



Progressive Rehabilitation and Closure Plan

Stuart Kerogen Shale Project

Queensland Energy Resources

Version 5

23 July 2026



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Abbreviations

Abbreviation	Definition
AD	acid drainage
AEP	annual exceedance probability
ALARA	as low as reasonably achievable
AMD	acid mine drainage
ANZG	Australian and New Zealand Guideline
ATP	Alberta Taciuk Process
AusRivAS	Australian River Assessment System
BTEX	benzene, toluene, ethylbenzene, xylene
CF	Curlew Formation
CSIRO	Commonwealth Science Industrial Research Organisation
CWHP	clean water holding ponds
DCCEEW	Department of Climate Change, Energy, Environment, and Water
DSI	Detailed Site Investigation
dS/m	deciSiemens per metre
DES	Department of Environment and Science
DETSI	Department of the Environment, Tourism, Science and Innovation
DO	dissolved oxygen
EA	Environmental Authority
ECWHP	East clean water holding pond
EC	electrical conductivity
ECEC	effective cation exchange capacity
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMOS	<i>Stuart R&D Project MLA 80003 Environmental Management Overview Strategy</i>
EP Act	<i>Environmental Protection Act 1994</i>
EP Regulation	Environmental Protection Regulation 2019
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
ERA	environmentally relevant activities
ESP	exchangeable sodium percentage
FLURP	Final Land Use and Rehabilitation Plan
GDE	groundwater dependent ecosystems
Gladstone SDA	Gladstone State Development Area
HIL(A)	health-based investigation level

Abbreviation	Definition
ILUA	Indigenous Land Use Agreement
KCK	Kerosene Creek (member)
LGA	local government area
LOD	land outcome document
LOR	limit of reporting
LTC	Telegraph Creek lower (sub-member)
mAHD	metres Australian Height Datum
mBGL	metres below ground level
MERFP Act	<i>Mineral and Energy Resources (Financial Provisioning) Act 2018</i>
mg/kg	micrograms per kilogram
ML	mining lease / megalitres
Mm ³	million cubic metres
MRA	mine reject area
MWSP	Mine Water Settling Pond
NAF	non-acid forming
NAF-S	non-acid forming sulphur
NC Act	<i>Nature Conservation Act 1992</i>
NMD	pH-neutral and metalliferous drainage
NUMA	non-use management area
OC	organic carbon
OD	organo-chemical drainage
PAF	potentially acid forming
PAF-LC	potentially acid forming-low capacity
PAH	polynuclear aromatic hydrocarbons
PAWC	plant available water content
PFL	Petroleum Facility Licence
pg TEQ/g	picograms TEQ per gram of solid
PMF	probable maximum flood
PMLU	post-mining land use
PP	Polishing Pond
PRCP schedule	Progressive Rehabilitation and Closure Plan schedule
PRC plan	Progressive Rehabilitation and Closure Plan
PRCP Guideline	<i>Guideline – Progressive Rehabilitation and Closure Plans (ESR/2019/4964)</i>
PSI	Preliminary Site Investigation
the Project	Stuart Kerogen Shale Project
QA	quality assurance

Abbreviation	Definition
Qa	Quaternary
QC	quality control
QBEIS	Queensland Biodiversity and Ecology Information System
QER	Queensland Energy Resources, collective name for Queensland Energy Resources (Aussun) Pty Ltd, Queensland Energy Resources (No. 1) (Stuart) Pty Ltd, and Queensland Energy Resources (No. 2) (Stuart) Pty Ltd
QWQG	Queensland Water Quality Guidelines
RA	rehabilitation area
RE	Regional Ecosystem
RM	rehabilitation milestone
R&D	research and development
RNTBC	First Nations Bailai, Gurang, Gooreng Gooreng, Taribelang Bunda People Aboriginal Corporation registered native title bodies corporate
ROM	run-of-mine
RUSLE	Revised Universal Soil Loss Equation
SD	saline drainage
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i>
SEVT	Semi-evergreen vine thicket
SILO	Scientific Information for Landowners
SP	sediment pond
SP4 (WP2 Pond)	sediment pond (SP4) and licensed release point (i.e. WP2)
SPR	source-pathway-receptor
SSW	stripped sour water
t/d	tonnes per day
t/h	tonnes per hour
t/ha/y	tonnes per hectare per year
TDP	technology demonstration plant
TN	total nitrogen
TSF	tailings storage facilities
Tw	Tertiary (weathered)
UC	uncertain
UTC	Telegraph Creek upper (sub-member)
µg/L	micrograms per litre
µS/cm	microsiemens per centimetre
WCWHP	West clean water holding pond
WP1	Licensed release point (i.e. WP1)

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1. Introduction

1.1. Background and purpose

On 30 November 2018, the *QLD Mineral and Energy Resources (Financial Provisioning) Act 2018* (MERFP Act) commenced, requiring all mines with a site-specific Environmental Authority (EA) to prepare a Progressive Rehabilitation and Closure Plan (PRC plan).

In accordance with the *Environmental Protection Act 1994* (EP Act) and MERFP Act, all mining activities approved through a site-specific EA application must develop and submit a PRC plan to the Department of Environment, Science and Innovation (DESI) (formerly the Department of Environment and Science [DES]) for assessment. The PRC plan must be developed in accordance with the *Guideline – Progressive Rehabilitation and Closure Plans* (DES, 2023a) (ESR/2019/4964) (PRCP Guideline).

The primary purpose of the PRC plan is for the holder of an EA to plan for how and where activities will be carried out on land in a way that maximises progressive rehabilitation to a stable condition, and to provide for the condition to which the holder must rehabilitate the land before the EA is surrendered.

The MERFP Act includes transitional provisions for the application of the PRC plan requirement concerning existing mines, with Part 27 of Chapter 23 of the EP Act setting out the transitional provisions following the commencement of the MERFP Act. For the purposes of the transitional provisions, Section 750 of the EA Act includes definition of a ‘mining EA holder’ of which Queensland Energy Resources (Aussun) Pty Ltd, Queensland Energy Resources (No. 1) (Stuart) Pty Ltd and Queensland Energy Resources (No. 2) (Stuart) Pty Ltd (collectively referred to as QER) are the holders of an environmental authority for a mining activity relating to a mining lease (i.e. ML 80003) at the Stuart Kerogen Shale Project (the Project) (EA ref. EPML00658213). The EA also covers Petroleum Facility Licence (PFL) 8.

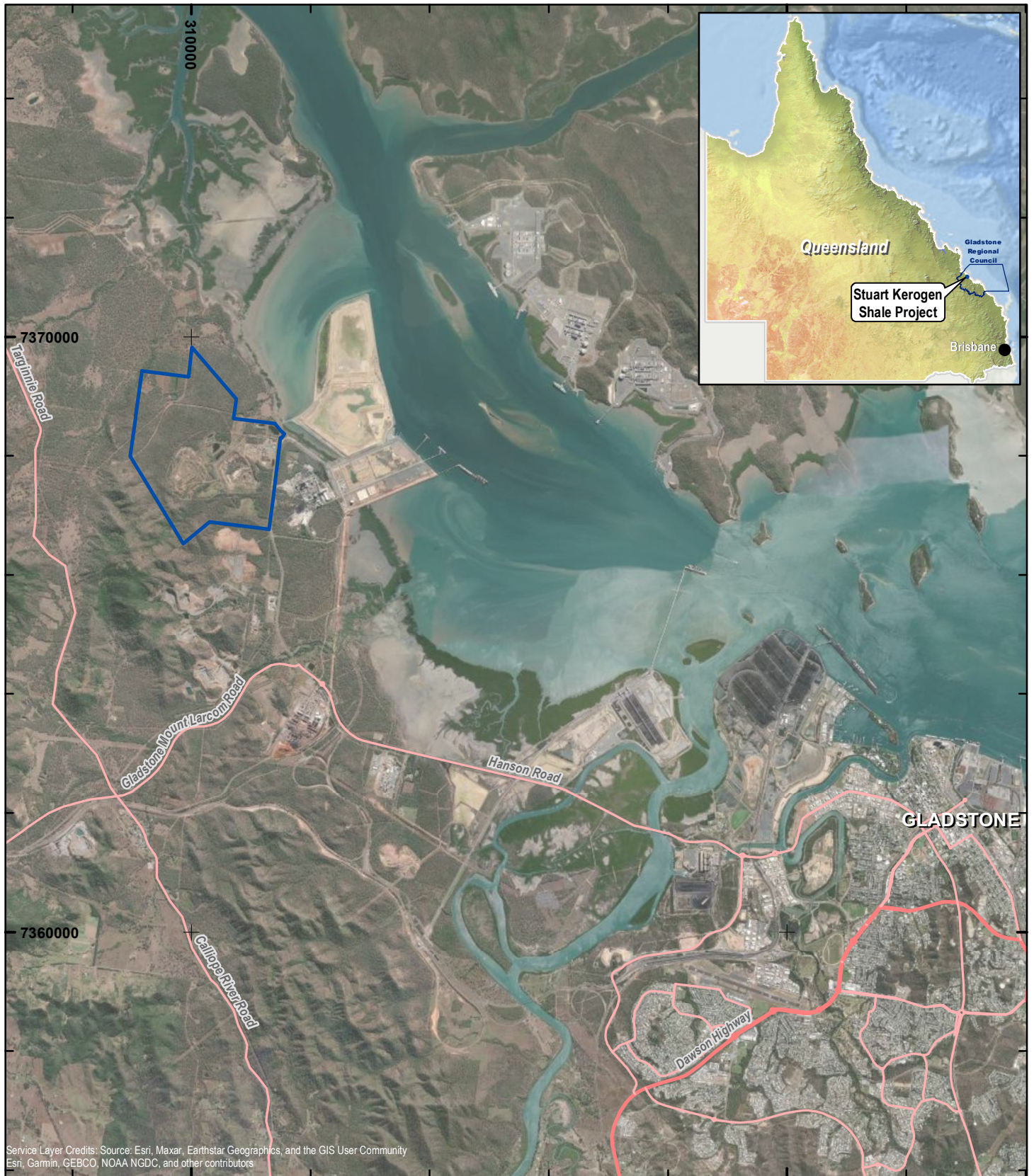
Existing mining EA holders were issued with a transition notice under Section 754 of the EP Act from the administering authority dated 26 May 2021 (Ref: 101/0005990-001[E]) (Appendix A). This PRC plan meets the legislative requirements in Sections 126C and 126D of the EP Act and PRCP Guideline, and comprises three parts:

- Part A: Rehabilitation planning part – provides information about the site, the rehabilitation plans, and evidence and justification to support the development of the proposed PRCP schedule.
- Part B: PRCP schedule – includes maps of rehabilitation and closure outcomes for the site and tables of time-based milestones.
- Part C: Appendices – provides key information and specialist studies to support this PRC plan.

1.2. Project overview

The Project is a kerogen shale development located within the Gladstone State Development Area (Gladstone SDA) at 375 Landing Road, Yarwun, QLD approximately 13 km north-west of Gladstone, within the Gladstone Regional Council Local Government Area (LGA) (Figure 1.1). Landing Road is a public road which provides access to the Yarwun Estate section of the Gladstone SDA. Access to the Project site is via Hanson Road from the south, Gladstone Mount Larcom Road from the southwest, and Forest Road from the north.

The Project comprises an existing conventional open-cut mine of the Kerosene Creek Member of the Stuart Kerogen Shale Deposit, together with associated infrastructure. Both the mining lease and the PFL authorise an associated processing plant. Kerogen shale is crushed and dried, followed by retorting and refining.



0 0.45 0.9 1.35 1.8 2.25
km

QUEENSLAND ENERGY RESOURCES

Stuart Kerogen Shale Project

N
W E
S
GDA2020, MGA Zone 56

Figure 1.1
Regional Location

Legend

- ML 80003
- Highway
- Secondary Road
- Gladstone Regional Council

Date: 2/05/2023

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0001_A

Requested by: John Linden

Sources:
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The Project site generally consists of the following areas:

- Out-of-pit mine reject area (MRA)
- mine pit, which would be used as an MRA as mining progresses northward (referred to as the In-pit MRA)
- water management infrastructure, including settling ponds, clean water holding ponds (CWHP), sediment dams and detention ponds
- haul and plant roads
- Forest Road, which is owned, managed and operated by Gladstone Regional Council
- process plant site and infrastructure areas
- ore stockpile area (i.e. run-of-mine [ROM]) for stockpiling of shale and processed shale)
- fuel and storage areas
- sewage treatment plant and disposal area
- exploration tracks and pads
- existing rehabilitated areas
- topsoil stockpiles

The Project, as operated by Southern Pacific Petroleum, consisted of a kerogen shale mine and an Alberta Taciuk Processor (ATP) technology-based pilot retorting plant which operated from 1999 to 2004. The ATP plant was much larger and used different technology than the technology demonstration plant (TDP) currently used by QER, capable of processing 6,000 tonnes of kerogen shale and producing approximately 720 cubic metres (m³) per day.

Following purchase of the site in 2004, QER decommissioned the ATP plant prior to installing a new TDP, using new processing technology (i.e. Paraho II). Construction of the TDP was completed in late 2011 on an area of existing disturbed land and the plant became fully operational in 2013. Operation of the TDP occurred over a two-year period under a full range of operating conditions, producing high quality ultra-low sulphur diesel and jet fuel from kerogen (the organic component of kerogen shale). Operation was completed under strict environmental licence conditions, with independent laboratory, engine and road testing confirming the fuels met all required specifications.

Since late 2014, the Project has been in a research and development (R&D) operating mode with minimal shale extraction and no operation of the TDP occurring. While the mine is currently in R&D, mining and processing for further research and development purposes is proposed over the medium term, for the purpose of fine-tuning various aspects of the operation for the longer term.

1.3. Legislative considerations

1.3.1. Mineral and Resources (Financial Provisioning) Act 2018

To improve rehabilitation and financial assurance outcomes in the resources sector, the Government of Queensland released the MERFP Act on 30 November 2018 and established the following key changes in legislation:

- the MERFP Act replaced the financial assurance arrangements for resource activities under the EP Act with a new financial provisioning scheme
- changed how the estimated rehabilitation cost for an EA is calculated
- amended the EP Act to introduce new requirements for the progressive rehabilitation and closure of mined land

The MERFP Act also describes transitional provisions for the application of the PRC plan requirement concerning existing mines. Holders of an existing EA are issued with a notice specifying a start date by which a PRC plan must be developed and submitted to DETSI (the administering authority). Such a notice was issued to QER for the Project, stating that the EA holder must submit a PRC plan to the administering authority by 19 May 2023 (Appendix A).

1.3.2. Environmental Protection Act 1994

The amendments to the EP Act requiring mines with site-specific EAs to have a PRC plan, came into effect on 1 November 2019. The EP Act provides the legislative information requirements for the rehabilitation planning part (Section 126C) and PRCP schedule (Section 126D). The EP Act also details the assessment process for the approval of a PRC plan.

The EP Act contains transitional provisions relating to existing site-specific mines. During the three-year transition period, DETSI has issued notices to existing mines requiring them to develop and submit a PRC plan by a specific date (i.e. 19 May 2023 for the Project). The transitional provisions also state that existing approvals may be translated into the PRC plan without additional assessment or public notification. Final voids approved in a land outcome document (LOD) as a non-use management area (NUMA) are exempt from the prohibition of a final void in a floodplain and the requirement for a public interest evaluation. However, no NUMAs exist for the Project site.

1.3.2.1. Transitional arrangements

Based on the Transitional Provisions in Chapter 13 Part 27 of the EP Act, the following are applicable to this PRC plan:

- A Transition Notice for the Project was issued to QER by DETSI (as delegate of the administering authority), dated 26 May 2021 (Appendix A). This Transition Notice requires submission of the PRC plan for the Project by 19 May 2023.
- LODs have been identified under Section 750 of the EP Act, ranked and outlined in further detail in Section 1.3.2.2.
- Under the LODs, the holders do not assert that there is any pre-approved NUMA for the Project.
- All post-mining land uses (PMLUs) for the land have been previously identified in LODs and this PRC plan proposes that the PMLUs for the land are to remain the same as, or substantially similar to, the pre-approved PMLUs. Therefore, the notification stage does not apply under Section 755B(2).
- Under Section 756 of the EP Act, the administering authority may amend the EA to remove rehabilitation conditions. For the EA, these are primarily the conditions of Schedule E.

Prior to submission of this PRC plan, nine DETSI and QER pre-lodgement meetings were undertaken between December 2020 and May 2023. Pre-lodgement meetings were held to discuss and/or confirm process requirements, confirm Project concepts and operational timeframes, discuss preliminary results from specialist assessments and the plan for submission of the PRC plan, and assist with preparation of a PRC plan-related EA amendment application. The key pre-lodgement meeting was held between DETSI and QER on 30 November 2022. This meeting was arranged to agree upon the approach to preparation of the PRC plan, with this PRC plan based on the key aspects discussed with DETSI during this meeting, as documented in the PRC plan Stuart Kerogen Shale Project DETSI engagement memorandum (QER, 2022) (Appendix B).

Aligned to the above and the requirements of Section 6 of the PRCP Guideline, the following process for transitioning rehabilitation and closure outcomes from the Project EA into the site's PRCP schedule has been undertaken:

1. Identifying rehabilitation and closure outcomes in the LODs.
2. Identifying the PMLU (NB: NUMAs are not planned for the Project).
3. Defining rehabilitation areas within the PMLU.
4. Identifying milestones.
5. Identifying milestone criteria.
6. Identifying when the first milestone must be commenced and completion dates for the milestones.

1.3.2.2. Land outcome documents

In accordance with the definition in Section 750 of the EP Act, the following LODs apply to the Project and are referenced throughout this PRC plan:

- EA EPML00658213
- *Final Land Use and Rehabilitation Plan* (FLURP) (QER, 2011) (Document ref D11/07415) (Appendix C) which was required under Condition E15 of the EA
- Successive plans of operations were required to update the FLURP under the note at the foot of Condition E15 of the EA

Under Section 755B(4) of the EP Act, to the extent of any inconsistency between LODs, the EA prevails to the extent of the inconsistency. Some inconsistencies have been identified between the EA and documents lodged under the EA. Therefore, this PRC plan relies primarily on Schedule E of the EA and references other LODs for context and further detail.

Additional documents which do not comprise LODs, but are also referenced for further background information:

- Environmental Impact Assessment (EIA) (Envirosciences, 1993) (Appendix D): The EIA pre-dated the transfer of environmental administration from the Minister for Mines to the Minister for Environment in 2001. Therefore, there was no EIA assessment report as defined in Section 57(2) of the EP Act. The EIA (Envirosciences, 1993) for the Project was originally assessed under the *Commonwealth Environmental Protection (Impact of Proposals) Act 1974* and the *Mineral Resources Act 1989*.
- Stuart R&D Project MLA 80003 Environmental Management Overview Strategy (EMOS) (SPP, 1996) (Appendix E): The EMOS (SPP, 1996) was accepted in 1996 and this was followed by commencement of operations by the original proponents in 1997. Before 6 November 2014, the former Condition (A22) of the EA required compliance with the commitments of the EMOS (SPP, 1996). In 2014, following commencement of the Environmental Protection (Greentape Reduction) Amendment Act 2012, QER applied for amendment of the EA to delete the redundant reference to the historic EMOS (SPP, 1996) and replace with the corresponding model mining conditions (A2) and (A3) and the rehabilitation schedule under Section 701 of the EP Act. The EMOS (SPP, 1996) remains relevant to interpreting any ambiguous or 'manifestly absurd' condition of the EA under Section 14B of the Acts Interpretation Act 1954, given that the purpose of the 2014 application was to transition the commitments of the EMOS (SPP, 1996) to conditions under Section 701.

Rehabilitation commitments were included in the EIA (Envirosciences, 1993) and the EMOS (SPP, 1996) and these commitments were originally adopted in the EA by former Condition (A22), and a corresponding special condition of ML 80003. In 2014, the current holders applied to convert this condition to the modern format of disturbance and rehabilitation conditions under Section 701 of the EP Act.

This PRC plan proposes to transition the existing rehabilitation commitments of the EA and other LODs into the format of a PRC plan. No NUMAs were proposed in the EA or other LODs. ML 80003 is not on a 'flood plain' as defined in the Environmental Protection Regulation 2019. All PMLUs for the land have been previously identified in LODs and this PRC plan proposes the PMLUs for the land are to remain the same as, or substantially similar to, the pre-approved PMLUs. Therefore, the notification stage does not apply under Section 755B(2).

1.3.2.3. Availability for rehabilitation

As per Clause 126D(5) of the EP Act, disturbed land associated with mining activities is considered available for rehabilitation, 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 proposed PRCP schedule or the application for an environmental authority for relevant activities to which the schedule relates 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 rehabilitation; or*
- (ba) the land is required for the mining of a probable or proved ore 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.*

While some areas will be available for rehabilitation during the R&D period, extraction, and processing of kerogen ore at a rate of up to 60 tonnes per day (t/d) or 2.5 tonnes per hour (t/h) is proposed during the R&D period and within the next 10 years (i.e. prior to, and continuing after, 2033). As a result, emplacement of waste (i.e. overburden/interburden and processed shale) resulting from extraction and processing works during the R&D period will be required at the Out-of-pit MRA between 2023 and 2043. Therefore, the In-pit MRA and Out-of-pit MRAs are not considered available for rehabilitation during the R&D period in accordance with Clause 126D(5)(ba) of the EP Act.

1.3.3. State Development and Public Works Organization Act 1971

The Project is located both within the Gladstone SDA and the Gladstone Regional Council local government area, adjacent to various other existing heavy industry, such as the Cement Australia plant, and opposite Curtis Island, which is also developed for heavy industry, such as liquified natural gas.

Some of the areas within the Project site have an identified industrial PMLU. This is in the context that the *Gladstone SDA Development Scheme* (Development Scheme) (DSDILGP, 2022), which designates the majority of the Project site for the Industry Investigation Precinct and a small balance area for the Port Related Industry Precinct.

The Intent for the Industry Investigation Precinct states that development must not compromise the future use of this precinct for industry. While mining itself is exempt from the Development Scheme, the post-mining land uses are not exempt. Under Section 84 of the *State Development and Public Works Organisation Act 1971* (SDPWO Act), the Development Scheme overrides local planning instruments. Section 84 provides:

(1) This section applies to the extent an approved development scheme for a State development area identifies regulated development in the area.

(2) If another Act or law would, apart from this section, regulate the regulated development, the other Act or law does not apply to the regulated development to the extent the other Act or law regulates that development.

