effective revegetation establishment, revegetation monitoring and management as required	C2	P		L		II	0	0	1	0	II		
T	F 04	Non-polluting - geochemical risk																
T	F 04 01	Not applicable																
T	F 04 02																	
T	F 05	Non-polluting - other environmental harm																
T	F 05 01	Not applicable																
T	F 05 02																	
T	F 06	Sustainable - PMLU																
T	F 06 01	Self sustaining vegetation communities not achieved	Rehabilitation failure/ vegetation disease/loss, climatic events (drought), other	Localised land impacts and downstream water quality impacts	Best practice rehabilitation methodologies implemented, rehabilitation area monitoring and assessment, undertake repairs and maintenance works as required	C1	U		L		I	0	0	0	1	I		
T	F 06 02	Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C1	U		L		I							
T	F 06 03	Insufficient pasture density/diversity and recruitment	Adverse climatic conditions, poor soil characteristics, poor management practices impacting germination, vegetation establishment and PMLU density metrics, and shortage of topsoil resources	Insufficient pasture productivity	Best practice rehabilitation methodologies implemented, rehabilitation area monitoring and assessment, undertake repairs and maintenance works as required	C1	U		L		I	0	0	0	1	I		

Ref.	Risk Type (T=Threat) Category Subcategory Item	Risk Description				Control Effectiveness	Risk Evaluation				Risk Rating				Count				Final Risk Rating	Management Effectiveness		
		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls	Likelihood - Frequency		Likelihood - Probability	Health			Environment			Compliance			Health	Safety			Environment	Compliance
								Health	Safety	Environment	Compliance	Health	Safety	Environment	Compliance							
T	G	Retained dams																				
T	G	01	Safe																			
T	G	01 01	Dam failure (overtopping) of retained structures	Extreme rainfall events beyond design capacity, insufficient water level monitoring	Downstream hazard to public	Only engineered water storage to be retained at closure; dam will be assessed as safe and stable by appropriately qualified person prior to relinquishment; volume is relatively small and water will be free of contaminants	C1	U		L			I				0	0	0	1	I	
T	G	02	Stable - geotechnical risk																			
T	G	02 01	Wall failure/dam break of retained structures	Extreme rainfall events beyond design capacity, insufficient water level monitoring	Downstream hazard to public	Only engineered water storage to be retained at closure; dam will be assessed as safe and stable by appropriately qualified person prior to relinquishment; volume is relatively small and water will be free of contaminants	C1	U		L			I				0	0	0	1	I	
T	G	03	Stable - erosional risk																			
T	G	03 01	Initial/ongoing gully, pipe and/or sheet erosion of dam embankments	Dispersive topsoils and subsoils, adverse weather events	Localised land impacts and downstream water quality impacts, risk of not achieving PMLU	Good topsoil management practices; adequate/effective soil amelioration where required, grading and shaping of dam banks, prompt revegetation establishment of dam banks, revegetation monitoring and management as required	C2	U		M			II				0	0	1	0	II	
T	G	04	Non-polluting - geochemical risk																			
T	G	04 01	Poor water quality in retained water storages	Adverse geochemical characteristics of disturbed materials in catchment	Downstream water quality impacts	Mine affected water to be removed from dam, water quality monitoring program to allow early detection and management of poor water quality	C1	U		L			I				0	0	0	1	I	
T	G	05	Non-polluting - other environmental harm																			
T	G	05 01	Not applicable														0	0	0	0		
T	G	06	Sustainable - PMLU																			
T	G	06 01	Water quality in retained storages not meeting PMLU water quality requirements	Adverse geochemical characteristics of disturbed materials in catchment or other sources of contamination	Livestock health	Mine affected water to be removed from dam, water quality monitoring program to allow early detection and management of poor water quality	C1	U		L			I				0	0	0	1	I	
T	H	Diversion drains																				
T	H	01	Safe																			
T	H	01 01	Surface roughness (rockiness, depressions) in excess of that expected for the PMLU	Challenging subsoils/ topsoils, inadequate surface preparation, localised settlement, erosion gullies	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), monitoring, maintenance controls (pre-closure)	C1	U		L			I				0	0	0	1	I	