Although Section 84 is expressed in broad terms, QER's legal advice is that it does not override the EP Act to the extent that mined land rehabilitation is required under the EP Act, because mining is expressly 'excluded development' under the Development Scheme. However, as Section 84 expressly takes priority to the extent of any inconsistency, it does not allow for PMLUs to be inconsistent with the Development Scheme.

Section 85 of the SDPWO Act permits the continuation of any existing lawful uses that were in place before the commencement of the Development Scheme. This allows for the continuation of the State Forest land use, agistment for grazing purposes, and potentially also the orchard land use in the north-west corner of ML 80003. Therefore, to the extent that Schedule E, Table 2 of the EA already allows for some mine infrastructure (such as detention ponds) to be retained for water storage (stock use) PMLU, this is consistent with Section 85.

Surrounding land uses proposed to be facilitated by the Coordinator-General under the Development Scheme are industrial, with the Project site itself also earmarked for future industrial development as a result of the Precinct planning under the Development Scheme.

The PRC plan proposes to retain the existing PMLUs of native ecosystem (bushland) and water storage (freshwater wetland) under Schedule E, Table 2 of the EA and where there is no alternative industrial PMLU available in Schedule E, Table 2 of the EA. However, the Development Scheme is likely to impose some constraints on the extent to which isolated areas of rehabilitated bushland and wetland are realistically able to replicate analogue sites. While these PMLUs may be perceived as inconsistent with Precinct intents under the Development Scheme, it is not unusual for large industrial estates to include some landscape features and native vegetation corridors, provided these PMLUs remain a minority of the overall Project site. Therefore, this is not considered inconsistent.

In addition, it is arguable that, if the native ecosystem (bushland) PMLU only replicate pre-mining values (a combination of State Forest and agistment), this would be consistent with Section 85 of the SDPWO Act. The advice on 'baseline information' regarding flora and fauna which would otherwise normally have been applicable in the PRCP Guideline has to be interpreted in this context.

Parts of the Project site have already been progressively rehabilitated, with some areas permanent, while other parts comprise interim rehabilitation, pending future disturbance. Progressive rehabilitation of native ecosystem (bushland) PMLUs has been undertaken in accordance with the criteria in the EMOS (SPP, 1996), with compliance with the commitments of the EMOS (SPP, 1996) (required by former Condition (A22) of the EA), prior to transitioning of the EMOS (SPP, 1996) into conditions under Section 701 of the EP Act in 2014. Under Section 701, where rehabilitation commitments of an EMOS (SPP, 1996) were converted into EA conditions, this was required to be consistent with the existing rehabilitation commitments. Therefore, the references to the water storage (freshwater wetland) and native ecosystem (bushland) PMLUs should continue to be interpreted in the context of the original commitments.

When assessing a transitional PRC plan, the administering authority must, to the extent possible, have regard to the same matters that the Department would have had regard to, if the proposed PRC plan had accompanied the application for the holder's EA, under Section 755(6)(b). If the PRC plan had accompanied the original application for an EA, the Development Scheme at that time was only applicable to the southern corner of ML 80003. Section 755(6)(b) is subject to the words 'to the extent possible' and in this regard, the EIA (Envirosciences, 1993) and the EMOS (SPP, 1996) were, to some extent, superseded by the expansion of the Development Scheme area and the consequential relevance of Section 84 of the SDPWO Act.

The words 'to the extent possible' in Section 755(6)(b) allow for this type of exceptional circumstance. Other than this, if the PRC plan had been submitted with the original EA application, the water storage (freshwater wetland) and the native ecosystem (bushland) PMLUs would have been required to be interpreted in the context of the EMOS (SPP, 1996) and the EIA (Envirosciences, 1993), as was the case at the time, because former Condition (A22) of the EA adopted the EMOS (SPP, 1996), until it was transitioned under Section 701 of the EP Act in 2014.

PART A – REHABILITATION PLANNING

2. Project planning

Legislative requirement

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

- Section 126C(1)(b):
 - each resource tenure, including the area of each tenure;
 - the relevant activities to which the application relates; and
 - the likely duration of the relevant activities.
- Section 126C(c)(ii):
 - how and where the relevant activities are to be carried out, including maps.

2.1. Project description

PRCP Guideline (Section 3)

The project description must include the following details:

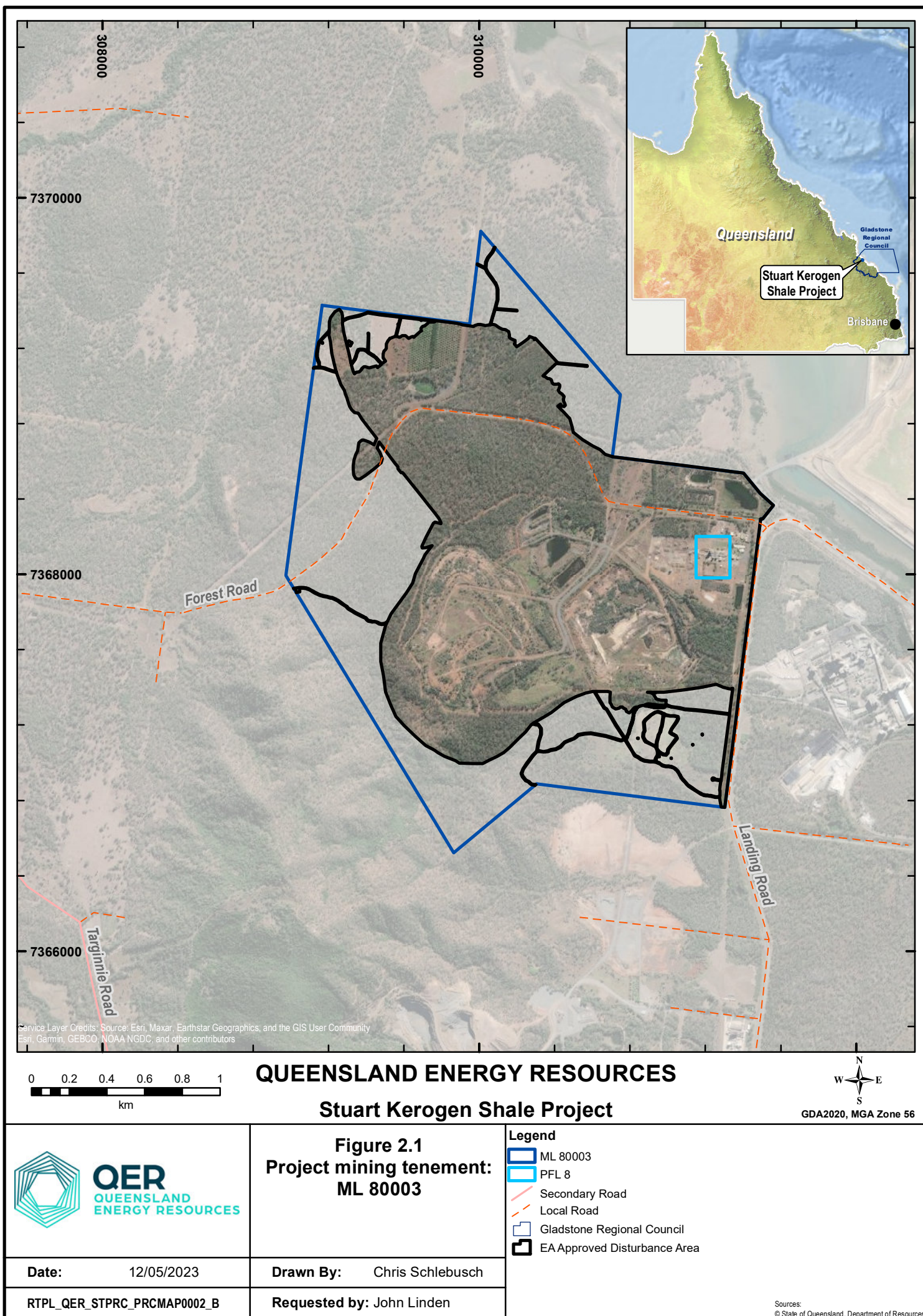
- mining tenements;
- primary mine features/infrastructure on site (e.g. tailings storage facilities (TSF), waste rock dump, etc.);
- type of mining operation; and
- proposed duration of operation as a whole.

It is the intent of the PRC plan to include information relating to all mining tenures on the EA including exploration permits, mineral development licences and mining claims. If the relevant EA application includes a petroleum tenure this must be noted in the project description, but the PRC plan and PRCP schedule do not need to include any further detail of the petroleum activities.

2.1.1. Mining and other tenements

The Project allows for kerogen shale mining and processing within ML 80003, which was granted for 30 years, commencing 1 August 1996. ML 80003 covers approximately 527 ha, with an approved disturbance footprint of approximately 326.94 ha (as at May 2023). ML 80003 is illustrated in Figure 2.1. In addition, the Project also allows for petroleum activities in association with the TDP via PFL 8.

While the EA for the Project relates to both ML 80003 and PFL 8, a PRC plan can only relate to a mining lease and not to the PFL. However, the effect is the same, as ML 80003 specifically includes not only the purpose of mining for kerogen shale, but also the additional purpose of the TDP under former Section 298(8) of the *Mineral Resources Act 1989* (QLD).



Environmentally relevant activities (ERA) relevant to ML 80003 are chemical manufacturing (ERA 7[4][b]); chemical storage (ERA 8[3]); gas producing (ERA 10), oil refining or processing (ERA 11[c]); fuel burning (ERA 15), mineral processing (ERA 31[2][b]); crushing, milling, grinding or screening (ERA 33); bulk material handling (ERA 50[1][a]); regulated waste storage (ERA 56); waste disposal (ERA 60[1][d]); waste incineration and thermal treatment (ERA 61[3][b]); and sewage treatment (ERA 63[b][i]).

2.1.2. Type of mining operation

The Project is an existing conventional open pit mine targeting kerogen shale within the Stuart Shale Deposit. Leaving aside the associated infrastructure, processing plant and rehabilitation activities, mining activities typically include:

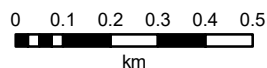
- Vegetation clearance, topsoil stripping and stockpiling for rehabilitation.
- Mining of waste rock (i.e. overburden and interburden) by open cut methods.
- Haulage of waste rock to a combination of Out-of-pit MRA and In-pit MRA emplacement.
- Mining of kerogen shale by open cut methods using surface miners and/or excavators.
- Loading of mined kerogen shale to haul trucks using front end loaders and/or excavators.
- Haulage of the kerogen shale to the ROM stockpile.

2.1.3. Primary feature and infrastructure within the mine footprint

The main features and infrastructure disturbance approved within the EA for the Project are summarised in Table 2.1. These areas current as at May 2023 are illustrated in Figure 2.2.



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



QUEENSLAND ENERGY RESOURCES

Stuart Kerogen Shale Project



GDA2020, MGA Zone 56

Figure 2.2
Project EA activities



Legend

- ML 80003
- Open pit
- Out-of-pit MRA
- Rehabilitated land
- ROM pad
- Plant site
- Haul road
- Exploration track or pad
- Fuel and storage
- Water storage
- Water treatment
- Sewage treatment plant

Date: 15/05/2023

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0003_B

Requested by: John Linden

Sources:
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Table 2.1 Primary features and infrastructure disturbance at the Project Site, as approved within the EA

Disturbance type	Feature description
Out of pit MRA	The Out-of-pit MRA commenced use in 1999 and is located immediately to the west of the existing pit void. In total, approximately 6.8 million cubic metres (Mm³) of waste and processed shale have been placed in the Out-of-pit MRA to date. On recommencement of full production in 2043, pit progression at the In-pit MRA will result in emplacement of a further 3.0 Mm³ of mine reject material (waste rock and processed shale) at the Out-of-pit MRA between 2043 to 2045 (Year 3 to 5 of the mining schedule), after which all remaining material will be emplaced at the In-pit MRA.
In-pit MRA	The existing pit void has a surface area of approximately 27.3 ha, with a total depth of approximately 37 metres below ground level (mBGL). During active mining, surface and groundwater inflow to the void are removed via a sump to create safe and dry working conditions. Since 2013, the void has generally stored minimal water with periodic pumping undertaken as required. On recommencement of full production in 2043, pit progression for the Project will consist of a northward migration of the pit void from its current location to the northern extent of ML 80003. From 2043 to 2045 (Years 3 to 5 of the mining schedule), pit progression will occur in tandem with placement of mine reject material (waste rock and processed shale) in both the Out-of-pit and In-pit MRAs. From 2045, processed shale and waste rock will be emplaced at the In-pit MRA, producing the final landform of the In-pit MRA at closure.
Settling ponds	There is currently one site settling pond (i.e. the Mine Water Settling Pond [MWSP]). The main intent of this storage feature is to allow sediment to settle out of surface water prior to transfer through the mine water management system for discharge. The MWSP is an in-line settlement pond, which collects water from sediment pond (SP) 1 via connection pipes and overflow spillway. The MWSP flows to the Polishing Pond (PP), which is in turn connected to the release point (i.e. SP4 [WP2 Pond]). The MWSP has a capacity of approximately 146.3 ML. While the MWSP and PP will not be retained in their current form, they will be relocated during the northward progression of mining (i.e. between Years 10 and 15 of the mine plan or 2050 to 2055). At this time, the settling pond located west of the CWHPs will be constructed.
CWHP	Dedicated CWHPs collect runoff from the Project site infrastructure area, with storage capacities of 74.3 ML (East [E] CWHP) and 47.4 ML (West [W] CWHP). The overflow from the WCWHP reports to Port Curtis from the licensed discharge point WP1 via a dedicated channel and concrete spillway.
Sediment dams	There are currently four sediment dams (referred to as sediment ponds) on-site that allow sediment to settle out of surface water prior to discharge. The SPs are described in further detail as follows: • SP1: captures most runoff from disturbed areas across the mine area where it is either transferred to the MWSP or transferred to the ECWHP or WCWHP for discharge via WP1 once compliance with relevant conditions of the EA is confirmed. SP1 has a capacity of approximately 15.5 ML. • SP2: captures runoff from a small laydown area between the current mine pit and the processing plant. Water contained within SP2 is generally transferred to SP1 as required; however, an overflow allows for emergency flows to the mine pit. SP2 has a capacity of approximately 33.3 ML. • SP3: captures water along the southern edge of the Project site via a series of table drains, with any overflows directed to the mine pit via a dedicated drain. SP3 has a capacity of approximately 0.6 ML. • SP4 (WP2 Pond): SP4 (WP2 Pond) is the final collection/storage point after the MWSP prior to discharge to Gully C.
Detention ponds	The two detention ponds will be constructed in a location west and south-west of the final void during the northward progression of mining (i.e. between Years 10 and 15 of the mine plan, or approximately 2050 to 2055). The detention ponds will capture surface water runoff from Gullies D and E to reduce maximum peak flows in Targinie Creek due to the diversions of Gullies C, D and E.
Roads – haul roads	Haul and plant roads. Post-closure, these will be retained for an industrial PMLU.

Disturbance type	Feature description
Roads – Forest Road	The existing Forest Road is a public road and would be impacted by the northward progression of mining within the In-pit MRA between Year 8 to 13 of the mine plan (i.e. 2048 to 2053). Therefore, while Forest Road (shown on Figure 2.2) is not a mine feature or mining infrastructure, realignment of Forest Road will need to be undertaken during the operational phase of the Project. No specific rehabilitation requirements are required for Forest Road, other than to construct and commission the realigned road infrastructure in accordance with conditions specified in an agreement and/or approvals between QER, Gladstone Regional Council and the Queensland Government.
Plant site	Located on the east side of the site, the TDP was constructed in late 2011 and is capable of processing kerogen shale at a rate of up to 2.5 t/h using Paraho II technology. The plant site includes but is not limited to: • formed access and sealed roads • car parking • process plant and conveyors, including adjacent cleared area • oily water pond • fire pump station • warehouse • main workshop • bathhouse • administration building and surrounds • warehouse • chemical storage shed • engineering building • laboratory and cold room • core shed • sample preparation shed • oily water separator • high voltage switchyard • gas pipeline terminal • product storage tanks • emergency generator • storage shed • training room • 11 kV switchyard • retort feed test unit • process loading pad • cleared and laydown areas, including for laboratory, sewerage, oily water processing area, warehouse, ROM, HV switchyard and pipeline terminal

Disturbance type	Feature description
Infrastructure	On-site infrastructure, including: • cleared areas, including drain and access tracks • fence road/fire breaks • dust monitor tracks and dust deposition gauges • numerous access tracks, including for historic mining activities and dust monitors • fence line visual screen This does not include individual items of infrastructure that have been addressed separately in Schedule E, Table 2 of the EA, such as fuel and storage areas.
Ore stockpile area	ROM pad.
Fuel and storage areas	Fuel and storage areas, including product loadout tank, product loading area, tank farm (revegetated), product loading loop (internal cleared area) and road loop (internal cleared area).
Sewage disposal areas	Sewage treatment plant, including cleared and laydown areas.
Exploration tracks and pads	Exploration tracks and pads include: • groundwater monitoring (i.e. exploration and groundwater bores and associated drill pads; and pad access tracks) • access tracks, including for historic mining activities
Voids and wetlands	Upon recommencement of full production in 2043, the existing pit void will be progressively backfilled during the northward progression of mining; however, a final void will remain to the north of the Project site at closure. When full, the final void water body will have a surface area of approximately 43 ha, with a total depth approximately 56 mBGL. The base of the pit will be at approximately -45 metres Australian Height Datum (mAHD) and the crest of the pit will be at approximately 11 mAHD.
Farm detention dam (Gully B)	Removed and revegetated Gully B farm detention dam.

2.1.4. Proposed duration of the operation

A resource of approximately 36 million tonnes of kerogen shale exists within ML 80003. While it is technically possible to extract up to 6,000 t/d or 250 t/h of kerogen shale, the processing capacity of the TDP is only 60 t/d or 2.5 t/h. This is a condition of PFL 8. It will not be possible to increase processing capacity without an amendment or replacement of the PFL. Therefore, this PRC plan has to assume that, at least for the short-term, the PFL conditions must be taken into account when calculating duration.

The EIA (Envirosciences, 1993) assumed a processing rate of 250 t/h, in which case, the Project would have had a 20-year life, if operated continuously. The ML term of 30 years relied on this assumption, which is no longer accurate because of the terms of the PFL. In terms of quantity of ore extracted to date, the Project is currently at Year three of the original estimate in the EIA (Envirosciences, 1993). Therefore, this PRC plan assumes renewal of ML 80003.

The current R&D period is planned to continue until 2043, after which full production is proposed for a further period of 17 years (to 2060). Future operating rates are contingent on the Queensland Government Oil Shale Policy position at that time, as well as any relevant Australian Government laws and policies. Based on assumptions derived from current policy settings, it is assumed that, when full production resumes, excess shale would need to be transported to the adjacent port for off-site processing, with processed shale to be returned to the Project site for management and on-site disposal. In this context, it is noted that the EIA (Envirosciences, 1993), assessed under the (repealed) *Commonwealth Environment Protection (Impact of Proposals) Act 1974* and subsequently transitioned, already included as part of its scope, product transfer to the Port of Gladstone and shipment.

While regular operation of the TDP is not scheduled to occur during the R&D phase, intermittent operation, and various trials including but not limited to, kerogen shale drying, materials handling and alternative retorting methods, may continue to be carried out in accordance with the EA. Similarly, intermittent extraction will occur throughout the R&D phase to supply the TDP.

While rehabilitation is progressive as areas become available, there will also be a period following completion of the full production period, when rehabilitation of the balance areas is undertaken. It is noted that this final rehabilitation period comprises part of the overall duration of the mine. Rehabilitation periods for different types of PMLUs differ, as set out in the PRC schedule. Most importantly, for the final void, this includes demonstration that water quality outcomes have been complied with for at least five consecutive years. Following the cessation of placement of waste at the MRAs (i.e. the Out-of-pit and the In-pit MRAs), post-closure care is required to be undertaken for:

- a period of 30 years
- such shorter period until it is demonstrated to the administering authority in a competent manner using relevant information that the MRA and surrounding site are geotechnically stable and that no release of waste materials, contaminated runoff/seepage or other contaminants that may cause environmental harm is likely

At the date of lodgement of this PRC plan, these requirements are included in Condition G28 of the EA and are proposed to be adopted by this PRC plan (and any rehabilitation requirements of the EA may be deleted by the administering authority upon approval of the PRCP schedule).

The rehabilitation and closure requirements and outcomes from the EA have been integrated into the PRCP schedule, which identifies when each rehabilitation milestone and milestone criteria are to be achieved.

The proposed rehabilitation timing is detailed further in Section 2.4, Section 7.6 and the PRCP schedule (Part B, Section 11).

2.2. Baseline information

PRCP Guideline (Section 3.1)

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

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

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

It is important to note that the baseline information only needs to be included 'where relevant'. The Project Site is within the Gladstone SDA and PMLUs will be regulated by the Development Scheme, which overrides any other legislation that regulates land use under Section 84 of the SDPWO Act. This does not override the requirements regarding rehabilitation of mined land under the EP Act, but it means that PMLUs can only be interpreted in the context of either the Development Scheme or the continuation of existing lawful uses under Section 85 of the SDPWO Act. To the extent that the EA currently allows an option for some areas to be developed for an Industrial PMLU, that option has been adopted for this PRC plan and this PMLU needs to be interpreted in the context of the Development Scheme.

To the extent that other PMLUs proposed to be transitioned from the EA, these can only be interpreted in the context of Section 85 of the SDWPO Act, that is, as continuations of an existing lawful use (e.g. State Forest or grazing). The conversion of dams to farm dams is consistent with this. Because of Section 85 of the SDPWO Act, the PMLU of 'native bushland ecosystem' can only be interpreted in the context of analogue State Forest and only to the extent that this development is not inconsistent with the future development of the Project site (and surrounding land) for industrial purposes.

This PRC plan has taken the approach of including various baseline information even where it is clearly not relevant to the PMLUs. However, where this has been done, the baseline information must be interpreted in the context of the SDPWO Act and also Section 755(6)(b) of the EP Act (i.e. if the PRC plan had been lodged with the EA application, the PRC plan would have been interpreted in the context of the EIS 1993 and the EMOS 1996, both of which explained the PMLUs of 'native bushland ecosystem' and the 'freshwater wetland' in further detail).

2.2.1. Site topography

The Project is situated on a coastal plain approximately 3 km east of Mount Larcom Range, which rises to more than 600 mAHD. Mount Larcom peak is located approximately 4.7 km west of the Project site. The Project site is located in the Calliope River Basin, which covers an area of approximately 2,236 km², with the site drained by a number of ephemeral drainage lines generally in a north-easterly direction to the Gladstone Harbour.

The drainage lines commence in the ridgeline immediately to the west of the Project site, with steep gullies associated with the steeper topography in the vicinity of the ridgeline transitioning to wider, flatter overland flow paths in the eastern portion of the Project site where the topography is relatively flat. The ridgeline to the west of the Project site is approximately 325 mAHD.

Site contour data indicates topographic relief decreases in a generally north-easterly direction to approximately 0 mAHD in the tidal areas to the east of the Project site. Across ML 80003, elevation typically ranges from 10 to 40 mAHD. The existing mine pit and other infrastructure associated with the Project have locally altered elevations.

2.2.2. Climate

Gladstone is part of a tropical savannah climate and Australia's southernmost region to be classified as such, meeting the requirements of this classification as a result of:

- average temperatures in excess of 18°C
- dominant dry season with less than 60 mm of rainfall
- average maximum temperatures of 27°C

The closest Bureau of Meteorology weather station is located approximately 13.5 km to the south-east of the Project site at the Gladstone Radar Station (Site Number 039123), with data collection commencing at this located in 1957 and provides more than 75 years of data.

The region experiences an average maximum temperature of 27.8°C and an average minimum temperature of 18.6°C. January is the hottest month with an average maximum temperature of 31.4°C, while July is the coldest month with an average minimum temperature of 13.5°C. The long-term monthly mean maximum and minimum temperature for the Gladstone Radar Station is presented in Figure 2.3. The annual average relative humidity reading collected at 9:00 am from the Gladstone Radar Station is 67%, while at 3:00 pm the annual average is 53%.

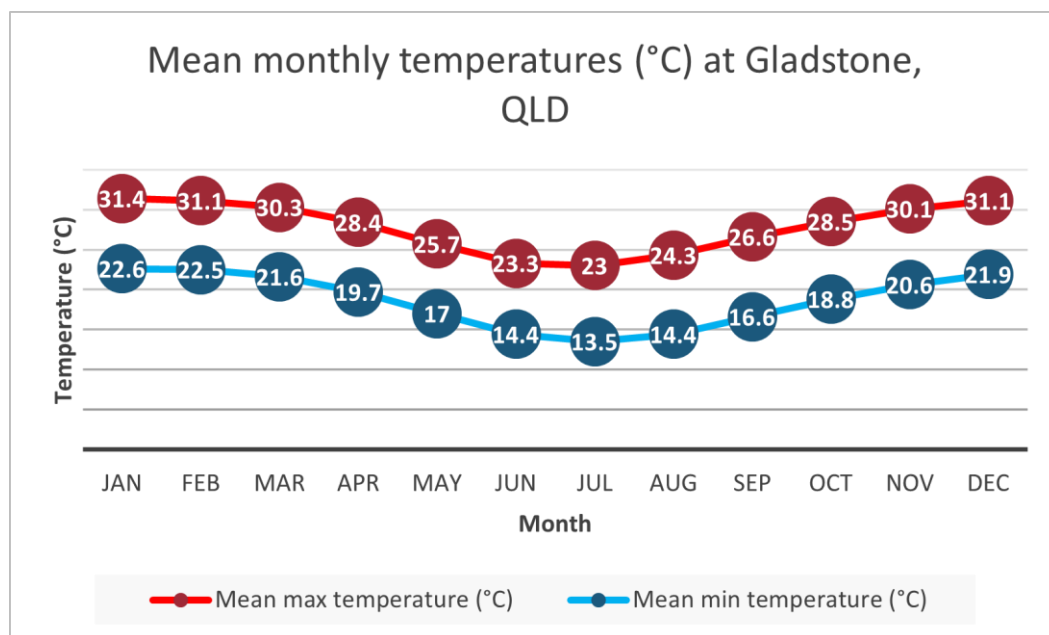


Figure 2.3 Long-term maximum & minimum monthly temperatures at Gladstone Radar Station

Rainfall data collected at the Gladstone Radar Station shows that January is the wettest month, with an average rainfall of almost 170 mm. The average annual rainfall is 958 mm.

Additional rainfall and evapotranspiration data were sourced from the Scientific Information for Landowners (SILO) database. SILO is operated by DESI, with data contributions from Bureau of Meteorology. The evaporation rate is highest from November through January. The evaporation rate is lowest from May through July. The only months where the rainfall exceeds the estimated evaporation rates are January and February, June, and July. Mean potential annual evapotranspiration for the region is estimated to be 1,858.1 mm, which is almost double the annual average rainfall of 958 mm. The long-term monthly mean rainfall and evaporation rates from SILO is presented in Figure 2.4.

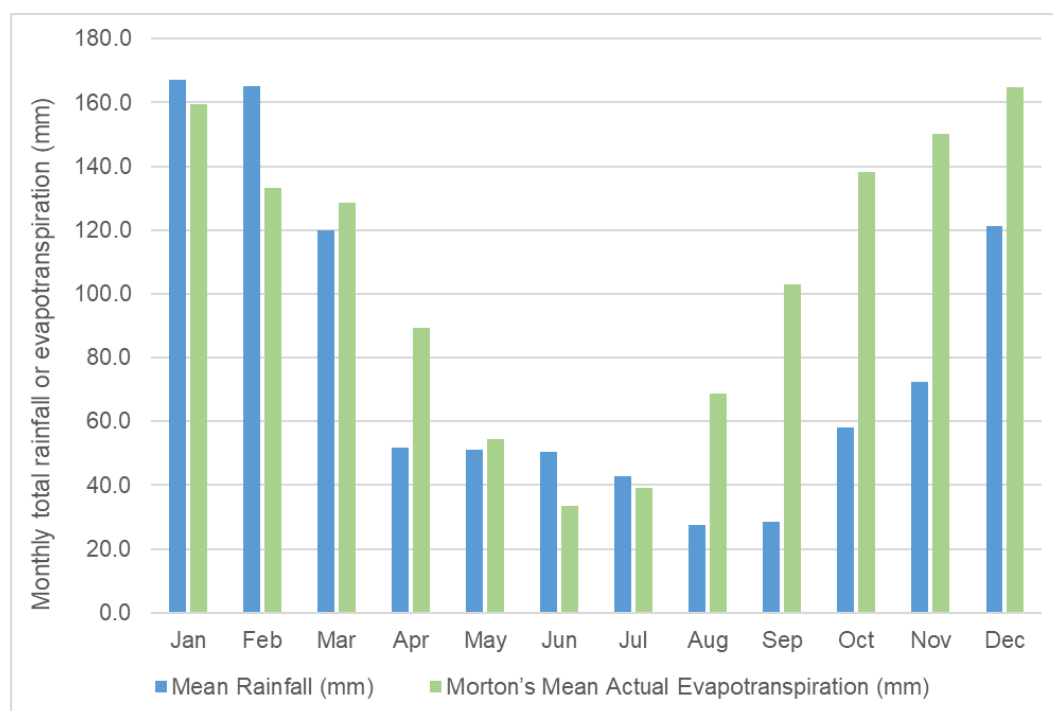


Figure 2.4 Long-term average monthly total rainfall and evapotranspiration (Morton's areal actual)

On an average basis, the prevailing winds follow a south-east/east axis at 9:00 am and east/north-east axis at 3:00 pm. During the summer months, the winds originate from the south-east/east axis at 9:00 am and north-east/east axis at 3:00 pm, while during the winter months the winds originate from the south-east/west axis at 9:00 am and east/north-east axis at 3:00 pm. Spring and autumn are a transition of these wind flows.

2.2.2.1. Long-term climate predictions

Long-term climate projections for the region will be influenced by continually evolving climatic change. The long-term climate projections for Queensland and the region include (Climate Change in Australia, 2021):

- increased temperatures
- increase in number of 'hot' days above 35 °C
- longer fire seasons
- more intense extreme rainfall events during the wet season
- dryer dry seasons.

2.2.3. Geology

2.2.3.1. Geological setting and stratigraphy

The Project lies within the Narrows Graben, a late-Palaeozoic structure-oriented north-south along the Gladstone coast. The graben is about 40 km long and about 5 km wide and filled with Tertiary period sediments, called 'The Narrows Group'. Sedimentation (in-filling) of the graben commenced prior to the middle-Eocene (about 42 million years ago) and continued through until the late-Eocene (about 35 million years ago), culminating in over 1000 m of sediment thickness.

The predominant geological group at the Project is The Narrows Group, which comprises three major formations (described as follows from youngest to oldest):

- Curlew Formation (CF): is up to 20 m thick at the Project site and has been informally subdivided into upper and lower sub-units. The upper section comprises claystone and clayey sandstones with interbedded kerogen shale, lignite, and siltstone. The lower sub-unit predominantly comprises lignite and carbonaceous kerogen shale. The CF conformably overlies the Rundle Formation. At the Project site, all CF material is expected to be mined as ore (and will comprise about 5% of the ore).
- Rundle Formation: was formed in a freshwater lacustrine environment and comprises six kerogen shale members and two claystone members. The uppermost kerogen shale member is the Kerosene Creek Member (KCK), which is the kerogen shale is mined at ML 80003 and is the dominant kerogen shale resource for the Project, representing about 95% of the ore. The Rundle Formation is up to 600 m thick, with the upper 400 m containing the bulk of the kerogen shale. Some minor lignite beds also occur. The Rundle Formation conformably overlies the Worthington Formation.
- Worthington Formation: a generally upward fining sequence of cobble conglomerate grading up through sandy siltstone and siltstone to variably sandy and silty claystone. The Worthington Formation is at least 290 m thick and lies below the kerogen shale units.

The Narrows Group is unconformably overlain by Quaternary (Qa) colluvium and alluvium.

A generalised stratigraphy of the resource at the Project is shown in Figure 2.5 and simplified west-east and north-south geological cross-sections through the northern part of the pit (and final void) are shown in Figure 2.6. Further detail is provided in the *Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste* (Terrenus, 2023) (Appendix F).

Project Stratigraphy						
Era	Period	Group	Formation	Member	Lithology	Designation ^{1,2}
Cainozoic	Quaternary (Qa) [Holocene]	---	---	Surficial deposits	Alluvial gravel; sand; silt; clay; saline mud; ridge sand	waste rock
		---	---	Colluvial deposits	Colluvial gravel; sand & soil; minor conglomerate & sandstone	waste rock
	Tertiary (T) [Middle to Late Eocene]	The Narrows Group	Curlew Fm (CF)	---	Claystone; interbeds of lignite, kerogen shale & sandstone	ore
			Rundle Fm	Kerosene Ck (KCK)	Kerogen shale; lesser interbeds of claystone & lignite	~93% ore ~7% waste rock
				Telegraph Ck (TC) ³	Claystone; lesser interbeds of kerogen shale; minor dolomite	waste rock
				Munduran Ck (MUN)	Kerogen shale; lesser interbeds of claystone; rare lignite	not mined
				Humpy Ck (HC)	Kerogen shale; lignite; lesser claystone interbeds	
				Brick Kiln (BKN)	Kerogen shale; minor interbeds of claystone; rare lignite	
				Ramsay Crossing (RX)	Kerogen shale; claystone dominant in upper section; rare lignite	
				Teningie Ck (TEN)		
				Monte Christo (MOC)	Interbedded claystone and kerogen shale; siltstone; sandstone; lignite; dolomite; "red beds"	
			Worthington Fm	---	Fining upward sequences of conglomerates, sandstone and claystone	
			Palaeozoic sedimentary units (Curtis Island Group) not mined			

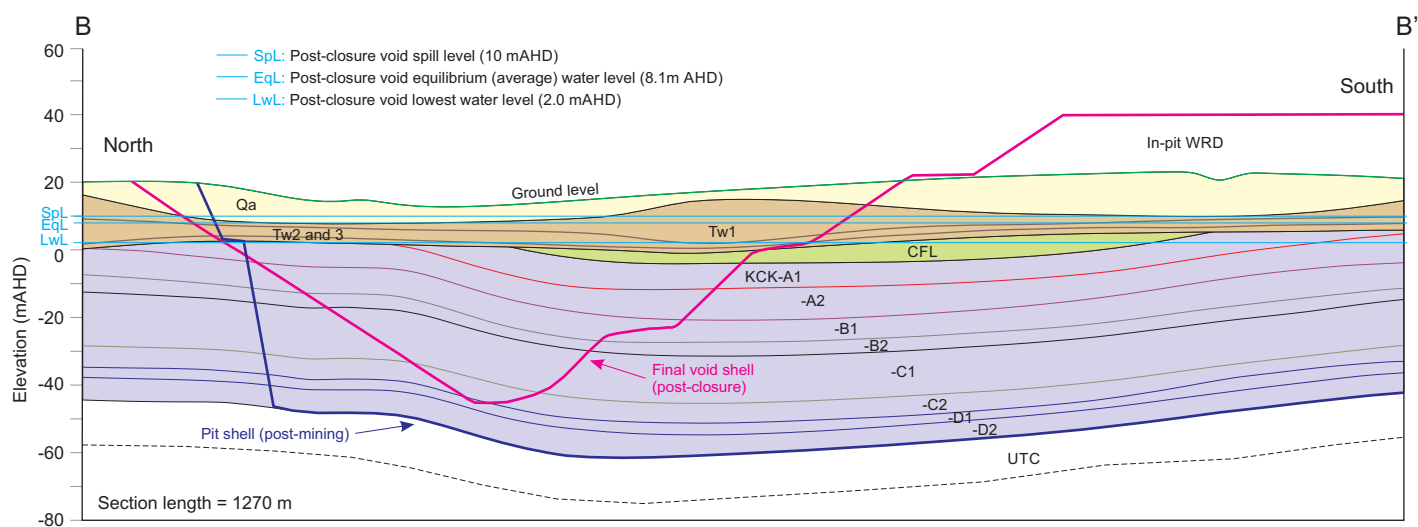
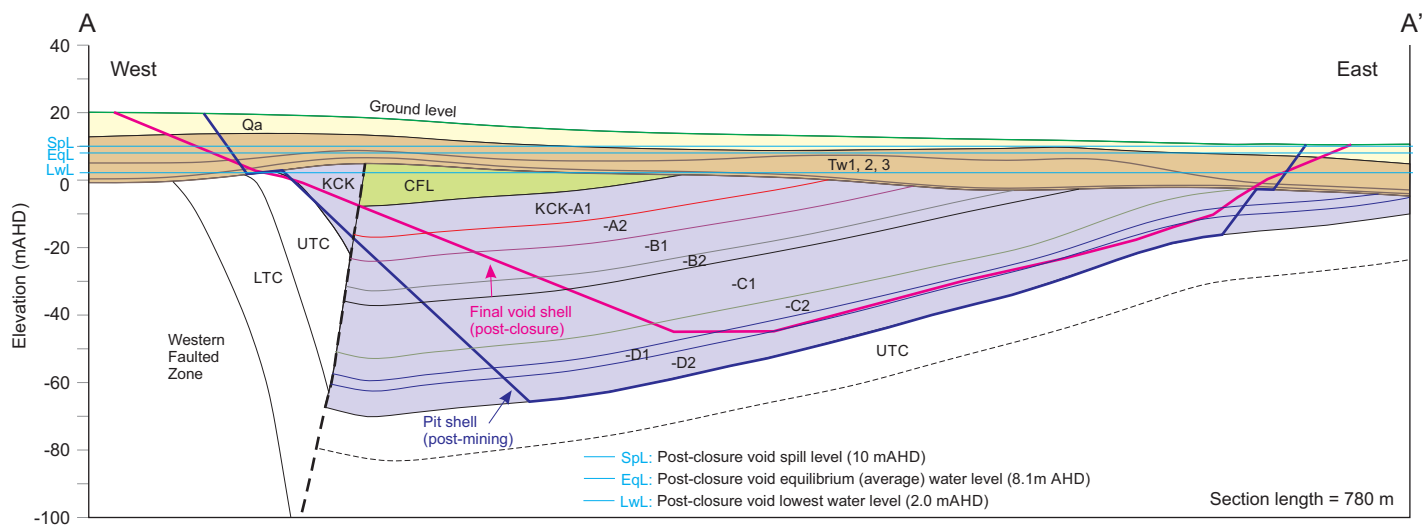
1. Designation applies to unweathered (fresh) rock as being 'waste rock' or 'ore'.

2. Weathered (oxidised) material, regardless of geological unit, is waste rock.

3. A small quantity of the TC member will be mined (as waste) as part of pit development.

Source: Terrenus (2023).

Figure 2.5 Stratigraphic column of the Stuart deposit



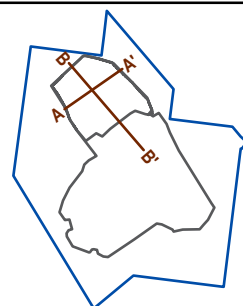
Source: 'Cross-section QER PRCP.cdr' Terrenus 2023-04-17, modified 2023-04-26

QUEENSLAND ENERGY RESOURCES

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Figure 2.6
Simplified stratigraphic west-east
and north-south cross-sections
through the final void location
(Terrenus, 2023)



Date: 26/04/2023

Drawn By: Ian Swane

RTPL_QER_STPRC_PRCMAP0005_A

Requested by: John Linden

2.2.3.2. Weathering

The weathered zone (comprising weathered Tertiary [Tw] and Qa sediments) is up to 45 m thick through the deposit, however the depth to base of weathering in the pit area is typically about 16 to 20 m below natural surface. The Tw1, Tw2, or Tw3 designation is applied to any weathered Tertiary substrate and generally reflects the intensity of weathering that has occurred: Tw1 being completely weathered; Tw2 being moderately to highly weathered; and Tw3 being slightly to moderately weathered. Additionally, Tw1 and Tw2 are primarily claystone, whereas Tw3 is mostly weathered kerogen shale.

2.2.3.3. Stratigraphy of the main waste rock units

Qa and weathered Tertiary units (Tw1, Tw2, and Tw3) collectively comprise about 90% of all waste rock to be mined (Figure 2.7), with the remaining waste rock primarily being KCK-B2 sub-member. The weathered Tertiary units are comprised of weathered CF and weathered KCK members (primarily KCK-A and KCK-B sub-members).

2.2.3.4. Stratigraphy of the main ore units

The KCK member is the primary kerogen shale unit to be mined and represents approximately 95% of ROM ore. The KCK has four sub-members (KCK-A, B, C, and D) and each sub-member has an upper and lower ply (nominated as 1 and 2). For example, KCK-A1 and KCK-A2. All KCK sub-members are ore, except for the B1 sub-member, which is waste rock. The CF immediately above the KCK (and where present, is situated between the Tw3 and the KCK members) is mined as ore and represents approximately 5% of ROM ore.

2.2.4. Soil types, properties, and productivity

2.2.4.1. Contaminated land

A contaminated land assessment was undertaken for the Project site by Environmental Earth Sciences (2015) (Appendix G). The assessment was in the form of a Stage 1 – Preliminary Site Investigation (PSI), which was prepared in accordance with the Guidelines for Contaminated Land Professionals (DEHP, 2014). The PSI included an assessment of the land use history, a contaminated land database search, site inspection, and soil sampling. No evidence of significant contamination or previous contaminating activities were found within the Project disturbance footprint.

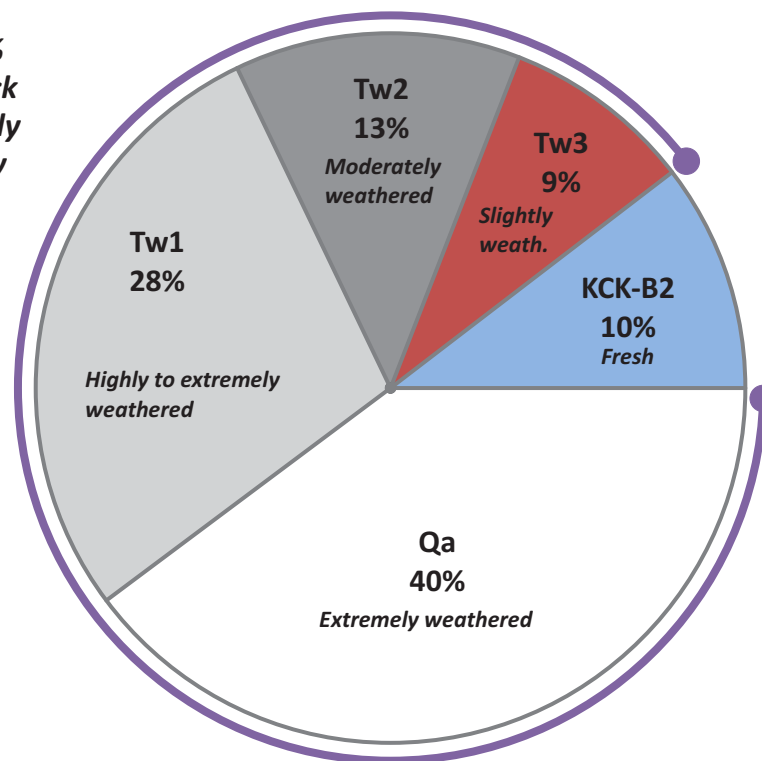
As such, no further investigation or assessment was found to be required.

2.2.4.2. Previous in situ soil mapping

Envirosciences (1992) surveyed soils within ML 80003 for the EIA (Envirosciences, 1993), with 14 Test Pits assessed as part of the survey. The ML was found to contain red and yellow duplex loamy soils. Of the 14 Test Pits, 9 soils from within the surface 0.3 m were assessed for particle size distribution, Emerson class (dispersion risk), organic carbon (OC), pH measured in water (pHw), and soil salinity (EC1:5). These data are reproduced in Table 2.2. The sand, silt and clay proportions are expressed as a fraction of the fine fraction (<2 mm) rather than as a fraction of the fine and gravel fraction combined to better assess the texture of the soil.

All soils had very low salinity, and slightly to moderately acidic pH. All soils had relatively high OC, which was reflected in the very stable (highly aggregated) Emerson class values measured (Class 8). Emerson class values of the subsoils from Test Pit 1 and 14 (Class 3) indicate that these subsoils may be prone to dispersion. All soils had relatively high silt content and low sand content. The soils commonly had a silty loam texture.