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Ref.	Risk Description					Control Effectiveness	Risk Evaluation		Risk Rating		Count				Final Risk Rating	Management Effectiveness		
	Risk Type (T=Threat) Category Subcategory Item		Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency Likelihood - Probability	Health Safety Environment Compliance	Health Safety Environment Compliance									
T H 01 02		Pests and weeds	Poor monitoring and corrective actions for pests and weed management	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C2	P		L		II		0	0	1	0	II	
T I 01		Mine infrastructure areas																
T I 01		Safe																
T I 01 01		Surface roughness (rockiness, depressions) in excess of that expected for PMLU	Inadequate surface preparation, localised settlement, erosion gullies	Safety hazard for personnel, stock and wildlife	Surface preparation measures (initial), monitoring, maintenance controls (pre-closure)	C2	P		L		II		0	0	1	0	II	
T I 02		Stable - geotechnical risk																
T I 02 01		Not applicable																
T I 03		Stable - erosional risk																
T I 03 01		Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Dispersive topsoils and subsoils, adverse weather events	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt revegetation establishment, revegetation monitoring and management as required, sediment controls during establishment	C1	U		L		I		0	0	0	1	I	
T I 03 02		Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Inadequate rehabilitation drainage capacity and/or design	Localised land impacts and downstream water quality impacts	Drainage network design with acceptable design standards for drainage structures, avoidance of flow concentration, subcatchment delineation, sufficient water storage structures, engineered flow channels, adequate and effective revegetation techniques, rehabilitation monitoring and management as required	C1	U		L		I		0	0	0	1	I	
T I 03 03		Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Adverse climatic events and/or climatic sequences beyond design capacity	Localised land impacts and downstream water quality impacts	Downstream sedimentation controls, revegetation, monitoring and maintenance	C2	P		L		II		0	0	1	0	II	
T I 03 04		Initial/ongoing gully, pipe and/or sheet erosion of rehabilitated areas	Rehabilitation failure/ vegetation disease/loss, climatic events (drought)	Localised land impacts and downstream water quality impacts	Landform design moderating slope, adequate/effective subsoil and topsoil amelioration, prompt and effective revegetation establishment, revegetation monitoring and management as required	C2	P		L		II		0	0	1	0	II	
T I 04		Non-polluting - geochemical risk																
T I 04 01		Not applicable											0	0	0	0		
T I 05		Non-polluting - other environmental harm											0	0	0	0		
T I 05 01		Contaminated land	Operational phase industrial use of land	Land contamination, surface water impacts	Appropriate infrastructure management; storage and bunding of hazardous materials, housekeeping and proactive spills management. Phase 1 assessment at closure	C2	U		M		II		0	0	1	0	II	

Ref.	Risk Description				Control Effectiveness	Risk Evaluation				Risk Rating				Count				Final Risk Rating	Management Effectiveness
	Risk Type (T=Threat) Category Subcategory Item	Causes (Triggers / Indicators)	Impacts (Consequences)	Controls		Likelihood - Frequency Likelihood - Probability	Health Safety Environment Compliance	Health Safety Environment Compliance	Health Safety Environment Compliance	Health Safety Environment Compliance									
T I '06	Sustainable - PMLU																		
T I 06 01		Self sustaining grazing native vegetation community not achieved	Rehabilitation failure/ vegetation disease/loss, climatic events (drought), other	Localised land impacts and downstream water quality impacts	Best practice rehabilitation methodologies implemented, rehabilitation area monitoring and assessment, undertake repairs and maintenance works as required	C2	P		L		II		0	0	1	0	II		
I 06 02		Pests and weeds	Poor local, regional or site property management practices.	Increased risk of not achieving designated PMLU	Pest and weed management practices, monitoring programs to allow early detection and management, intensify monitoring and management measures as appropriate	C2	P		L		II		0	0	1	0	II		
0 I 06 03		Insufficient pasture density/diversity and recruitment	Weather, poor soil characteristics, poor management practices impacting germination, vegetation establishment and PMLU density metrics, and shortage of topsoil resources	Insufficient pasture productivity	Best practice rehabilitation methodologies implemented, rehabilitation area monitoring and assessment, undertake repairs and maintenance works as required	C1	U		L		I		0	0	0	1	I		
T J	Retained infrastructure																		
T J '01	Safe																		
T J 01 01		Not applicable											0	0	0	0			
T J '02	Stable - geotechnical risk																		
T J 02 01		Not applicable											0	0	0	0			
T J '03	Stable - erosional risk																		
T J 03 01		Initial/ongoing gully, pipe and/or sheet erosion of retained areas	Dispersive topsoils and subsoils, adverse weather events	Localised land impacts and downstream water quality impacts	Grading and shaping, monitoring and management as required	C2	P		L		II		0	0	1	0	II		
T J 03 02		Initial/ongoing gully, pipe and/or sheet erosion of retained areas	Inadequate rehabilitation drainage capacity and/or design	Localised land impacts and downstream water quality impacts	Suitable sedimentation and drainage controls implemented, monitoring and maintenance	C2	P		L		II		0	0	1	0	II		
T J '04	Non-polluting - geochemical risk																		
T J 04 01		Not applicable											0	0	0	0			
T J '05	Non-polluting - other environmental harm																		
T J 05 01		Contaminated land	Operational phase industrial use of land	Land contamination, downstream surface water impacts	Appropriate infrastructure management; storage and bunding of hazardous materials, housekeeping and proactive spills management. Phase 1 assessment at closure	C2	U		M		II		0	0	1	0	II		
T J 05 02													0	0	0	0			
T J '06	Sustainable - PMLU																		
T J 06 01		Not consistent with surrounding land use	Not consistent with designated PMLU	Not consistent with designated PMLU	Infrastructure retained in accordance with landholder agreement	C1	U		L		I		0	0	0	1	I		

Appendix G. Field data sheet

Rehabilitation transect pro-forma

Project:				
Date:		Season:	Wet	Dry
Recorder:				
Transect name:				
Start point:	Easting:		Northing:	
End point:	Easting:		Northing:	
Datum:			Zone:	
Photo No:	Start (0 m):	Mid (50 to 0 m)	Mid (50 to 100 m)	End (100 m):

Site Location:	
Landscape Context*:	
Notes:	

* rocky hill, slope, valley bottom, floodplain, clay plains, etc.

Erosion pattern [^]	Slope (°)	Slope aspect# (e.g. Slope direction in degrees)

[^] refers to the combination of local relief and slope class (refer to Speight (2009) classification system attached).

At the mid-point record the direction in degrees, of the downward slope of the transect. For flat areas record a dash.

Rehabilitation transect pro-forma

Disturbance	Severity of Disturbance (circle relevant score)			Disturbance	Severity of Disturbance (circle)
	Proportion*	Age*	Height*		
Storm damage Estimate the proportion of the crown cover damaged at the site and the age of the damage.	0 1 2 3	1 2	N/A	Remnant	Yes No
Vehicle tracks Record old or recent tracks present at the site. Record proportion and age of the site affected.	0 1 2 3	1 2	N/A	Weeds Estimate percentage cover of exotic plant species. Sum of cover for all weed species.	Cover %:
Fire Record proportion of the site burnt, age and tallest vegetation affected.	0 1 2 3	1 2	1 2 3	Grazing Evidence of grazing (damage to ground layer plants, evidence of livestock faeces or tracks). ^Severe means major impact on groundcover abundance or composition.	Not apparent Present ^Severe
*Proportion: 0 = 0; 1 ≤ 1%; 2 1-5%; 3 ≥5% *Age: 1 ≤ 3 yrs. (short term impact still evident); 2: >3yrs * Fire height: 1 ≤1m; 2 1-6m; 3 6-12 m				Clearing Proportion of site previously cleared / thinned and regrown	No Present Severe
Other (note any other disturbance):					

*Leave blank where disturbance is absent

Rehabilitation transect pro-forma

Erosion classification	Minor	Moderate	Severe	Extreme	Notes/observations
No. of rills	< 15	15–30	31–50	> 50	
Average depth (cm)	< 10	10–30	30–60	> 60	
Proportion of site affected by disturbance (%) ¹	< 1	1–5	> 5	—	

* Provide GPS co-ordinates for any areas of moderate or heavy erosion

Geology:			
Soil description:			
Soil sample taken:	YES / NO	Date:	
Sample ID:		Time:	

Topsoil	5 m	10 m	15 m	20 m	25 m	30 m	35 m	40 m	45 m	50 m
Depth (cm)										

Canopy coverage (length of tape under canopy)	Total (m)	%
(example) 0–4, 8–13, 28–31, 45–48	= 15/50 * 100	30

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Vegetation Layer	E	T1	T2	T3	S1	S2	G
Height (m)							

E = Emergent; T1, T2 and T3 – Refers to tree layers where T1 is the tallest tree canopy layer (or Ecologically Dominant Layer) and T3 is the shortest tree layer ; S1 and S2 – Refers to the shrub layers where S1 is the tallest shrub layer and S2 is the shortest shrub layer; G – Refers to the Ground layer.