*approx. 81%
of waste rock
is moderately
to extremely
weathered;
and 9% is
slightly
weathered*



UTC & LTC
<0.1%
Fresh

Source: Terrenus 2023-04-17

QUEENSLAND ENERGY RESOURCES

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Figure 2.7
Proportion of waste rock units
expected to be mined
(Terrenus, 2023)

Date: 26/04/2023

Drawn By: Ian Swane

RTPL_QER_STPRC_PRCMAP0006_B

Requested by: John Linden

Table 2.2 Characteristics of the duplex sandy loam soils of the Project

Test Pit	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Emerson Class	OC (%)	pHw (pH Units)	EC1:5 (dS/m)
1	0.0 to 0.1	65	54	29	17	8	6.7	6.4	0.06
1	0.1 to 0.2	47	70	19	11	3	3.4	5.9	0.02
3	0.0 to 0.1	46	61	28	11	8	5.5	6.0	0.05
8	0.0 to 0.1	30	43	34	23	8	2.8	6.5	0.04
12	0.0 to 0.1	59	46	24	29	8	3.3	5.8	0.02
13	0.0 to 0.15	32	49	28	24	8	4.2	5.6	0.02
14	0.0 to 0.1	7	37	39	25	8	3.8	5.0	0.03
14	0.1 to 0.2	43	40	28	32	8	3.3	5.7	0.01
14	0.2 to 0.3	22	47	44	9	3	3.8	5.8	0.04

Source: Envirosciences (1992).

GSS (2012) completed a soil, land and strategic cropping land suitability assessment for a wider area that included the Project's ML. Soils identified within the ML include sodosols, ferrosols, dermosols, kurosols, and chromosols. A summary of the properties of the surface soils (A horizons) in these broad soil types is given in Table 2.3. The results compare favourably to those of Envirosciences (1992) in that the textures are silty loams, salinity levels are low, and pHw is acidic. GSS (2012) listed exchangeable sodium percentage (ESP) values. These data indicate that only the sodosols could be considered sodic and prone to clay dispersion.

Table 2.3 Summary characteristics of the surface soils of the Project

Soil type	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	pHw (pH Units)	EC1:5 (dS/m) ²	ECEC (meq/100g)	ESP (%)
Sodosols	10	50 to 60	30	10 to 20	6.0 to 7.0	0.10 to 0.20	11 to 12	12 to 33
Ferrosols	10 to 20	40 to 50	20 to 30	15 to 40	6.0	0.01	4 to 6	2 to 3
Dermosols	5 to 10	40 to 50	30	25	6.0 to 7.0	0.05	8 to 10	1 to 6
Kurosols	30 to 60	40 to 50	30 to 50	5 to 15	6.0	0.10	6 to 17	2 to 3
Chromosols	5	30 to 50	25 to 30	20 to 40	6.0	0.01	5 to 11	1

Source: GSS (2012).

ECE values converted to EC1:5 by dividing by 15.

Soil Mapping and Monitoring (2014) conducted a soil and land suitability assessment for the previously proposed Stage 2 of the Project (subsequently withdrawn); this is essentially the land surrounding the proposed disturbance area and within the ML boundary (Figure 2.1). Similar soils to those reported by GSS (2012) were found, including:

- gravelly gradational soil overlying sedimentary rocks
- gravelly bleached mottled texture contrast soil on colluvial pediments

The gravelly gradational soils had acidic pH and low salinity and sodicity (ESP). Clay contents in the upper 0.3 m ranged from 20 to 30% and these soils had a loam texture. Similarly, gravelly bleached mottled texture contrast soils had acidic pH and low salinity and ESP. Clay contents in the upper 0.3 m ranged from 10 to 16%, and these soils had a loam texture.

2.2.4.3. Stockpiled soils

Soils have been stockpiled to the south-eastern section of the Out-of-pit MRA. These soils have been sourced from within the footprint of disturbance that currently exists, with 20 soil samples assessed as part of the work completed for the *Landform Cover Design* (Landloch, 2024a) (Appendix H), *Rehabilitation Landform Design* (Landloch, 2024b) (Appendix I) and *Revegetation Plan* (Landloch, 2024c) (Appendix J). This sampling was undertaken to determine the current condition of this soil resource, as it is assumed to be an important source of primary growth media for rehabilitation. Samples were taken from five locations and four depths at each location (Figure 2.8).

The 20 samples were tested for:

- pHw
- EC1:5 and soluble chlorine (Cl)
- exchangeable cations (calcium [Ca²⁺], magnesium [Mg²⁺], potassium [K⁺], sodium [Na⁺], and aluminium [Al³⁺]), and calculations of Effective Cation Exchange Capacity (ECEC), and ESP;
- coarse fraction (>2mm)
- particle size distribution of the fine fraction (<2mm) (sand, silt, clay)
- plant available water content (estimated based on particle size distribution)
- total nitrogen (TN) and total phosphorus
- organic C
- Colwell soil test – available P and K, and (potassium chloride [KCl]) S
- trace elements (copper [Cu], zinc [Zn], manganese [Mn])

The testing results are given in the Final Landform report (Landloch, 2024a).

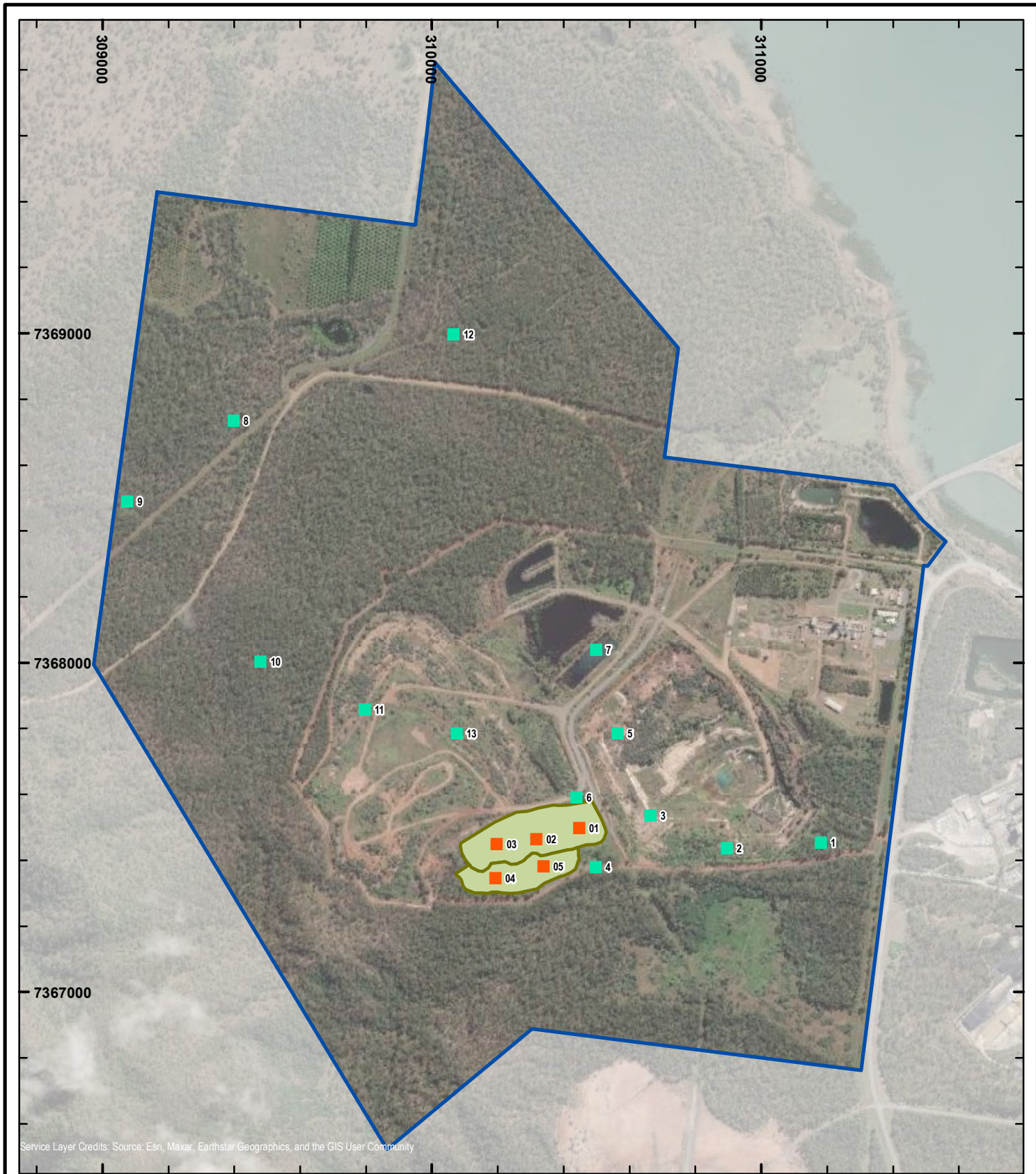
All soils are slightly to moderately acidic and have low salinity, except for the 1.0 to 2.0 m sample at Test Pit 4 that was moderately saline.

The samples generally have silty loam to clay loam textures, except for Test Pit 3 which had clay textures. Coarse fraction contents were similar (or slightly higher) to those measured by Envirosciences (Table 2.2) and higher than those reported by GSS (Table 2.3). This is likely due to the presence of hard soil clods that were not readily broken down by the sieving process. The soils are generally non-sodic (median ESP 2.5% with only one sample with an ESP >6%) and considered not prone to dispersion, hardsetting, or tunnel erosion.

The soils have low levels of TN (median 783 micrograms per kilogram [mg/kg] or 0.08%), but generally suitable levels of other nutrients. A modest addition of N-based fertiliser at the point of reseeding would improve plant establishment.

The plant available water content (PAWC) of the soils is 12 to 28% or 120 to 280 mm of water storage per 1 m of soil (median value of 200 mm/m). This is relatively high and will mean that relatively large rainfall events will be stored near the surface at depths available for plant water use, especially because the underlying overburden and interburden that will form the secondary growth media layer also has a silty loam to clay loam texture with similar PAWC. For example, a PAWC of 200 mm/m could store a nine-hour duration design storm with a return period of 50 years or a six-hour storm with a return period of 100 years. Average infiltration below 1 m from the surface of the rehabilitation landform is predicted to be 7% of rainfall, or 62 mm per year.¹

¹ Output from the HowLeaky model using the soils data from Table 6 (Properties of the stockpiled soils) of Appendix I and climate data from Gladstone



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	Figure 2.8 1992 and 2023 Soil sample locations (Landloch, 2024b)	Legend  ML 80003  Topsoil stockpile  Soil sample location - 2023  Soil sample location - 1992
Date: 8/03/2024	Drawn By: Chris Schlebusch	
RTPL_QER_STPRC_PRCMAP0007_C	Requested by: John Linden	Sources: © State of Queensland, Department of Resources

Based on these results, it was concluded that the stockpiled soils have similar properties to those measured for the in-situ soils. This is important because the in-situ soils currently support woodland ecosystems similar to the ecosystems targeted by the PMLU. It was concluded that the available soils (in situ and stockpiled) are considered to be of suitable quality for use as a primary growth media to support the PMLU (woodland species), given that these soils are currently supporting similar ecosystems.

2.2.5. Site hydrology and fluvial networks

The Project is situated in the Calliope River sub basin. The Calliope River sub basin has a total catchment of 2,249 km², representing the total area of the greater Calliope drainage basin (DEHP, 2014). The Calliope catchment is surrounded by the Fitzroy, Dawson, and Boyne rivers and Curtis Island sub basin (DEHP, 2014).

The main river within the Calliope Basin is the Calliope River, which flows towards the east from its headwaters in the Calliope Ranges. The Calliope River flows into Port Curtis, and the coastal drainage flows directly into the Coral Sea/Pacific Ocean. All waterways eventually lead into the Great Barrier Reef Marine Park (DEHP, 2014).

The Project site is located at the eastern boundary of the Calliope Basin, bordering Port Curtis, a busy industrial harbour. There is one named waterway (Targinie Creek) which traverses the upper north-western corner of ML 80003, otherwise only ephemeral unnamed gullies known as Gullies A through E (Figure 2.9).

The lower reaches of Gully C are used as a water release point for excess stored mine area run off. Targinie Creek and the gullies drain directly to Port Curtis approximately 1 km downstream of the Project site (Figure 2.9).

The gullies are ephemeral and flow following rainfall events with catchment areas ranging between 80 ha to 200 ha at the downstream extent of the ML. Targinie Creek is the largest waterway near the project and intersects the northwest corner of the ML. Targinie Creek has a total catchment area of 950 ha at the site location and is unaffected by mining activities at the Project site.

Surface water flows entering (and from) the southern end of the site flow into un-named drainage depressions that flow into Port Curtis near Serrant Road. Surface water entering (and from) the northern end of the site flows into 'Gully E', an ephemeral drainage depression that flows into Port Curtis beyond the northern extent of ML 80003.

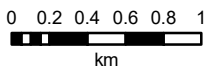
Further information on site hydrology can be found in the *Hydrology and Water Management Technical Study* (Engeny, 2024) (Appendix K).

2.2.6. Groundwater levels and properties

The following information about groundwater and hydrogeology is general and provided for broad context. The *Hydrogeological Report* (AGE, 2024) (Appendix L) contains detailed information about the groundwater environment at the Project.



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



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Stuart Kerogen Shale Project



GDA2020, MGA Zone 56



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Figure 2.9
Drainage characteristics
of the Project site
(AGE, 2024)

Legend

- ▬ ML 80003
- ~ Watercourse

Elevation
(mAHD)

325
0



Sources:
© State of Queensland, Department of Resources

Date: 8/03/2024

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0008_C

Requested by: John Linden

Groundwater in the Project site is associated with two primary aquifer systems:

- Qa alluvium/colluvium: unconfined local – to intermediate-scale flow systems in unconsolidated sediments. Groundwater flow is controlled by the presence of clayey materials, which typically inhibit productive yields. Some thicker, more permeable zones exist along drainage channels. Where this occurs locally, important shallow aquifers are present. Groundwater levels within the Quaternary alluvium are relatively shallow and generally less than 10 mBGL, with an average water level of about 5 mBGL. Groundwater elevation in the Qa alluvium responds closely to rainfall events, with rapid rises following rainfall events followed by a rapid decline.
- Rundle Formation: semi-confined to confined fractured rock aquifer with groundwater flow primarily a result of secondary porosity (e.g. via fractures). In some areas, artesian groundwater pressures have been encountered. Groundwater in the Rundle Formation is generally less than 15 mBGL, with an average depth of 10 mBGL. Groundwater elevation in the Rundle Formation shows a muted, delayed response to rainfall events, except in areas adjacent to drainage channels where groundwater levels are more responsive to rainfall.

The Qa alluvium and Rundle Formation aquifers are indicated to be hydraulically separated by a layer of weathered Tertiary material that conformably overlies the kerogen shale-bearing Rundle Formation.

A third aquifer 'system' – the Yarwun Targinie Hinterland pre-tertiary volcanics, metamorphics, and fractured rock – comprises unconfined fractured rock and unconsolidated sediment aquifers. Limited information is available to characterise this system, however it is not considered a significant aquifer system with respect to the Project.

The main recharge mechanisms to the shallow aquifers are diffuse rainfall recharge and point source recharge along drainage lines. Recharge to the Rundle Formation is via leakage from the alluvium and/or across the Western Faulted Zone. The main discharge processes are evapotranspiration from the shallow aquifer and coastal discharge.

Groundwater flow is generally towards the coast. There is a distinct cone of depressurisation around the existing pit. The cone of depression is elongated in a north-south direction, extending approximately 1.5 km north and south of the Project, and is largely constrained to the west by the Western Faulted Zone and to the east by the coast (hence, the elongated shape of the cone of depression).

2.2.6.1. Groundwater quality

Groundwater quality has been monitored for a large number (>40) of parameters across and near the Project site since 1989. These parameters include salinity indicators (e.g. total dissolved solids and electrical conductivity [EC]), field parameters (temperature, dissolved oxygen [DO], and field pH), major ions, total and dissolved metal concentrations, and nutrients (e.g. nitrogen compounds).

Quaternary alluvium and colluvium

Within the greater region of the Project, the Quaternary alluvium generally hosts the best water quality (AGE, 2010) compared with the fractured rock aquifers. The fresher water in these units results from the relatively higher recharge rates of this unit. However, where the fresh alluvial groundwater mixes with sea water at the marine interface, high salinity groundwater is present (generally closer to the coast or estuaries).

In the representative background bores, groundwater in the Quaternary alluvium and colluvium ranges from acidic to slightly alkaline, with highly variable EC and sulphate concentration as a result of the marine interface.

Groundwater samples from the Quaternary units have a sodium cation dominated composition, with a chloride dominated anion composition, reflecting the influence of sea salts. The bores with relatively low pH have sulphate concentrations of about 20 to 70 mg/L. Some contribution of acidity could be from dissolution of soil CO₂ during recharge. In addition, the sulphate concentrations indicate that some acidity may be from oxidation of organic matter (potentially present in the very dark grey Holocene sediments that are highly organic). The concentration of dissolved metals in the Quaternary units is generally low.

The bores with the highest EC values are located proximal to the coast and have groundwater elevations that are generally <3 mAHD, indicating that seawater is mixing with groundwater in these bores. The geometry of this seawater interface is incorporated into the conceptual groundwater model.

Rundle Formation

Water in the Rundle Formation is generally more saline than water from the overlying alluvium, where the alluvial water is not mixing at the marine interface. This is an expected result due to the comparably low recharge rate of the Rundle Formation. The salinity of groundwater is often linked to the degree to which the groundwater is flushed or diluted by recharge, and the degree of water-rock interaction; deeper units often have higher salinity. As such, it has been inferred that the variability in salinity of the Rundle Formation reflects the variable recharge rates.

In the representative bores, groundwater in the Rundle Formation is mildly acidic to alkaline, with highly variable EC, and sulphate concentration. The two bores with the highest EC values (SRH249 and TS10) are located proximal to the coast, indicating that, at depth, the seawater at the marine interface is mixing with groundwater in these bores, which is consistent with seawater influence.

Groundwater samples from the Rundle Formation generally have a sodium-dominated cation composition, with a chloride-dominated anion composition. One of the bores with relatively low pH (TS9/2) has relatively low sulphate concentrations (40 to 140 mg/L). Some contribution of acidity could be from dissolution of soil CO₂ during recharge. In addition, the sulphate concentrations indicate that some acidity may be from oxidation of sulphides present in kerogen shales. The concentration of dissolved metals in the Rundle Formation is generally low.

Hinterland Units

Within the greater region of the Project, there are a number of private groundwater bores and water quality of these bores has been previously reviewed by AGE (2010). These bores are generally screened within the Targinie Quartz Monzonite and most have EC values <3,500 microsiemens per centimetre (µS/cm) (i.e. they are suitable for stock watering purposes) (AGE, 2010).

There is only one representative bore from the Hinterland units and that bore (SRH 449) is screened in the Wandilla Formation. Groundwater in this bore is generally acidic, with relatively low EC, and low sulphate concentration. Groundwater from this bore has a sodium dominated cation composition, with a chloride dominated anion composition. Groundwater bores screened in the Hinterland units are distal enough from the coast to not be affected by the seawater mixing. The concentration of dissolved metals in the representative bores is also generally low.

2.2.7. Land Stability

Erosion monitoring was conducted on three locations at the Project between 2005 and 2009 (Landloch, 2012). Two of the locations were on the Out-of-pit MRA (east Out-of-pit MRA and south Out-of-pit MRA) and one location was in an undisturbed area adjacent to the Out-of-pit MRA. The two Out-of-pit MRA plots had gradients ranging from 10 to 20% and slope lengths of 34 to 44 m. The undisturbed plot had a gradient of 8% and a slope length of 30 m.

The east Out-of-pit MRA plot and undisturbed plot were both subjected to 2,236 mm of rain between March 2005 and March 2009 (4 years). The average annual rainfall was 569 mm, with annual rainfall ranging from 400 to 781 mm. For the same period, the annual erosivity (erosive potential of rain) calculated from rainfall intensity data from Gladstone was 1,952 MJ.mm/ha/hr/y. The South Out-of-pit MRA plot was operated from March 2005 to September 2007 (two years). It was subjected to a total of 1,287 mm rain. The average annual rainfall applied to this plot was 644 mm, and the rainfall erosivity for the trial period was 967 MJ.mm/ha/hr/y.

The long-term annual average erosivity for Gladstone is 3,486 MJ.mm/ha/hr/y, using data from December 1961 to November 2017. When the erosivity of the trial period is compared with the average long-term erosivity for Gladstone, the plots received rainfall with below average erosivity. The east Out-of-pit MRA and undisturbed plots received 56% of average annual erosivity and the south Out-of-pit MRA plot received 28% of average annual erosivity.

During the monitoring period, total erosion values expressed as an average annual value and adjusted to reflect long term average values were:²

- East Out-of-pit MRA: 0.85 tonnes per hectare per year (t/ha/y)
- South Out-of-pit MRA: 0.86 t/ha/y
- undisturbed area adjacent to the Out-of-pit MRA: 0.31 t/ha/y

The differences in the results reflect the difference in the gradients and vegetation cover of the Out-of-pit MRA and undisturbed plots of the Out-of-pit MRA. These results are for relatively short slopes but can be used to estimate soil erodibility that in turn can be used to predict erosion from longer slopes similar to those present at the Project using the Revised Universal Soil Loss Equation (RUSLE)³ (Renard et al., 1997).

Using the values from the RUSLE calculations, naturally occurring annual average erosion rates in the order of 1 to 12 t/ha/y can be expected for slopes present in the vicinity of the Project; rates are more commonly 4 to 6 t/ha/y. Based on these results, a target erosion threshold of <5 t/ha/y was used to indicate a landform with a low erosion rate. Erosion rates >10 t/ha/y were used to indicate slopes that erode at rates consistent with the high rates observed in the vicinity of the Project. Rates >10 t/ha/y are also often associated with land subject to higher degrees of rill and/or gully erosion.

2.2.8. Vegetation communities and ecological data

Baseline information is only required to be included 'where relevant' under Section 3.1 of the PRCP Guideline (DES, 2023a). Details of flora and fauna are not relevant to the industrial PMLU, permanent infrastructure or the conversion of detention basins to water storage (stock use).

Normally, full details of vegetation communities, fauna and ecological data would be relevant to identifying appropriate analogues and milestones for PMLUs such as the 'Freshwater Wetland' PMLU and the 'Native Bushland Ecosystem' PMLU. However, in the site-specific circumstances of this Project site, there are particular legal constraints, in particular:

² Adjustment was made by factoring the measured erosion up by the ratio between long-term erosivity and measured erosivity for the trial period.