Rehabilitation transect pro-forma

Opportunistic fauna observations		
Species	Number	Notes

Additional notes (sketch if required)

Rehabilitation transect pro-forma

Species dominance (D, CD, A, O)							Species	Woody stem count	Sample #/code	Photo #	Ground cover percentage*									
E	T1	T2	T3	S1	S2	G					Q1	Q2	Q3	Q4	Q5	Q6	A7	Q8	Q9	Q10
							Bare													
							Litter													
							Rock													
							1.													
							2.													
							3.													
							4.													
							5.													
							6.													
							7.													
							8.													
							9.													
							10.													
							11.													
							12													
							13.													
							14.													
							15.													

Species dominance (D, CD, A, O)							Species	Woody stem count	Sample #/code	Photo #	Ground cover percentage*									
E	T1	T2	T3	S1	S2	G					Q1	Q2	Q3	Q4	Q5	Q6	A7	Q8	Q9	Q10
							16.													
							17.													
							18.													
							19.													
							20.													
							21.													
							22.													
							23.													
							24.													
							25.													
							26.													
							27.													
							28.													
							29.													
							30.													
							31.													

Key: D = dominant, CD = Co-Dominant, A = Associated and O = Occasional

*To be assessed as per ground cover assessment methodology and includes cover of bare ground, organic litter, rock and foliage cover

Slope class							
Class	LE Level	VG Very gently inclined	GE Gently inclined	MO Moderately inclined	ST Steep	VS Very steep	PR Precipitous
Percentage	<1	1–3	3–10	10–32	32–56	56–100	100
Degrees (rounded to nearest whole number)	0–0°35'	>0°35'– 1°45'	>1°45'– 5°45'	>5°45'–18°	>18°–30°	>30–45	>45
Relief class	Erosional landform pattern						
M Very high >300 m (about 500 m)	–	–	–	RM Rolling mountains	SM Steep mountains	VM Very steep mountains	PM Precipitous
H High 90– 300 m (about 150 m)	–	–	UH Undulating hills	RH Rolling hills	SH Steep hills	VH Very steep hills	PH Precipitous hills
L Low 30– 90 m (about 50 m)	–	–	UL Undulating low hills	RL Rolling low hills	SL Steep low hills	VL Very steep low hills	B Badlands
R Very low 9– 30 m (about 15 m)	–	GR Gently undulating rises	UR Undulating rises	RR Rolling rises	SR Steep rises	B Badlands	B Badlands
P Extremely low <9 m)	LP Level plain	GP Gently undulating plain	UP Undulating plain	RP Rolling plain	B Badlands	B Badlands	B Badlands

Source: Speight (2009), table 2

Figure C1 Types of erosional landform patterns by slope and relief class (Source: after Neldner 2019)

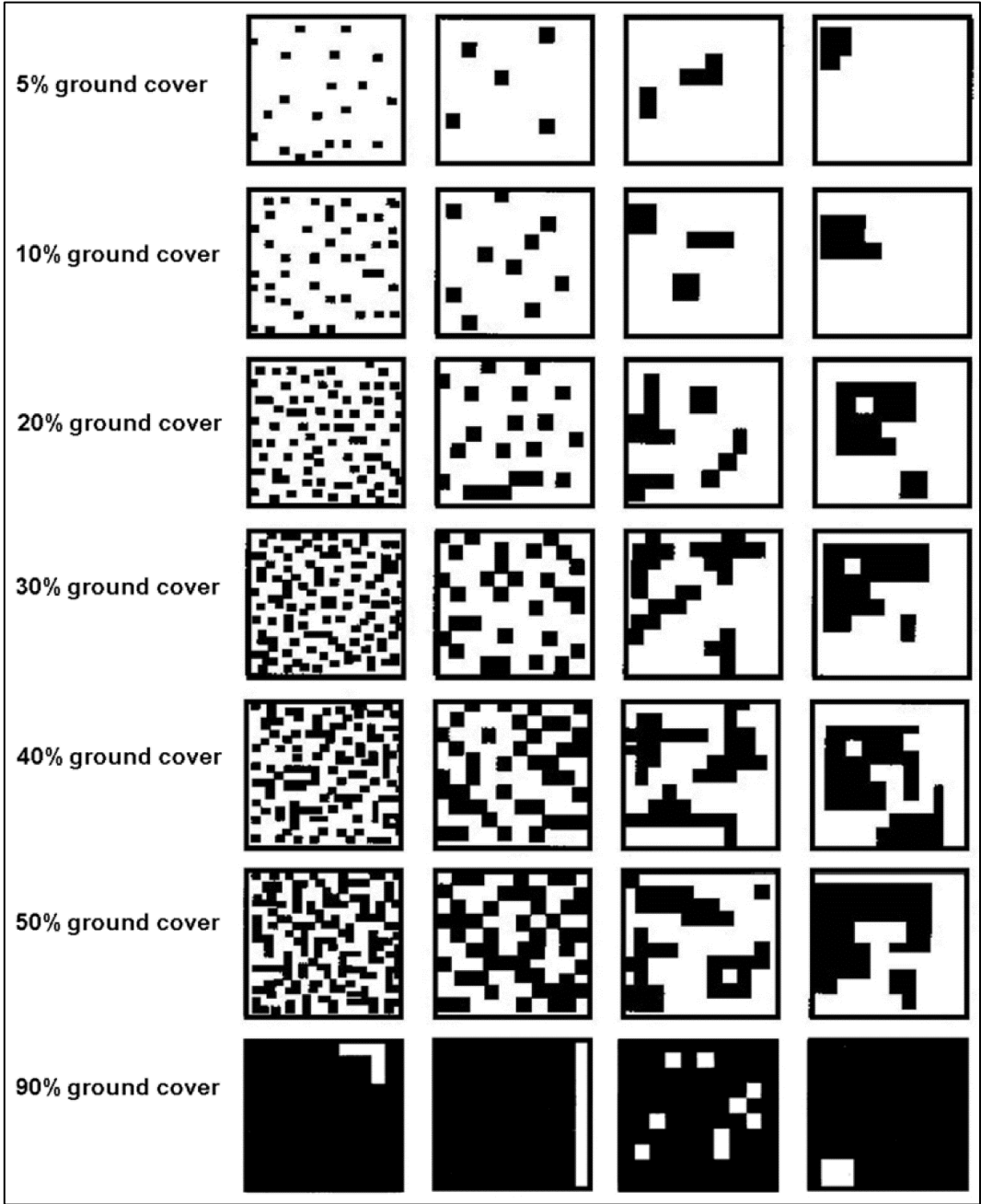


Figure C2 Guide to estimating ground cover percentage (Eyre et al. 2017)

Table C2 Soil profile proforma

[Site Description]

Date:		Site:		
Location:		Coordinates:	E	N
Landform Pattern:		Micro Relief:		
Landform Element:		Rock Outcrops:		
Morphological Type:		S C Fragments:		
Site Disturbance:		Substrate:		
Erosion:		Surface Condition:		
Landform	Elevation:		Permeability:	
	Slope (%):		Drainage:	
	Relief:		Run-off:	

[Soil Description]

Horizon	Depth (mm)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations	Consistency	Field pH	

Vegetation

Notes

Pasture Productivity Data Sheets

Table D1 Pasture height record sheet

Paddock Name:			
cm (A)	Place a tick in the appropriate row	No. measurements (B)	A x B
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20+			
	Total number of measures and pasture heights (C)		
	Total height of pastures (D)		
	Average pasture height = D/C		
	Average pasture mass <u>kgDM/ha</u>		

Source: after Meat & Livestock Australia 2019

Table D2 Approximate relationship between pasture height and kg DM/ha

Height (cm)	Lightly grazed 50 % green	Moderately grazed 100% green	Dense 100% Green
1	250	400	500
2	500	700	800
3	600	1000	1100
4	800	1200	1400
5	1000	1400	1700
6	1150	1600	2000
7	1300	1700	2300
8	1450	1900	2600
9	1600	2000	2800
10	1700	2200	3000

Source: after Meat & Livestock Australia 2019

Appendix H. Landholder agreement

Spatial information

GIS data associated with this application is available upon request to the Department of Environment and Science.

Information on how to make a request is available at:

<https://www.qld.gov.au/environment/pollution/licences-permits/public-register>