³ The RUSLE equation is $A = R \times K \times LS \times P \times C$, where A is annual erosion, R is annual rainfall erosivity, K is soil erodibility, LS is the topographic factor, P is the practice factor (set to 1 for rangelands), and C is the cover factor.

To the extent that some of the PMLUs are not industrial, they are only protected under Section 85 of the SDPWO Act and under the intent for the Industry Investigation Precinct in the Development Scheme (DSDILGP, 2022), to the extent that they are continuations of an existing lawful use or an expansion of an existing lawful use that is not inconsistent with the industrial development of the Project site. Relevant existing uses of the Project site are State Forest and grazing, while there is an orchard in the north-west corner of the site, this is unlikely to be relevant as it is not proposed to be expanded.

Under Section 755(6)(b) of the EP Act, if this PRC plan had been submitted together with the Project site's EA application, it would have been assessed against the EIA (Envirosciences, 1993) and the EMOS (SPP, 1996), in which case, only revegetation was required and there were no criteria relating to re-establishment of fauna. The EMOS (SPP, 1996) was transitioned under Section 701 of the EP Act. However, the EMOS (SPP, 1996), provided for the re-establishment of fauna in the water storage (freshwater wetland) PMLU.

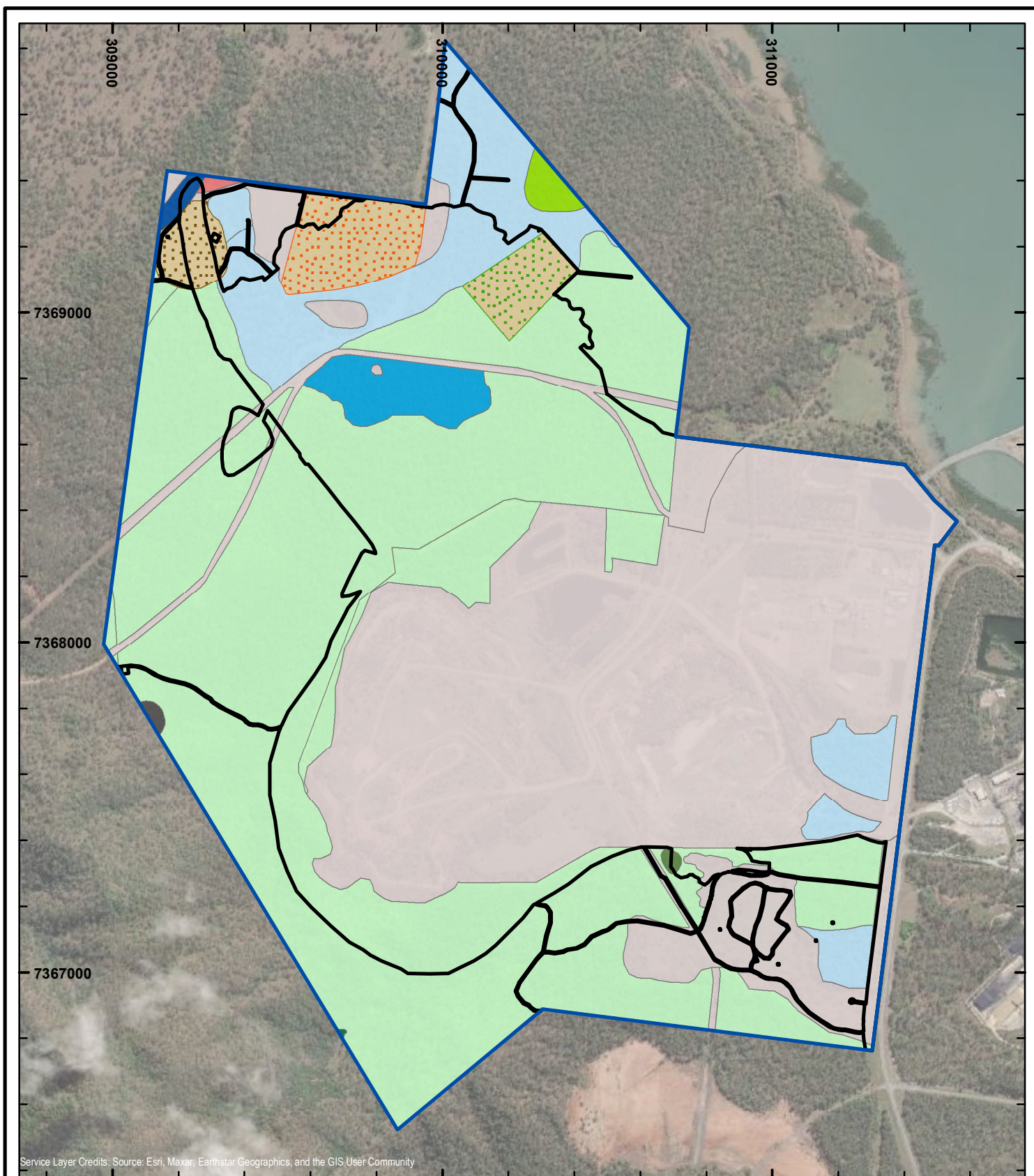
In practical terms, it will also be beyond the control of the holders to ensure re-establishment of fauna within relatively isolated areas of native ecosystem (bushland), given that both the Project site and surrounding land have been earmarked for future major Industrial development under the Development Scheme. In this context, water storage (freshwater wetland) and native ecosystem (bushland) are likely only to comprise isolated, unconnected landscape features within an overall Industrial estate.

2.2.8.1. Threatened ecological communities

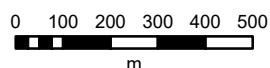
There are no listed threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) within ML 80003, or the EA approved disturbance area; however, Ecosure (2014a) identified 0.52 ha of semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions in four small patches to the west of ML 80003. SEVT is listed as Endangered under the EPBC Act. Essence (2025) mapped five Regional Ecosystems (REs) within the EA approved disturbance area, and a further four REs within the broader ML 80003 (Table 2.4). Of these, one has an Endangered biodiversity status (12.3.3) and three are Of Concern (11.3.25, 12.11.4, 12.11.14). However, of these Endangered and Of Concern REs, only 11.3.25 and 12.11.14 are present within the EA approved disturbance area (Figure 2.10).

2.2.8.2. Regional ecosystems

As part of the *Terrestrial and Aquatic Ecology Technical Report* (Essence, 2025) (Appendix M) reviewed five REs within the EA approved disturbance area, and a further four REs within the broader ML 80003 (Table 2.4) as mapped by Ecosure (2014c). Of these, one has an Endangered biodiversity status (12.3.3) and three are Of Concern (11.3.25, 12.11.4, and 12.11.14). However, of these Endangered and Of Concern REs, only 11.3.25 and 12.11.14 are present within the EA approved disturbance area (Figure 2.10). No groundwater dependent vegetation was recorded in surveys reviewed by Essence (2025).



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



QUEENSLAND ENERGY RESOURCES

Stuart Kerogen Shale Project



GDA2020, MGA Zone 56

Figure 2.10
Location of ground-truthed
Regional Ecosystems
(Essence 2024)

Legend

- ML 80003
- EA Approved Disturbance Area

GTRE in ML80003

- | | | |
|--|--|---|
| Non-remnant | 11.11.15 | 12.11.6 |
| Macadamia plantation | 11.3.25 | 12.3.3 |
| Mango plantation | 11.3.29 | 12.3.6 |
| Rehabilitated spotted gum regrowth | 12.11.14 | 12.5.1 |
| | 12.11.4 | |

Date: 8/03/2024

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0009_C

Requested by: John Linden

Table 2.4 Regional Ecosystems ground-truthed in ML 80003 and EA approved disturbance area

RE	Short description	Biodiversity Status	Area in EA approved disturbance area (ha)	Area in ML 80003 (ha)
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	OC	0.31	10.64
11.3.29	<i>Eucalyptus crebra</i> , <i>E. exserta</i> , <i>Melaleuca</i> spp. Woodland on alluvial plains	NC	8.63	8.63
12.5.1	Open forest complex with <i>Corymbia citriodora</i> subsp. <i>variegata</i> on subcoastal remnant Tertiary surfaces. Usually deep red soils	NC	0.03	11.85
12.11.6	<i>Corymbia citriodora</i> subsp. <i>variegata</i> , <i>Eucalyptus crebra</i> woodland on metamorphics +/- interbedded volcanics	NC	89.91	352.97
12.11.14	<i>Eucalyptus crebra</i> , <i>E. tereticornis</i> , <i>Corymbia intermedia</i> woodland on metamorphics +/- interbedded volcanics	OC	22.28	50.15
11.11.15	<i>Eucalyptus crebra</i> woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics	NC	-	1.51
12.11.4	Semi-evergreen vine thicket on metamorphics +/- interbedded volcanics	OC	-	6.12
12.3.3	<i>Eucalyptus tereticornis</i> woodland on Quaternary alluvium	E	-	20.54
12.3.6	<i>Melaleuca quinquenervia</i> +/- <i>Eucalyptus tereticornis</i> , <i>Lophostemon suaveolens</i> , <i>Corymbia intermedia</i> open forest on coastal alluvial plains	NC	0.15	0.33

Source: Essence (2025).

Biodiversity Status: E Endangered; OC Of Concern; NC Not of Concern

2.2.8.3. Potential groundwater dependent ecosystems

According to the Groundwater Dependent Ecosystems Atlas (GDE Atlas) (BoM & DSITI, 2016), there are ecological areas in the region of the Project that are potentially dependent on groundwater to some degree for ecological function.

Terrestrial GDEs

According to the GDE Atlas, there are moderate potential terrestrial GDEs north of the Project (Figure 2.11). Bores near the Project site document that the depth to groundwater, particularly in the Quaternary units, is often close (<5 mBGL) to the surface and within the reach of vegetation roots. As such, identification of potential terrestrial GDEs is dependent on professional ecological surveys, with Essence (2025) identifying two ecosystems (RE 11.3.25 and RE 12.11.14) that are considered to have a conservation status as 'Of Concern' (Section 2.3.8.2).

In addition, based on interpreted hydraulic head contours for rock above ground surface, Coffey (2014) identified areas along the reaches of Humpy Creek and Targinie Creek that may contain springs as a result of basement sub-crop acting to restrict the transmissive capacity of overlying alluvium. If they exist, these spring zones would have potential for terrestrial GDEs. These potential spring zones are displayed on Figure 2.11

In determining potential impacts from groundwater, the key consideration for the identified REs is the species assemblage and the rooting depth, which, when coupled with groundwater levels, allows evaluation of the potential for the RE to be a potential receptor; this information is summarised in Table 2.5.

The potential terrestrial GDEs described here are considered potential receptors out of an abundance of caution (AGE, 2024). It is important to note that groundwater dependence of the vegetation is uncertain (and unlikely) in the Project site because groundwater, especially in the Rundle Formation is saline and it is unlikely to be relied upon by vegetation because of its natural salinity.

Table 2.5 Summary of concern REs and associate rooting depths

RE	Species	Predicted maximum rooting depth (m)	Source
11.3.25	<i>Eucalyptus tereticornis</i>	~7 up to 9	Jones et al. (2019); Kallarackal and Somen (1998)
	<i>Melaleuca fluviatilis</i> ¹	>4 but <7	O'Grady et al. (2006)
	<i>Casuarina cunninghamiana</i>	0 to 2; trees mostly use free river water	O'Grady et al. (2006)
12.11.14	<i>Eucalyptus crebra</i>	Probably <2; 60% of root biomass in 0 to 100 m	Fensham and Fairfax (2007)
	<i>Corymbia intermedia</i> ²	>7	O'Grady et al. (2006)
	<i>Eucalyptus tereticornis</i>	<7	Jones et al. (2019)
	<i>Lophostemon suaveolens</i>	4 to 6	O'Grady et al. (2006)

Surrogate species in publication is *M. leucadendra*: very similar habitat to preferences to *M. fluviatilis*.

Surrogate species in publication is *C. clarksoniana*: similar habitat preferences to *C. intermedia*.

Aquatic GDEs

The definition of an aquatic GDE is an ecosystem (be it an aquatic, riparian or wetland ecosystem) that is dependent to some degree on the surface expression of groundwater. Therefore, for an aquatic GDE to be present, a surface expression of groundwater must be suspected or identified.

According to the GDE Atlas, there are no known springs in ML 80003 (Government QLD, 2018), and the only mapped potential aquatic GDE within the region is a constructed dam being used for industrial purposes at a neighbouring industrial site (Figure 2.11). While QER is of the view that inclusion of this historic slurry dam in the GDE mapping may be in error, this has been considered in the report completed by AGE (2024).

As discussed above, Humpy Creek retains isolated pools of water during dry times, suggesting some groundwater contribution, and baseflow to regional creeks is estimated to contribute up to 12% of creek discharge (Coffey, 2014). In addition, the potential for groundwater contributions to Targinie Creek have been suggested.

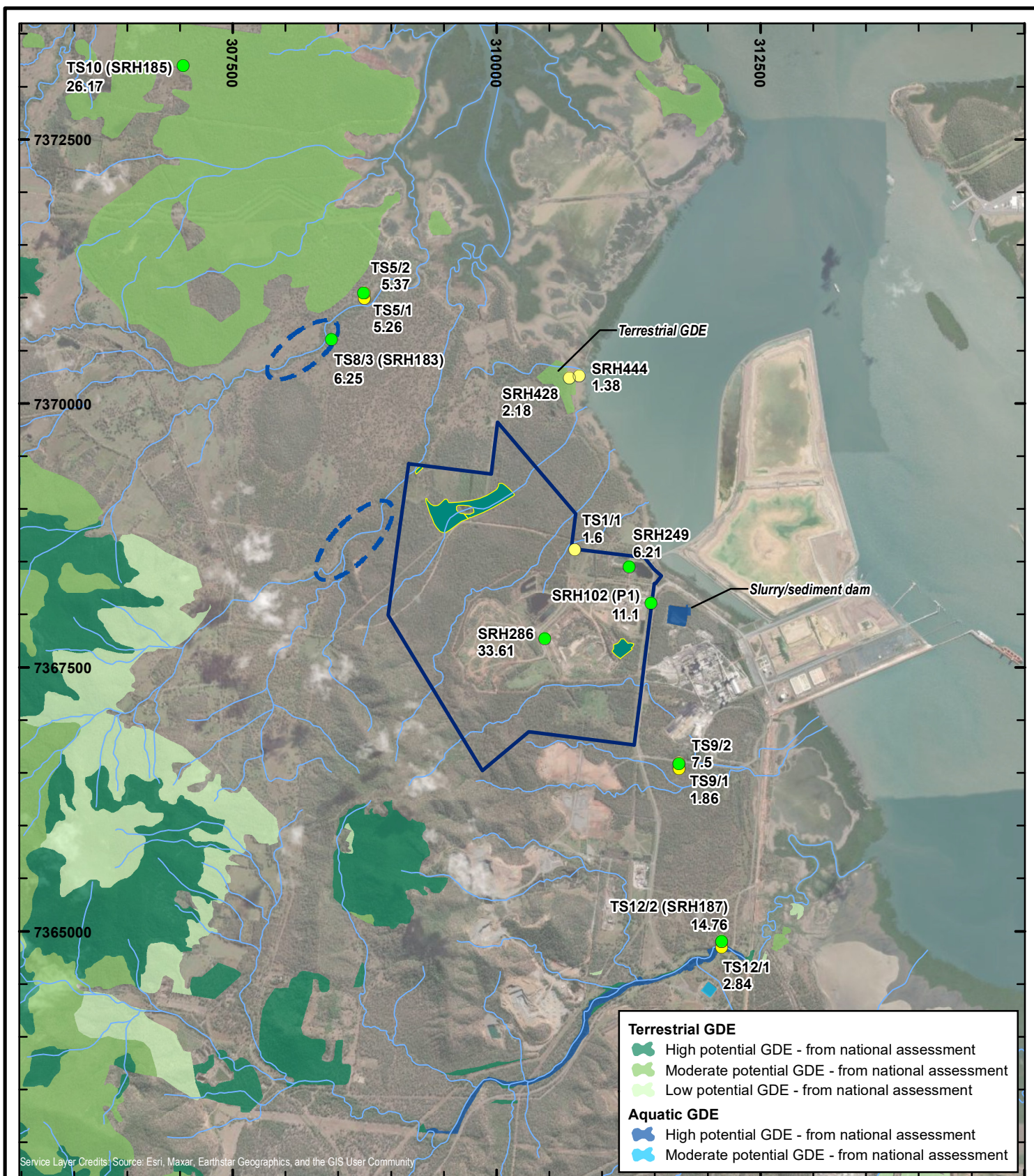
As such, out of an abundance of caution, the potential for aquatic GDEs along Humpy and Targinie Creeks were considered further in the impact assessment (AGE, 2024).

Subterranean GDEs

The definition of a subterranean GDE is an ecosystem that is dependent to some degree on the sub-surface expression of groundwater and exists within the subsurface. These types of GDEs mainly include stygofauna and cave ecosystems. There are no mapped subterranean GDE areas, and no known caves within the vicinity of the Project.

Stygofauna sampling was undertaken in the Quaternary alluvium, Quaternary residual soil, and Tertiary-Quaternary weathered deposit by Essence (2025). Subterranean fauna were detected in samples from 5 of the 10 bores sampled. These taxa comprised 29 individuals from 7 distinct taxa. One bore also recorded the presence of a troglobite in the form of a blind millipede.

The stygofauna are unlikely to be considered unique in a regional context but are considered a potential receptor to all of the potential water level and water quality changes outlined the impact assessment; however, it is not listed as a separate potential receptor in the formal impact assessment as any impact is unlikely to cause environmental harm (AGE, 2024).



0 0.4 0.8 1.2 1.6 2
km

QUEENSLAND ENERGY RESOURCES

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N
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GDA2020, MGA Zone 56



Figure 2.11
Groundwater dependent ecosystems
and potential ecosystem interaction
(AGE, 2024)

Legend

- ML 80003
- Watercourse
- Potential spring zone (Coffey, 2014)
- Regional ecosystem of concern
- Quaternary Alluvium
- Rundle Formation

Date: 8/03/2024

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0011_C

Requested by: John Linden

Sources:
© Commonwealth of Australia (Bureau of Meteorology)
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2.2.8.4. Aquatic flora

There are 110 wetland indicator plant species recorded within the Calliope River basin on the WetlandInfo database (DES, 2023b). None of these are listed as Endangered, Vulnerable or Near Threatened. A total of 44 species of aquatic plants have been detected during prior field surveys of ML 80003 and surrounding areas (Essence, 2025), including four weed species. Aquatic flora diversity was highest at sites with good water availability, and lowest at ephemeral sites which were frequently dry.

The majority of aquatic plants present were emergent species including sedges (*Cyperus* spp.) and aquatic grasses (family Poaceae). Submerged aquatic plants included Blyxa (*Blyxa aubertii*), water ribbon (*Triglochin procerum*) and swamp lily (*Ottelia ovalifolia*), Cape blue waterlily (*Nymphaea caerulea* subsp. *zanzibarensis*) and water nymph (*Najas tenuifolia*).

Targinie Creek had a high diversity of aquatic plants, with 12 species recorded during field surveys (Essence, 2025). The most abundant native aquatic flora species identified within ML 80003 and surrounding areas, based on Australian River Assessment System's (AusRivAS) assessment methods, are shown in Table 2.6.

Table 2.6 Native aquatic flora detected on ML 80003 or surrounds in 2014 with an AusRivAS abundance of moderate (50 to 75%) or extensive (>75%)

Scientific name	Common name	Areas located (Ecosure 2014c)
<i>Lobelia stenophylla</i>	-	Ephemeral Gully D
<i>Cyperus aquatilis</i>	flat sedge	Targinie Creek
<i>Cyperus haspan</i>	flat sedge	Targinie Creek, Ephemeral gullies (B, C, D, E), Humpy Creek
<i>Pseudoraphis spinescens</i>	spiny mudgrass	Targinie Creek, Ephemeral Gullies (C and D)
<i>Acrostichum speciosum</i>	mangrove fern	Ephemeral Gully B
<i>Blechnum indicum</i>	bungwall fern	Ephemeral Gully C
<i>Juncus</i> sp.	rush	Targinie Creek, Ephemeral Gully D
<i>Leersia hexandra</i>	swamp rice grass	Targinie Creek, Ephemeral Gullies (C and D)

Source: Ecosure (2014c).

A total of 12 introduced wetland indicator flora species are recorded by WetlandInfo for the Calliope River basin (DES, 2023b), with an additional species (molasses grass) recorded on the database, but not listed as a wetland indicator species. Three of these species were recorded during field surveys of ML 80003 and surrounding areas (Essence, 2025), along with Cape blue water lily, which is not recorded in the WetlandInfo database for the Calliope catchment (Table 2.7).

Table 2.7 Introduced wetland plants recorded in the Calliope catchment and ML, and surrounds

Scientific name	Common name	Occurrence on ML and surrounds
<i>Eclipta prostrata</i>	white eclipta	Unconfirmed
<i>Cyperus involucratus</i>	umbrella sedge	Unconfirmed
<i>Cyperus papyrus</i>	papyrus	Unconfirmed
<i>Eleocharis minuta</i>	-	Unconfirmed
<i>Nymphaea caerulea</i>	Egyptian water lily	Confirmed
<i>Echinochloa colona</i>	awnless barnyard grass	Confirmed
<i>Echinochloa crus-galli</i>	barnyard grass	Unconfirmed
<i>Paspalum distichum</i>	water couch	Unconfirmed
<i>Paspalum vaginatum</i>	saltwater couch	Unconfirmed

Scientific name	Common name	Occurrence on ML and surrounds
<i>Urochloa mutica</i>	para grass	Unconfirmed
<i>Eichhornia crassipes</i>	water hyacinth	Unconfirmed
<i>Salvinia molesta</i>	salvinia	Unconfirmed
<i>Melinis minutiflora</i>	molasses grass	Confirmed
<i>Nymphaea capensis</i>	Cape blue water lily	Confirmed

Source: DES (2023b) and Essence (2025).

Aquatic ecology surveys completed as part the Gladstone to Fitzroy Pipeline Project Environmental Impact Statement (EIS) in 2007 identified two macrophytes within Larcom Creek (located within the Calliope River basin approximately 10 km west of ML 80003; GAWB 2008):

- *Nymphaea violacea* a native lily that occupies lagoons and slow-moving creeks in a 1 to 3 m depth zone; and
- Hornwort (*Ceratophyllum demersum*), a submergent species which was present as dense instream cover.

2.2.9. Flora and fauna presence and populations

When considering the relevance of the flora and fauna baseline information below, it is also worth noting that:

- ML 80003 was granted on 30 July 1996. There is an exemption regarding protected plants (now contained in Section 57 *Nature Conservation (Plants) Regulation 2020*) where a mining lease (or petroleum lease) had been granted before the commencement of the previous version of the section (31 March 2014), which is the case for ML 80003. The existing EA for the Project site was also transitioned under the *Environmental Offsets Act 2014* which commenced on 1 July 2014.
- Unusually for a mine, parts of the Project site comprise 'Urban Areas' as defined under the Environmental Offsets Regulation 2014, because they are zoned Special Industry in the Gladstone Regional Council planning scheme. Therefore, under Section 5(3) of the *Environmental Offsets Regulation 2014*, some relevant types of mapping that would otherwise comprise matters of state environmental significance (e.g. 'of concern' regulated vegetation and essential habitat mapping) are exempt.
- In addition, under Section 7(1)(c) of the *Vegetation Management Act 1999*, it does not apply to an area declared as a State Forest or timber reserve under the Forestry Act 1959. The majority of the Project site comprises State Forest. It is difficult to select analogue State Forest sites because timber is subject to the entitlement of the forest operator to undertake harvesting, as specifically noted in QER's Compensation Agreement with the State for the State Forest. This means that, while State Forest 'baseline' sites can be selected for comparison, they will not necessarily survive as 'analogue' sites by the time mining operations have been completed.
- Finally, it should be noted that the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* does not apply to the area of land originally authorised for disturbance within the Project site. The EIA (Envirosciences, 1993) in respect of ML 80003 was assessed under the (repealed) *Environmental Protection (Impact of Proposals) Act 1974*, which was transitioned under the *Environmental Reform (Consequential Provisions) Act 1999*. QER's parent company retains control over a proponent of the EIA (Envirosciences, 1993). In addition, all necessary specific environmental authorisations were held for the Project before commencement of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. This is relevant to any consideration of matters of national environmental significance.

2.2.9.1. Fauna habitats and records

Based on Ecosure (2014b) field surveys, Essence (2025) determined five distinct fauna habitats present within ML 80003:

- woodlands and riparian forests
- SEVT (in the South-East Queensland Bioregion), so not a listed threatened ecological community of the Brigalow Belt
- Dams
- cleared areas

Of these, SEVT (equivalent to RE 12.11.4) and riparian forest (RE 11.3.25) occupy very small areas (Figure 2.10), with the bulk of ML 80003 and EA approved disturbance area being comprised of woodlands and areas disturbed by mining operations, plus several small artificial wetlands. Habitat condition varies considerably across ML 80003 (some of which is public land), with the following factors contributing to habitat condition:

- vegetation clearing
- erosion
- logging
- human disturbance
- the presence of weeds and pests

A summary of habitat condition is provided in the following sections (Essence, 2025).

Woodlands

Although logging has removed a proportion of the largest trees that may have contained hollows for arboreal fauna, small to large hollows persist in large dead trees. The ground cover is highly variable, but dense grasses provide shelter for small mammals and reptiles and feeding resources for small birds. Coarse woody debris is sparse to abundant, providing habitat and foraging opportunities for reptiles.

Riparian forest

The presence of large nectar-bearing trees (some with hollows), complex understories ranging from open to dense, exposed stream banks (e.g. nesting sites for pardalotes and rainbow-bee-eaters with the latter recorded multiple times by Ecosure [2014b]), and water make riparian forests very important as fauna habitat.

Semi-evergreen vine thicket

Vine thickets are found mainly outside ML 80003 and EA approved disturbance area, but their close proximity is important as they contain many fleshy-fruited species, deep leaf litter and rock crevices, which are habitat for several fauna species.

Dams

Water bodies provide some breeding habitat for frogs and water birds, and a source of water for drinking. The relative lack of fringing vegetation in some dams diminishes their habitat value.

Cleared areas

Clearing for the mine and associated infrastructure areas has removed the dominant vegetation layers in cleared areas. This has led to a reduction in the area available for native fauna to occupy within ML 80003.

There are few sheltering opportunities for native fauna in cleared areas, but the presence of grasses (both native and exotic) provides foraging resources for some small bird species.

2.2.9.2. Threatened species

All threatened species listed in database searches were assessed for their likelihood of occurrence within ML 80003. Lists generated in 2014 (Ecosure 2014a and 2014b) remain relevant where species are also listed in 2023 searches, with these species discussed in this section. Species were identified based on searches of Commonwealth (EPBC Act protected matters) and State (Wildlife Online) databases.

The likelihood of occurrence of identified ecological values was assessed based on four possibilities: Unlikely, Possible, Likely and Confirmed, as described in Table 2.8.

Table 2.8 Likelihood of occurrence categories used in this report

Likelihood of occurrence	Criteria
Unlikely	- no or very little suitable habitat occurs within ML 80003; and/or - the species has not been recorded in the region for more than 20 years.
Possible	- some limited habitat for the species occurs in ML 80003; and/or - the species is highly nomadic, and ML 80003 occurs within the species range.
Likely	- suitable habitat for the species occurs in ML 80003; and/or - a record occurs nearby in similar habitat; and/or - there is Essential Habitat mapped in ML 80003; and/or - the species is widespread and common in the region (e.g. squatter pigeon) and has broad habitat requirements.
Confirmed	species has been recorded during a previous or current field survey within ML 80003.

Flora habitat and records

Results of database searches revealed several species considered to have some likelihood (i.e. possible, or likely; Table 2.8) of occurring in ML 80003, which were not identified in the 2014 searches. These were:

- *Cossinia australiana* (cossinia)
- *Cycas ophiolitica* (marlborough blue)
- *Dichanthium setosum* (bluegrass)
- *Eucalyptus raveretiana* (black ironbox)
- *Leichhardtia* (syn. *Marsdenia*) *brevifolia*
- *Macadamia integrifolia* (macadamia nut)

Field surveys in 2014 (Ecosure, 2014a) did not detect any threatened flora species in their study area (which comprised ML 80003 and surrounding areas). A total of 265 least concern species were recorded, including 8 special least concern species:

- *Adiantum atroviride* (maidenhair fern)
- *Adiantum hispidulum* (rough maidenhair fern)
- *Brachychiton australis* (broad-leaved bottle tree)
- *Cymbidium canaliculatum* (black orchid)
- *Dendrobium discolor* (golden cane orchid)
- *Geodorum densiflorum* (pink nodding orchid)
- *Macrozamia macleayi* (zamia palm)
- *Xanthorrhoea johnsonii* (forest grass tree)

Essential habitat

Essential habitat for listed wildlife is mapped within ML 80003 (Figure 2.12). Species habitats included on this map are listed in Table 2.9. Of these, Essence (2025) detected koala (scats only), coastal sheath-tail bat (possible calls), squatter pigeon (several sightings) and greater glider within ML 80003 and/or surrounding areas.

Table 2.9 Species for which Essential Habitat is mapped by the state within ML 80003

Species	NC Act status	Position in landscape
Koala (<i>Phascolarctos cinerea</i>)	Endangered	Riparian areas, plains, and hill/escarpment slopes.
Water mouse (<i>Xeromys myoides</i>)	Vulnerable	Coastal areas near mangroves/swamps
Coastal sheath-tail bat (<i>Taphozous australis</i>)	Near threatened	Coastal areas (within 3 km of coast)
Powerful owl (<i>Ninox strenua</i>)	Vulnerable	Gully
Squatter pigeon (<i>Geophaps scripta scripta</i>)	Vulnerable	Gravelly ridges, traprock, and river flats.
Eastern curlew (<i>Numenius madagascariensis</i>)	Endangered	Associated with coastlines and wetlands
Western Alaskan bar-tailed godwit (<i>Limosa lapponica baueri</i>)	Vulnerable	Associated with coastlines and wetlands
Greater glider (central) (<i>Petauroides armillatus</i>)	Endangered	Eucalypt forests and woodlands

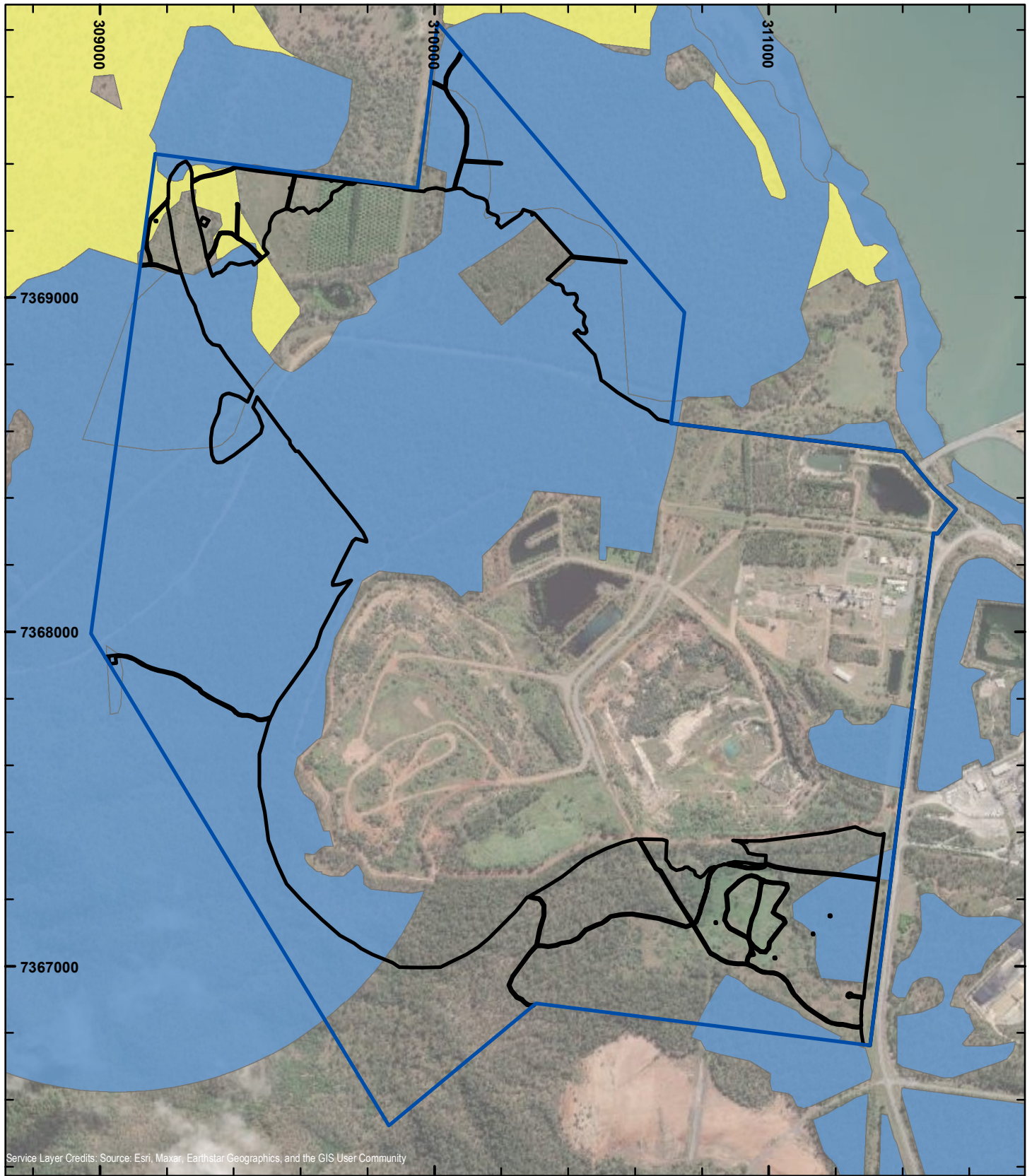
Conservation significant fauna

Ecosure (2014b) recorded several listed fauna species within ML 80003 during their field surveys in 2014. However, some of those species have since had their conservation status changed from Near Threatened to Least Concern. Conservation significant fauna based on current legislation that have been recorded within or adjacent to ML 80003, or were assessed as likely to occur, are summarised in Table 2.10.

Table 2.10 Conservation-significant fauna recorded or likely to occur within or adjacent to ML 80003

Species	NC Act status	EPBC Act status	Comments
Squatter pigeon (<i>Geophaps scripta scripta</i>)	Vulnerable	Vulnerable	Recorded in several locations within ML 80003 and the EA approved disturbance area, especially on dirt roads which it uses for dustbathing.
Grey-headed flying fox (<i>Pteropus poliocephalus</i>)	-	Vulnerable	Observed feeding at Gully B and at the western edge of ML 80003. No roost sites were detected.
Coastal sheath-tailed bat (<i>Taphozous australis</i>)	Near Threatened	-	Potential calls detected from north-eastern part of ML 80003. Likely to occur.
Koala (<i>Phascolarctos cinerea</i>)	Endangered	Endangered	Confirmed to be present from scats. Likely to be in low numbers in ML 80003 and possibly not resident. Large parts of ML 80003 are mapped as essential habitat for the species.
Greater glider (central) (<i>Petauroides armillatus</i>)	Endangered	Endangered	Recorded on the western fringe of ML 80003 by Ecosure (2014b), and on ML 80003 in 1999 (ALA, 2023). Likely to be present in ML 80003 and surrounding areas, in low numbers. While there is suitable habitat in ML 80003, large hollows are rare.
Short-beaked echidna (<i>Tachyglossus aculeata</i>)	Special Least Concern	-	Widespread and common in ML 80003.

Source: Essence (2025).



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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QUEENSLAND ENERGY RESOURCES

Stuart Kerogen Shale Project

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GDA2020, MGA Zone 56



Figure 2.12
Essential habitat in the vicinity
of ML 80003
(Essence, 2024)

Legend

- ML 80003
- EA Approved Disturbance Area
- MSES Regulated vegetation: Essential habitat**
- A or B
- C

Date: 8/03/2024

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0012_C

Requested by: John Linden

Sources:
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Essence (2025) assessed a range of conservation significant fauna as having potential to occur within ML 80003 and surrounding areas:

- reptiles: collared delma (*Delma torquata*), yakka skink (*Egernia rugosa*) and Dunmall's snake (*Furina dunmalli*)
- birds: red goshawk (*Erythrorhynchus radiatus*), Australian painted snipe (*Rostratula australis*) and glossy black cockatoo (*Calyptrorhynchus lathamii*)
- mammals: northern quoll (*Dasyurus hallucatus*), south-eastern long-eared bat (*Nyctophilus corbeni*), large-eared pied bat (*Chalinolobus dwyeri*) and water mouse (*Xeromys myoides*)

Such species, if present, may benefit from rehabilitation activities, and in particular the creation of permanent water within the freshwater wetland (e.g. Australian painted snipe and bat species).

Migratory species

Five listed migratory species (EPBC Act) were recorded by Essence (2025) within or adjacent to ML 80003 (excluding marine and estuarine areas). However, of these only the following remain listed as Migratory under the EPBC Act:

- rufous fantail (*Rhipidura rufifrons*)
- spectacled monarch (*Monarcha trivirgatus*)

None of these species is listed as threatened under either the *Nature Conservation Act* (NC Act) or EPBC Act. A full list of migratory species that could occur within ML 80003 and surrounding areas (including estuarine waters) is included in the report prepared by Essence (2025).

Other confirmed fauna records

In addition to the threatened and migratory species listed above, Essence (2025) recorded 179 Least Concern species of fauna within their study area (comprising ML 80003 and surrounding areas). These included:

- 10 species of amphibians, including the introduced cane toad (*Rhinella marina*)
- 18 species of reptiles, including 10 species of skink, 1 blind snake, 1 legless lizard, 3 snakes, 3 geckoes and 1 dragon species
- 111 species of birds
- 34 species of mammals, including 4 species of glider, 1 species of possum, 2 species of flying fox, 4 species of kangaroos and wallabies, 13 species of microbat, 2 species of marsupial mouse, 1 bettong and 5 introduced species (black rat, dog, cat, rabbit and brown hare)

2.2.9.3. Aquatic ecology

Aquatic habitats

No aquatic matters of national environmental significance were recorded within ML 80003 or were assessed as likely to occur (Essence, 2025).

Aquatic habitats of ML 80003 comprise the ephemeral Targinie Creek (stream order 3 watercourse), and a series of ephemeral gullies (stream order 1 watercourse) which flow to estuarine waters of Port Curtis and The Narrows following periods of heavy rainfall. A semi-permanent watercourse named Humpy Creek (stream order 3) is located approximately 1.5 to 2 km north of ML 80003.

Most of the ephemeral creek and gully habitats of ML 80003 assessed by Essence (2025) were found to be in either Excellent or Good condition overall. Salient aspects of the undisturbed aquatic habitats included streamside vegetation cover and bank vegetative stability. However, in some areas, habitat features were found to be absent or limited, affecting the overall rating of habitat quality. No wetlands were found to occur within ML 80003.

Sites on Targinie Creek were rated during the post-wet survey as having High aquatic value (based on AusRivAS habitat bioassessment scores of DNRM (2001), and other developed criteria). Habitat scores generally fell to Moderate during the pre-wet survey (Essence, 2025), indicating that the maintenance of high-quality aquatic habitat values is naturally limited by surface water availability.

Ephemeral gullies were generally rated as having Moderate aquatic value in both seasons. These sites often had excellent substrate composition, bankside vegetation and stability. However, three gullies and a site on Targinie Creek received an aquatic value rating of Low (Essence, 2025).

Macroinvertebrates

Essence (2025) found that taxonomic richness of macroinvertebrates within freshwater aquatic habitats of ML 80003 and surrounding areas was generally related to the presence of water. Targinie Creek had 18 taxa identified within bed habitats and 24 taxa identified within edge habitats. Ephemeral gullies had a low diversity of macroinvertebrate taxa, reflecting the shorter time periods over which suitable aquatic habitats are available for colonisation. The most diverse order recorded during field surveys was Odonata (dragonflies and damselflies), followed by Hemiptera (true bugs) and Diptera (true flies).

Samples collected from Targinie Creek recorded SIGNAL2 scores for bed habitat greater than the Queensland Water Quality Guidelines (QWQG) 20th percentile guideline value, though were below the guideline value for edge habitats. SIGNAL scores from edge and bed habitats in ephemeral gullies were generally below the 20th percentile in the QWQG, with minor exceptions (Essence, 2025). Such results indicate that macroinvertebrate assemblages of ML 80003 are generally within or below the range of scores predicted by the AusRivAS model (Essence, 2025). This is likely a reflection of the ephemeral nature of streams in ML 80003, with a lack of available surface water impairing the development and maintenance of diverse macroinvertebrate assemblages.

All sites exhibited a percentage of tolerant taxa unfavourably above the 80th percentile guideline for the Central Coast of Queensland, indicating relatively harsh conditions within aquatic habitats (a result that is also likely due to their ephemeral nature). AusRivAS OE50 results scores were generally within “Band B” for Targinie Creek and ephemeral gullies (Essence, 2025). This is indicative of fewer macroinvertebrate families than would be expected in minimally disturbed reference sites. Such results are likely due to the ephemeral nature of the watercourses limiting their colonisation by a diverse assemblage of macroinvertebrate taxa.

Fish and macro-crustaceans

Aquatic surveys detected three macro-crustacean families within ML 80003 and surrounding areas: Atyidae (freshwater shrimp), Palaemonidae (freshwater shrimp) and Parastacidae (freshwater crayfish).

A total of 11 species of freshwater fish were recorded within ML 80003 and surrounding areas (incorporating Humpy Creek). Larger watercourses generally had a higher diversity of fish species. Within Targinie Creek, the most abundant fish species was the eastern rainbowfish (*Melanotaenia splendida splendida*), followed by Midgley’s carp gudgeon (*Hypseleotris* sp. A), Agassiz’s glassfish (*Ambassis agassizii*) and firetail gudgeon (*Hypseleotris gallii*). The spangled perch (*Leiopotherapon unicolor*) and barramundi (*Lates calcarifer*) were also recorded in low numbers.

The semi-permanent waters of Humpy Creek to the north of ML 80003 contained additional fish species, including the empire gudgeon (*Hypseleotris compressa*) and long-finned eel (*Anguilla reinhardtii*). The introduced gambusia (*Gambusia holbrooki*) was found in low numbers at most aquatic sampling sites.

Other aquatic fauna

No freshwater turtles or platypus were detected during field surveys of ML 80003 and surrounding areas. However, the Department of Climate Change, Energy, Environment, and Water (DCCEEW) currently recognises the eastern range of the southern snapping turtle (*Elseya albagula*) in Gladstone to be the Mount Larcom area, suggesting it is unlikely to occur in the coastal waterways surrounding ML 80003 (DCCEEW, 2023). A habitat assessment suggested that Humpy Creek (located to the north of ML 80003) provides potential habitat for southern snapping turtle (*Elseya albagula*) (Essence, 2025).

In addition to aquatic fauna, the freshwater wetland PMLU could be expected to attract terrestrial fauna, subject to any inconsistent surrounding development as a result of the Gladstone SDA, which is applicable both to the Project site and the adjoining land.

Subterranean fauna

Five groundwater bores (of 10 sampled) within ML 80003 and surrounding areas were found to contain subterranean fauna. Identified fauna comprised 29 individuals from seven distinct taxonomic groups (Family/Order), including harpacticoids, mites, syncarids, ostracods, copepods, and an oligochaete worm. The presence of a cavernous species (troglobite) in the form of a blind millipede was recorded for one groundwater bore.

AGE (2024) noted that the aquifers encountered across ML 80003 and surrounding areas are relatively shallow and unconfined. It was concluded that the systems are unlikely to be inert, isolated bodies of water, and may influence adjacent terrestrial, aquatic, and marine ecosystems. Targinie Creek was assessed as likely to receive the majority of its flow from surface water runoff and groundwater recharge during and following rainfall events. Some persistent flow outside of rainfall events may also occur.

The presence of stygobitic species in groundwater samples collected from across ML 80003 and surrounding areas demonstrates the presence of a subsurface GDE (Essence, 2025). The unconfined aquifers beneath ML 80003 and surrounding areas provide sufficient groundwater quality, quantity, and usable void space to support stygofauna, and sufficient habitat for troglofauna in some areas (Essence, 2025). The stygofauna are unlikely to be considered unique in a regional context but are considered a potential receptor by AGE (2024) to all of the potential water level and water quality changes outlined in the impact assessment (Section 7.1.1).

2.2.10. Pre-mining land use

Prior to the grant of ML 80003 in 1996, the land comprised ten separate titles owned by the Department of Lands, Queensland Forest Service, Queensland Cement Ltd, one private landowner and the then proponents (i.e. Stuart Energy [Nominees] Pty Ltd).

As is currently the case, Targinie State Forest made up the majority of the lease area, with an area of 295 ha within ML 80003. Targinie State Forest makes up more than 50% of the total area of ML 80003. Woodland within the Targinie State Forest has previously been subject to logging in its capacity as production forestry, as well as selective clearing as part of surrounding agricultural activities.

QER holds a current Compensation Agreement with the State of Queensland in respect of the State Forest land. Under that agreement, relevant to this PRC plan:

- A copy of the PRC plan is required to be provided to the State's contact officer either before or on the same day as submitting the PRC plan under Section 754 of the EP Act (Special Condition [3])
- There is provision for consent to permanent infrastructure remaining (Special Condition [6]).
- All timber within the State Forest remains the property of the State, and, except in the case of disaster management, the State remains entitled to harvest all timber (and associated vegetation), so, whenever clearing is required within the State Forest land, QER must give the State reasonable notice to enable the State to undertake harvesting, as opposed to simply undertaking vegetation clearing itself in the normal way (Special Condition [9]).
- Special Condition (13) allows for the potential for a NUMA. However, a NUMA is not proposed by this PRC plan.

QER understands that the Queensland Government is currently considering revocation of the Targinie State Forest, resulting in the State Forest land becoming Unallocated State Land (USL), followed by conversion of the USL to State owned freehold land. QER's Compensation Agreement with the State in respect to what is currently State Forest land will remain in effect following the conversion of the State Forest to USL and Freehold tenure.

Pre-mining land use was primarily related to low-intensity stock grazing and other agricultural land uses (e.g. intensive fruit growing in the northern area of ML 80003). This included stock grazing by the then proponents via a permit over the Targinie State Forest. In addition, three residential dwellings were located within the ML area, one of which was not habitable at the time of the original application.

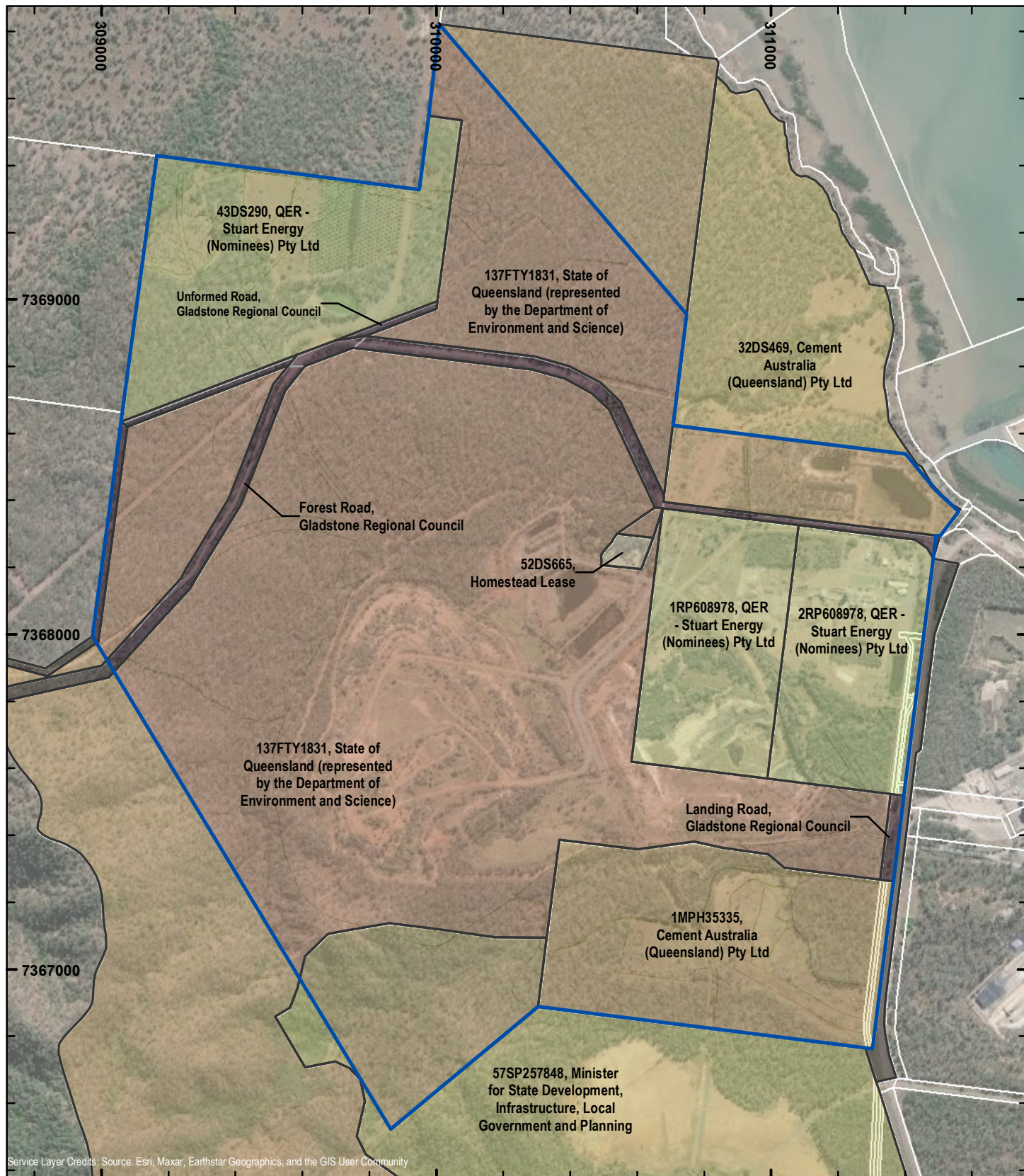
QER continues to agist part of the land to a neighbouring landowner for grazing purposes. The orchard is no longer commercially harvested, but the fruit trees comprising the orchard remain in place at the date of lodgement of this PRC plan.

2.2.11. Underlying landholders

The current underlying landholders for ML 80003 are illustrated in Figure 2.13 and summarised in Table 2.11.

Table 2.11 Real property description underlying ML 80003

Lot on Plan / Name	Tenure type	Landowner
Part of Lot 32 on CP DS469	Freehold	Cement Australia (Queensland) Pty Ltd – lease to Stuart Energy (Nominees) Pty Limited, a related corporation of QER.
Part of Lot 137 on CP FTY1831	State Forest	State of Queensland (tenure may change to USL and/or Freehold in the future [Section 2.2.10]).
Lot 43 on CP DS290	Freehold	Stuart Energy (Nominees) Pty Limited, a related corporation of QER.
Lot 1 on CP MPH35335	Freehold	Cement Australia (Queensland) Pty Ltd.
Lot 1 on RP 608978	Freehold	Stuart Energy (Nominees) Pty Limited, a related corporation of QER.
Lot 2 on RP 608978	Freehold	Stuart Energy (Nominees) Pty Limited, a related corporation of QER.
Part of Lot 57 on SP 257848	Freehold	Minister for State Development, Infrastructure, Local Government and Planning.
Lot 52 on CP DS665	Term lease 0/222086	State of Queensland – This is a term lease granted to Stuart Energy (Nominees) Pty Limited, a related corporation of QER.
Forest Road	Freehold	The State of Queensland.
Unformed Road	Freehold	The State of Queensland (road reserve trustee is Gladstone Regional Council).



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Stuart Kerogen Shale Project

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GDA2020, MGA Zone 56

Figure 2.13
Land ownership
(underlying landholders)
for ML 80003

Legend

- ML 80003
- Cadastral Boundary
- Intersected property



Date: 12/05/2023

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0013_B

Requested by: John Linden

Sources:
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2.3. Design for closure

PRCP Guideline (Section 3.1)

Transitional PRC plans are not required to demonstrate how aspects of the mine site have been designed for closure for existing or approved disturbance. However, any expansion to an existing site must demonstrate how it has been designed for closure.

As per Section 3.1 of the PRCP Guideline (DES, 2023a), transitional PRC plans are not required to demonstrate how aspects of the mine site have been designed for closure for existing or approved disturbance. This notwithstanding, this PRC plan has been developed to proactively manage progressive rehabilitation of the Project site to a stable PMLU, aiming to minimise long-term management requirements as well as associated closure costs.

Importantly, a focused design for closure underpins all sections of this PRC plan from:

- Engagement with relevant stakeholders to define suitable PMLUs, where optionality exists within the EA.
- Defining and implementing rehabilitation practices with consideration to relevant baseline information to inform development of the rehabilitation strategy, identifying risks that could influence achievement of milestone criteria.
- Demonstrating successful rehabilitation through defined site monitoring to develop a feasible PRCP schedule.

2.4. Rehabilitation and improvement planning

Legislative Requirement

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

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

PRC plan Guideline (Section 3.1)

To meet the legislative requirements in Sections 126C(1)(b) and (c)(ii) of the EP Act, the rehabilitation planning part must include:

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

This information could be provided in the proposed PRC plan in a variety of formats including maps, tables, or lists.

The rehabilitation/improvement planning must include data from when mining first commenced up until planned surrender. The transitional provisions of the EP Act include an exceptional circumstance for when land is available for rehabilitation.

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

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

2.4.1. Relevant activities

The relevant activities at the Project site that will require rehabilitation are provided in Table 2.12. This table also provides the predicted duration of each activity, and the associated rehabilitation area (RA) IDs, from when the activity commences (i.e. where topsoil is stripped, until it is available for rehabilitation).

As discussed in Section 1.3.2.3, while some areas will be available for rehabilitation during the R&D period, extraction, and processing of kerogen ore at a rate of up to 60 t/d or 2.5 t/h is proposed during the R&D period and within the next 10 years (i.e. prior to, and continuing after, 2033). As a result, emplacement of waste (i.e. overburden/interburden and processed shale) resulting from extraction and processing works during the R&D period will be required at the Out-of-pit MRA between 2023 and 2043. Therefore, the In-pit MRA and Out-of-pit MRAs are not considered available for rehabilitation during the R&D period in accordance with Clause 126D(5)(ba) of the EP Act.

Table 2.12 Relevant activities requiring rehabilitation at the Project site

Relevant activities	RA ID	Predicted duration		Approximate area (ha) ¹	Availability for progressive rehabilitation
		Year in Mining Schedule	Years		
Out-of-pit MRA	RA01	3 to 5	2023 to 2045	80	Waste placement within the Out-of-Pit MRA will be completed in the early stages of mining, between Years 3 and 5 (2043 to 2045). Rehabilitation of the Out-of-Pit MRA can occur at this time. The Out-of-pit MRA final landform will have a native ecosystem (bushland) PMLU and be water shedding, with runoff from the Out-of-Pit MRA reporting to the Final Void.
In-pit MRA	RA02	5 to 20	2023 to 2060 (Backfill: 2045 to 2060)	88.5	Rehabilitation activities will occur progressively and follow the advancing open pit. As a result, revegetation of the In-Pit MRA will be completed in a progressive manner over the life of the mine, between Years 5 and 20 (2045 to 2060). The In-pit MRA final landform will have a native ecosystem (bushland) PMLU and be water shedding, with runoff from the In-Pit MRA reporting to the Final Void.
Settling ponds	RA03	3 to 20	2023 to 2068	5	Required for water management until suitable groundcover has been achieved on RA02 (i.e. approximately two to three years after seeding), after which this RA will be retained on site as a water storage (industrial use) PMLU.
CWHPs	RA04	3 to 20	2023 to 2060	3	Required for water management until end of mining, after which this RA will be retained as an Industrial PMLU.
	RA03	3 to 20	2023 to 2068	4	Required for water management until suitable groundcover has been achieved on RA02 (i.e. ~ two to three years after seeding), after which these RAs will be retained on site as a water storage (industrial use) PMLU.
Sediment dams	RA04	3 to 20	2023 to 2060	3.3	Required for access until the majority of the rehabilitation is complete, after which this RA will be retained on site with an Industrial PMLU.
	RA03	3 to 20	2023 to 2068	0.3	Required for water management until suitable groundcover has been achieved on RA02 (i.e. ~two to three years after seeding), after which these RAs will be retained on site as a water storage (industrial use) PMLU.
Detention ponds	RA05	~10/15 to 20	~2050/2055 to 2060	3.3	Required for water management until end of mining, after which this RA will be retained on site as a water storage (stock use) PMLU.
	RA13	3	2026 to 2041	2	A former farm detention dam (Farm Detention Dam [Gully B]) on-site which requires rehabilitation as a result of mining disturbance
Former Stuart Box Cut	RA13	3	2026 to 2041	2.5	The Stuart Box Cut (2.5 ha) was subject to reshaping, surface preparation, and revegetation works as early as 1991. Therefore, rehabilitation monitoring to verify achievement of surface requirements (i.e. native ecosystem [bushland] PMLU) and confirmation of achieving the target PMLU are the only rehabilitation aspects which apply to this area. Furthermore, due to the extent of existing rehabilitation at the Stuart Box Cut area, it proposed to achieve a "hybrid" class of rehabilitated native ecosystem (bushland) PMLU in this area, consistent with the definition of Spain et al. (2023).
Roads (haul roads)	RA06	3 to 20	2023 to 2065	4	Required for access until completion of seeding works on RA02, after which this RA will be retained on site with an Industrial PMLU.

Relevant activities	RA ID	Predicted duration		Approximate area (ha) ¹	Availability for progressive rehabilitation
		Year in Mining Schedule	Years		
Roads (Forest Road)	RA07	~8/13	~2048/2053	11	Realignment of Forest Road would be undertaken between Year 8 to 13 of the mine plan (i.e. between 2048 to 2053), after which it will remain vested to the QLD Government with a permanent infrastructure PMLU.
Plant site	RA06	3 to 20	2023 to 2065	15.0	Required for operational activities until completion of seeding works on RA02, after which this RA will have an Industrial PMLU.
Infrastructure and final void perimeter	RA06	3 to 20	2023 to 2065	20.5	Required for operational activities until completion of seeding works on RA02, after which this RA will have an Industrial PMLU.
	RA08	3 to 20	2023 to 2060	1.0	Available once all mining activities are complete, after which this RA will have a native ecosystem (bushland) PMLU.
Ore stockpile area	RA09	3 to 20	2023 to 2060	2	Available once all mining activities are complete, after which these RAs will have an Industrial PMLU.
Fuel and storage areas	RA10	3 to 20	2023 to 2065	4	Required for operational activities until completion of seeding works on RA02, after which these RAs will have an Industrial PMLU.
Sewage disposal area	RA10	3 to 20	2023 to 2065	2	Required for operational activities until completion of seeding works on RA02, after which these RAs will have an Industrial PMLU.
Exploration tracks and pads	RA09	3 to 20	2023 to 2060	0.62	Available once all mining activities are complete, after which these RAs will have an Industrial PMLU.
	RA11	3	2026	0.42	Exploration tracks and pads not required for ongoing operational activities, available for rehabilitation from 10/12/2026.
Final void and wetlands, including void perimeter	RA08	~10/15 to 20	~2050/2055 to 2060	5.4	This area includes areas between the lagoon system and final void, as well as the clean water diversion drain to Targinie Creek. This area will be available for progressive rehabilitation of the end of the life of the mine (Year 20), after which this RA will have a native ecosystem (bushland) PMLU.
	RA12	20	2060	68.6	A final void will remain at the completion of mining. This void will be reshaped by backfilling with non-acid-forming wastes to reduce the gradient of the pit walls and to cover the exposed potentially-acid-forming materials in the pit walls. The void will be filled with water to an equilibrium elevation of 8.1 mAHD. This water will be sourced from natural surface water inflows and groundwater recharge. The final void will be available for progressive rehabilitation of the end of the life of the mine (Year 20). However, it is noted that filling of the void is predicted to take approximately 18 years (Engeny 2023). Therefore, completion of revegetation aspects of progressive rehabilitation of the final void margins may not be able to be commenced until after the final void has reached equilibrium levels.
	RA14	20	2060	9.2	Constructed lagoon system around the final void which will manage catchment runoff entering the pit lake, with detailed design and implementation is required during the operational phase of the mine to confirm the arrangement and performance.

Areas stated within this table have been rounded and will therefore not match precisely with the spatial data provided with the PRC plan.

2.4.2. Rehabilitation areas and milestones

The activities in Table 2.13 are grouped by RA. An RA is defined in the PRCP Guideline as an area of land in the post-mining land use to which a rehabilitation milestone for the post-mining use relates. A rehabilitation milestone (RM) for the rehabilitated land, means each significant event or step necessary to rehabilitate the land to a stable condition (Section 115 of the EP Act).

The RAs and RMs for the Project are referred to throughout this PRC plan and are summarised in Table 2.13 and Table 2.14 respectively. These are further illustrated in Section 11 and detailed in the PRCP schedule.

Table 2.13 Rehabilitation Areas for the Project

Relevant activities	RAs	
Out-of-pit MRA.	RA01	Out-of-pit MRA.
In-pit MRA.	RA02	In-pit MRA.
Settling ponds, Sediment dams, and CWHPs	RA03	Settling ponds (i.e. Raw Water Pond and MWSP), CWHPs (i.e. ECWHP and WCWHP), and Sediment dams (i.e. SP2 and SP3).
Sediment dams and CWHPs	RA04	Cleared area (partial) surrounding ECWHP and WCWHP, and sediment dams (including EP1 (water treatment cell), revegetation works only).
Detention ponds	RA05	Detention ponds and rehabilitated Gully D.
Plant site, haul road, and infrastructure	RA06	Plant site, haul road, and infrastructure including: • topsoil and laydown areas • cleared areas, including drain and access tracks • fence road/fire breaks • dust deposition gauges (i.e. ML7A, ML10A and ML11) • access tracks, including for historic mining activities and dust monitors • fence line visual screen
Roads – Forest Road	RA07	Forest Road realignment.
Infrastructure, and final void perimeter	RA08	Infrastructure, including: • numerous access tracks, including for historic mining activities • fence road/fire breaks • dust monitor tracks This includes areas between the lagoon system (RA14) and final void (RA12), as well as the clean water diversion drain to Targinie Creek.
Exploration tracks and pads, and Ore stockpile area	RA09	• ROM pad. • Exploration tracks and pads, including: ◦ groundwater monitoring including drill pads and access tracks ◦ access tracks, including for historic mining activities
Fuel and storage areas, and sewage disposal area	RA10	Fuel and storage areas, including: • product loadout tank • product loading area • tank farm • product loading loop (internal cleared area) • road loop (internal cleared area) Sewage treatment plant and disposal area.
Exploration tracks and pads	RA11	Exploration tracks and pads, including: • numerous access tracks, including for historic mining activities; and • exploration bores

Relevant activities	RAs	
Final void	RA12	Final void pit, including: • final void walls • lagoon system surrounding final void, including diversion channels • inflow channels to final void • outflow channel from final void to Gully E
Farm detention dam (Gully B) and Stuart Box Cut	RA13	Removed and revegetated Gully B farm detention dam, and the former Stuart Box Cut
Void perimeter	RA14	Constructed lagoon system around the final void which will manage catchment runoff entering the pit lake, with detailed design and implementation is required during the operational phase of the mine to confirm the arrangement and performance.

Table 2.14 Rehabilitation Milestones for the Project

RMs	
RM1	Infrastructure decommissioning and removal
RM2	Identification, remediation and removal of contaminated land
RM3	Landform development, and reshaping/reprofiling
RM4	Surface preparation
RM5	Revegetation – native ecosystem (bushland) PMLU
RM6	Revegetation – water storage (stock use), freshwater wetland (lacustrine), and freshwater wetland (palustrine) PMLUs
RM7	Achievement of Forest Road Realignment
RM8	Achievement of surface requirements – native ecosystem (bushland) PMLU
RM9	Achievement of surface and water quality requirements – freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs
RM10	Achievement of water quality requirements – water storage (stock use) PMLU
RM11	Achievement of PMLU to stable condition - Industrial PMLU and Permanent Infrastructure PMLU
RM12	Achievement of PMLU to a stable condition– native ecosystem (bushland) PMLU
RM13	Achievement of PMLU to a stable condition – Freshwater wetland (lacustrine) and freshwater wetland (palustrine)
RM14	Achievement of PMLU to stable condition – water storage (stock use) PMLU

2.4.3. Existing rehabilitation and interim revegetated areas

Approximately 3 to 4 ha of rehabilitation, and approximately 9 to 10 ha of interim or temporary revegetation has been undertaken within ML 80003 to date, including:

- **Stuart Box Cut Site:** A wide selection of trials and experiments were initially established on the Box Cut Site. Initial direct seeding trials were conducted on the 3.7 ha site in 1991 and included a range of experiments including:
 - species suitability
 - fertiliser application rates
 - sowing rates
 - site preparation techniques
 - direct seeding as opposed to seedling planting

Part of the rehabilitated box cut area is expected to remain undisturbed for the duration of the Project.

- **Out-of-pit MRA:** The Out-of-pit MRA interim revegetation trials were located on the slopes of the Out-of-pit MRA and are representative of future broadacre rehabilitation. This site was established in 1999 (with further seeding occurring in 2001) and includes two distinct areas adjacent to the north and south topsoil stockpiles (approximately 0.9 ha and 1 ha). The site adjacent to the south topsoil stockpile initially had four 25 m monitoring points established to assess floristic and soil developmental processes. During the 2012 monitoring event, three of these sites were able to be located, with another two permanent monitoring points established on the site adjacent to the north topsoil stockpile.

The review of monitoring data for the 1999 trials concluded that, depending on the source of topsoil (and its weed content), fertiliser will be applied with seed onto all future rehabilitated Out-of-pit MRA areas.

- **Old Tank Farm:** The Old Tank Farm Site is located directly south of the processing plant and has been established in the location that historically held the fuel tanks. The 1 ha site was revegetated in 2010.
- **Topsoil stockpiles:** The stabilisation and revegetation of topsoil stockpiles, shown in Figure 2.8, focussed on:
 - Short-lived acacia species because of the expected short storage life of the stockpile topsoil. It was expected to be 3 to 4 years, but due to cessation of the ATP operations in 2004, the main topsoil stockpiles are now almost 20 years old.
 - Seed was pre-treated in smoked boiling water and sown at 5.5 kg/ha.
 - The seed was mixed with fertiliser which was spread at 100 kg/ha.
 - The seed was spread over freshly ripped areas of the surface of the stockpiles.
 - Monitoring has focused on tree versus weed growth.

As a result of these works, it was determined that topsoil stockpile heights will be a maximum of 3 to 4 metres if there is a shortage of storage space. Furthermore, it was determined the top 20 centimetres of the stockpiles will be scalped off before the underlying topsoil is utilised in rehabilitation works to minimise spread of weeds.

- **Upper diversion bunds around MWSP and PP:** Revegetation works on the clean water diversion bunds and on land surrounding the mine water ponds focussed on:
 - sowing stabilising pasture species onto batter slopes and channels for the purposes of erosion control
 - grass seed was sown at 40 kg/ha
 - fertiliser applied at 200 kg/ha

Monitoring focused on the effectiveness of erosion control and the density of grass cover.

Grass establishment was more than sufficient to ensure erosion control as long as major structures remained stable/effective (i.e. rip-rap, rock lined drains).

- **Historic farm dam (i.e. Farm detention dam (Gully B):** A hybrid rehabilitated area of approximately 2 ha exists immediately south of the current mine pit where a farm dam existed prior to the commencement of mining (shown on Figure 2.2). The dam was subsequently decommissioned to facilitate depressurisation of groundwater adjacent to the mine pit.
- **Erosion monitoring at the Out-of-pit MRA (east and south areas) and an adjacent undisturbed area:** Erosion monitoring was conducted on three locations at the Project between 2005 and 2009 (Landloch, 2012). The two Out-of-pit MRA plots had gradients ranging from 10 to 20% and slope lengths of 34 to 44 m. The undisturbed plot had a gradient of 8% and a slope length of 30 m.

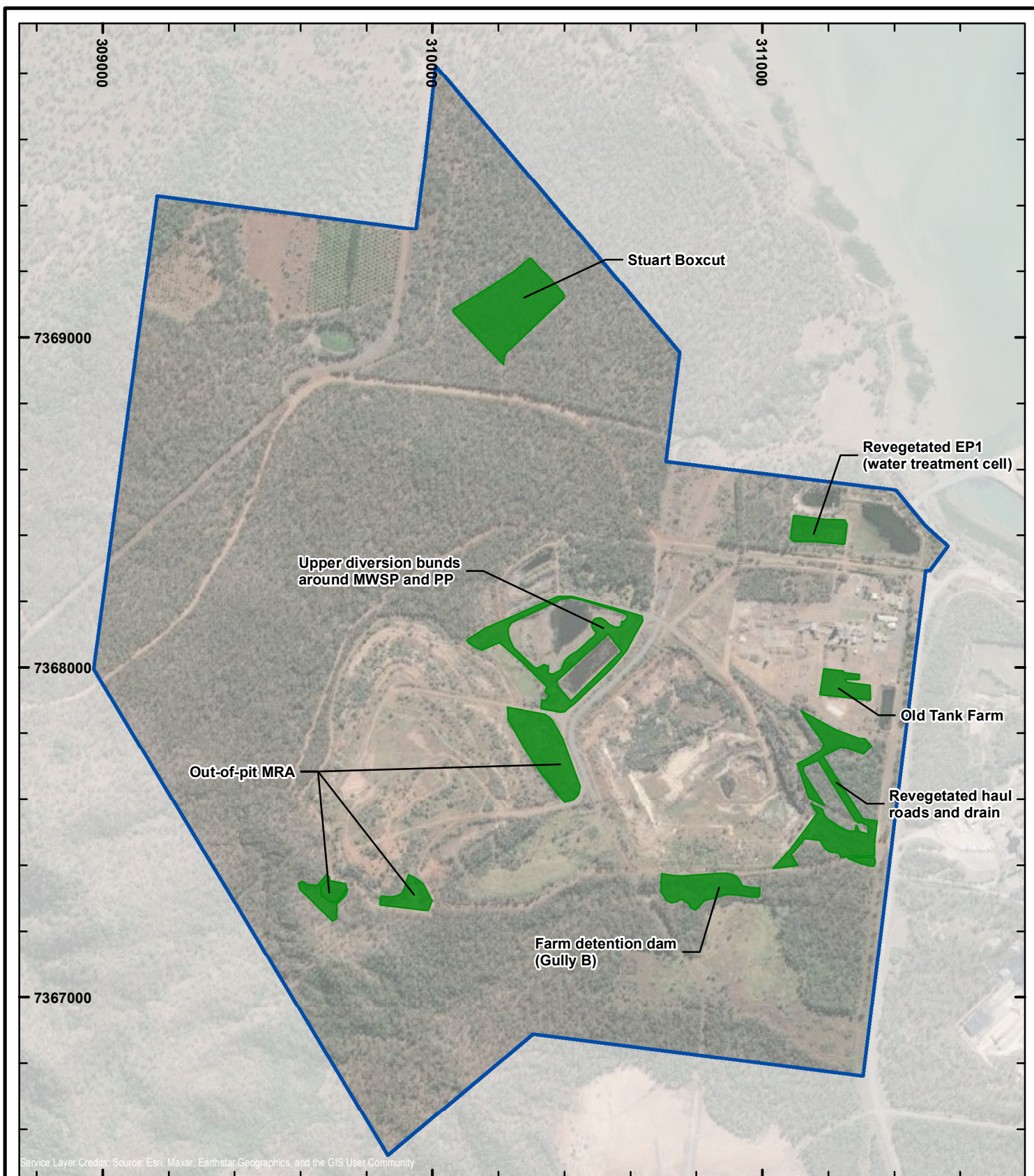
The eastern plot of the Out-of-pit MRA and undisturbed plot were both subjected to 2,236 mm of rain between March 2005 and March 2009 (4 years). The average annual rainfall was 569 mm, with annual rainfall ranging from 400 to 781 mm. For the same period, the annual erosivity (erosive potential of rain) calculated from rainfall intensity data from Gladstone was 1,952 MJ.mm/ha/hr/y.

The southern plot of the Out-of-pit MRA was operated from March 2005 and September 2007. It was subjected to a total of 1,287 mm rain over this period. The average annual rainfall applied to this plot was 644 mm, and the rainfall erosivity for the trial period was 967 MJ.mm/ha/hr/y.

Using data from December 1961 to November 2017, the long-term annual average erosivity for Gladstone is 3,486 MJ.mm/ha/hr/y. When the erosivity of the trial period is compared to the average long-term erosivity for Gladstone, the plots received rainfall with below average erosivity. The eastern plot of the Out-of-pit MRA and undisturbed plot received 56% of average annual erosivity and the southern plot of the Out-of-pit MRA received 28% of average annual erosivity.

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

The existing rehabilitation and interim revegetation areas are shown on Figure 2.14.



QUEENSLAND ENERGY RESOURCES

Stuart Kerogen Shale Project

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GDA2020, MGA Zone 56



Figure 2.14
Existing rehabilitation and interim revegetated areas

Legend

- ML 80003
- Revegetated Area

Date: 15/05/2023

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0040_B

Requested by: John Linden

Sources:
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3. Post-mining land uses

Legislative requirements

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

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

PRCP Guideline (Section 3.2)

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

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

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

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

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

Schedule 8A, Part 3, Table 1 of the Environmental Protection Regulation 2019 (EP Regulation) provides PRCP objectives and PRCP performance outcomes, with the following relevant to identification of PMLUs:

1. Each post-mining land use:

(a) is viable, having regard to the use of land in the surrounding region; and

(b) satisfies at least 1 of the following:

(i) the use is consistent with how the land was used before a mining activity was carried out on the land;

(ii) the use is consistent with a development approval relating to the land;

(iii) the use is consistent with a use of the land, other than a use that is mining, permitted under a State or Commonwealth Act, including, for example, a planning instrument under the Planning Act; or

(iv) the use will deliver, or is aimed at delivering, a beneficial environmental outcome.

In addition, Section 755B (application of notification stage) of the EP Act applies as follows (as relevant to the Project):

(1) If either of the following matters is satisfied in relation to land the subject of a proposed PRCP schedule:

(a) the outcome for land under a LOD is the same as, or substantially similar to, the post-mining land use or non-use management area stated for the area under the proposed PRCP schedule.

(2) The notification stage under chapter 5, part 4 does not apply for the assessment of the proposed PRCP schedule under section 755(2), to the extent of the matter.

(4) For applying subsection (2), if there is an inconsistency in LODs for land, the document appearing first in the list mentioned in section 750, definition LOD prevails to the extent of the inconsistency.

Relevant LODs, as defined in Section 750 EP Act, are identified in Sections 1.3.2.2 and 3.1, with the EA being the prevailing LOD to the extent of any inconsistency as per Section 755B(4) of the EP Act.

3.1. Transitional issues relating to PMLUs

As outlined in further detail above and in Section 1.3, under the transitional provisions of the EP Act, existing approved PMLUs can be transitioned into the PRC plan without further public notification. However, PMLUs must still comply with Section 126C(1)(d) and Schedule 8A Part 3 of the EP Regulation.

The primary LOD for the Project site is the EA, which identifies specific PMLUs in Schedule E, Table 2 and has been reproduced in Table 3.1. This PRC plan proposes that the outcome for land under a LOD is the same as, or substantially similar to, the PMLUs listed for the corresponding areas in the EA. Therefore, public notification is not required. There are two other LODs for the Project site:

- the FLURP (QER, 2011) (Appendix C)
- successive Plans of Operations that made any relevant changes to the FLURP, as referenced in Condition E15

To the extent PMLUs in Schedule E, Table 2 of the EA references native ecosystem (bushlands) and water storage (freshwater wetland) as the PMLUs for identified domains, Condition E14 is relevant, because it requires reference to analogue sites in Schedule E, Table 2 (Column 7). However, Condition E14 is not relevant to Industrial PMLUs.

The industrial PMLU in Schedule E, Table 2 was derived from the inclusion of the Project site in the Development Scheme (DSDILGP, 2022). Therefore, the Industrial PMLU should be interpreted in the context of the stated intent for each relevant precinct for the Project site as identified in the Development Scheme. The Development Scheme overrides the Gladstone Regional Council planning instruments from time to time, for the purposes of development assessment.

The FLURP (QER, 2011) was prepared and lodged before Schedule E, Table 2 was included in the EA. While it is of some relevance for further details, there is a degree of inconsistency with Schedule E, Table 2 and so, to this extent, the EA overrides the other LODs.

Several of the disturbance types in Schedule E, Table 2 of the EA (reproduced in Table 3.1) provide for multiple PMLU options. Where this is the case, existing disturbance types have been separated into multiple RAs based on the most appropriate PMLU for specific areas within that disturbance type (Table 3.1). This has primarily been undertaken in relation to disturbance types that are approved to be retained for industrial PMLU, and where there is justification for industrial use post-mining.

Table 3.1 EA Schedule E, Table 2 Rehabilitation landform criteria

Relevant activities	Area (ha)	Pre-mining land description	Pre mine land (capability/suitability) classification	Post mining land description	Maximum post-mine slopes (%) maximum/average	Analogue site identification
Out-of-pit MRA	80	100% Low Grade Forest	20% Class 3 55% Class 4 25% Class 5	100% Native Bushland Ecosystem	20/20 ³	Native forest ecosystem that is consistent with the final cover system specified in Condition G26 of the EA.
In-pit MRA	88.5	100% Low Grade Forest	5% Class 4 95% Class 5	100% Native Bushland Ecosystem	10/5 ³	Native forest ecosystem that is consistent with the final cover system specified in Condition G26 of the EA.
Settling ponds	5	50% Grazing 50% Low Grade Forest	70% Class 3 30% Class 4	Retain – Industrial use ¹ or Native Freshwater Wetlands and Stock Water Use	10/5	Analogous native forest and wetland sites
				If removed – 100% Native Bushland Ecosystem ²		
CWHPs	7	50% Grazing 50% Low Grade Forest	70% Class 3 30% Class 4	Retain – Industrial use ¹ or Native Freshwater Wetlands and Stock Water Use	10/5	Analogous native forest and wetland sites
				If removed – 100% Native Bushland Ecosystem ²		
Sediment dams	4	100% Low Grade Forest	50% Class 3 50% Class 4	Retain – Industrial use ¹ or Native Freshwater Wetlands and Stock Water Use	10/5	Analogous native forest and wetland sites
				If removed – 100% Native Bushland Ecosystem ²		
Detention Ponds	5.3	100% Low Grade Forest	50% Class 3 50% Class 4	Retain – Stock Water Use	10/5	Not applicable
				If removed – 100% Native Bushland Ecosystem ²		
Roads	11 (Forest Rd)	100% Low Grade Forest	50% Class 3 50% Class 4	Retain – Industrial use ¹ and/or public roads	10/5	Analogous native forest site
	If removed – 100% Native Bushland Ecosystem ²					
	4 (Haul and Plant Rds)		Various Classes 3 to 5	Retain – Industrial use ¹ and/or public roads		
				If removed – 100% Native Bushland Ecosystem ²		

Relevant activities	Area (ha)	Pre-mining land description	Pre mine land (capability/suitability) classification	Post mining land description	Maximum post-mine slopes (%) maximum/average	Analogue site identification
Plant Site	15	100% Grazing	100% Class 3	Retain – Industrial use ¹	10/3	Analogous native forest site
				If removed – 100% Native Bushland Ecosystem ²		
Infrastructure	21.5	100% Grazing	100% Class 3	Retain – Industrial use ¹	10/3	Analogous native forest site
				If removed – 100% Native Bushland Ecosystem ²		
Ore stockpile site	2	100% Grazing	100% Class 3	Retain – Industrial use ¹	10/3	Analogous native grassland site
				If removed – 100% Native Bushland Ecosystem ²		
Fuel and storage areas	4	100% Grazing	100% Class 3	Retain – Industrial use ¹	10/3	Analogous native forest site
				If removed – 100% Native Bushland Ecosystem ²		
Sewage disposal area	2	100% Grazing	100% Class 3	Retain – Industrial use ¹	10/3	Analogous native forest site
				If removed – 100% Native Bushland Ecosystem ²		
Exploration tracks and pads	1.04	100% Low Grade Forest	50% Class 3 50% Class 4	Retain – Industrial use ¹	10/5	Analogous native forest site
				If removed – 100% Native Bushland Ecosystem ²		
Voids and wetlands	74	100% Low Grade Forest	50% Class 3 50% Class 4	Void perimeter – 100% freshwater wetlands	30/20	Analogous native wetland site
				Void excavation water body – self-sustaining freshwater wetland		

It is noted that, at the time of finalising rehabilitation, some areas of ML 80003 may be used for subsequent industrial projects. Two options are therefore given, either to retained desired (sic) infrastructure and rehabilitate to suit the planned industrial use or to be rehabilitated to the alternate stated native [sic] land use.

Where rehabilitated to the alternate stated native [sic] land use, the land capability is to be restored to no worse than the pre-mining capability/suitability classifications.

The maximum gradient of the outer slopes of the Out-of-Pit and In-pit MRA design (12° or 21.3%) are slightly steeper than the gradients listed in Schedule E, Table 2 (i.e. 11.3° or 20%) and Condition G27 of the EA. Further discussion and justification provided in Section 7.1.5.2.

3.2. PMLU criteria

3.2.1. Government strategies/plans for the land

3.2.1.1. Gladstone State Development Area Development Scheme

Notwithstanding that the existing PMLUs under the EA are simply proposed to be transitioned under Section 755B of the EP Act, it is still necessary to examine government plans for the Project site under both Section 126C(1)(d)(ii) of the EP Act and Schedule 8A, Part 3 of the EP Regulation.

The Development Scheme (DSDILGP, 2022) is a regulatory document that controls planning and development within the Gladstone SDA. The Project is located within the following Gladstone SDA precincts:

- *Industry Investigation Precinct:* The preferred development intent for this precinct includes:
 - recognises and protects land for future industrial development, linear infrastructure, and linear infrastructure corridors
 - in the short-term resource activities are likely to occur
 - development within this precinct may be appropriate where it is for the suitable expansion of existing uses and does not compromise the future use of this precinct for industry
- *Port Related Industry Precinct:* The preferred development intent for this precinct includes:
 - accommodating industrial development that:
 - links to the Port of Gladstone through the import and export of material
 - benefits from close proximity to port related infrastructure and services
 - is difficult to locate and requires separation from sensitive land uses
 - may also accommodate industrial development that requires co-location with uses that support the preferred development intent

The 'Industry' PMLU in Schedule E, Table 2 is consistent with the planning intent for each of these precincts. The statements of intent for each precinct are also relevant to interpreting what is meant by the term 'Industry'.

The Intent for the Industry Investigation Precinct states that development must not compromise the future use of this precinct for industry. While mining itself is exempt from the Development Scheme, the post-mining land uses are not exempt. Under Section 84 of the SDPWO Act, the Development Scheme overrides local planning instruments. Section 84 provides:

(1) This section applies to the extent an approved development scheme for a State development area identifies regulated development in the area.

(2) If another Act or law would, apart from this section, regulate the regulated development, the other Act or law does not apply to the regulated development to the extent the other Act or law regulates that development.

Although Section 84 is expressed in broad terms, QER's legal advice is that it does not override the EP Act to the extent that mined land rehabilitation is required under the EP Act, because mining is expressly 'excluded development' under the Development Scheme. However, as Section 84 expressly takes priority to the extent of any inconsistency, it does not allow for PMLUs to be inconsistent with the Development Scheme.

Section 85 of the SDPWO Act permits the continuation of any existing lawful uses that were in place before the commencement of the Development Scheme. This allows for the continuation of the State Forest land use, agistment for grazing purposes. And potentially also the orchard land use in the north-west corner of ML 80003. Therefore, to the extent that Schedule E, Table 2 of the EA already allows for some mine infrastructure (such as detention ponds) to be retained for water storage (stock use) PMLU, this is consistent with Section 85.

3.2.1.2. Gladstone Port Land Use Plan

The Gladstone Port Land Use Plan also applies to the Project site, but this Plan gives priority to the Development Scheme, to the extent of the overlap.

3.2.1.3. Gladstone Regional Planning Scheme

If the Development Scheme ceased to be applicable to the land, the Gladstone Regional Planning Scheme would be applicable, but at the date of lodgement of this PRC plan, this is overridden by the Gladstone SDA Development Scheme. Therefore, for PRC plan purposes, the Gladstone Regional Planning Scheme is only relevant considering that prior to the commencement of the Development Scheme, the Project site was appropriately zoned to allow for State Forest, grazing and agricultural land uses.

Therefore, to the extent that these land uses continue, they are protected under Section 85 of the SDPWO Act.

3.2.1.4. Viable

Under Schedule 8A of the EP Regulation, it is also necessary to demonstrate that each proposed PMLU is 'viable'.

For the Industrial PMLU, it is considered that the planning studies undertaken by the Coordinator-General for the Development Scheme provide sufficient evidence that Industrial PMLUs are considered viable.

For the water storage (freshwater wetland) and native ecosystem (bushland) PMLUs, the EIA (Envirosciences, 1993) already assessed these PMLUs, and nothing in the additional reports of this PRC plan (i.e. Appendix F, Appendix H, Appendix I, Appendix J, Appendix K, Appendix L and Appendix M) contradicts the EIA (Envirosciences, 1993) in relation to the viability of these PMLUs.

3.2.2. Community consultation outcomes

Community consultation is described in further detail in Section 6 of this PRC plan. The key points for the purpose of assessing PMLUs are as follows:

The majority of the Project site comprises State Forest. A registered compensation agreement with the State is in place. Under a Special Condition of the compensation agreement, QER is required to provide a copy of the PRC plan to the State Forest contact for the purpose of State Forestry comments either before or on the same day as submitting the PRC plan. The State Forest contact also has an opportunity to consent to permanent infrastructure under the agreement.

The Minister for Economic Development is the freehold landholder of Lot 57, part of which is included in the Project site. The Coordinator-General has overlapping jurisdiction with DES regarding PMLUs for the Project site. A copy of the PRC plan has been provided to the Coordinator-General at lodgement under the EP Act.

An Indigenous Land Use Agreement (ILUA) is in place with the relevant native title holders for the non-freehold parts of the Project site. The ILUA already consents to rehabilitation in sufficiently broad terms that this covers this PRC plan.

The majority of community consultation regarding rehabilitation took place in relation to the EIA (Envirosciences, 1993), which already addressed the PMLUs regarding the freshwater wetland and the scope of the native bushland ecosystems proposed.

Public notification is not required under Section 577B of the EP Act.

QER operates a visitor centre at ML 80003 which welcomes visitors and is open daily to the general public. Weekly tours to site are undertaken in conjunction with a local tourism operator. QER's site manager and senior staff are the primary contacts with all visitors and QER's rehabilitation activities form part of the visitor centre experience. Visitors are typically interested in seed collection from existing rehabilitated/revegetated areas. Ecologists associated with rehabilitation at other sites in the region occasionally use QER's site to collect seed for other projects. QER also actively engages at community events such as Gladstone Ecofest which draw thousands of mostly local visitors and families annually, and occasionally the QER stall theme is focussed on rehabilitation.

Consultation with the community regarding rehabilitation of the site to date and future consultation and engagement with relevant stakeholders regarding the implementation of the PRC plan is discussed in Section 6. The focus of QER consultation of specific relevance to this PRC plan has been with existing landowners with ML 80003, and QER's direct neighbours.

4. Non-use management areas

PRCP Guideline (Section 3.3)

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

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

On the basis that the 'freshwater wetland' for the final void is already referred to in Schedule E, Table 2 of the EA as a PMLU, not a NUMA, there are no NUMAs proposed for the Project.

5. Voids in flood plains

PRCP Guideline (Section 3.4)

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

Note: Check requirements in relation to transitional PRCPs (such as this project) – specifically Section 6 of PRCP Guideline.

Section 126D(3) requires where land the subject of the proposed PRCP schedule will contain a void situated wholly or partly in a flood plain, the PRCP schedule must provide for rehabilitation of the land to a stable condition. However, as discussed in Section 7.1.2, the final void is pre-approved with as a PMLU of water storage (freshwater wetland), which is transitioned from Schedule E, Table 2 of the EA.

Therefore, whether or not the area is considered to be a flood plain, Section 126D(3) has been complied with and even if the water storage (freshwater wetland) had not been considered to constitute a PMLU, the existence and location of the void is already sufficiently addressed by an LOD (i.e. the EA). As such, whether or not the Project site is considered a flood plain under Section 41C of the EP Regulation, flood plain modelling is not required.

This notwithstanding, there are no relevant watercourses as defined under Section 41C of the EP Regulation (i.e. Targinie Creek and gullies [within the Project site] are stream order 3 and 1 respectively under the Strahler stream order classification system). However, an assessment of flood susceptibility and influence has been undertaken in Appendix K.

The assessment of flood susceptibility used the two-dimensional modelling software TUFLOW to quantify the flood behaviour and characteristics around the proposed final void. The TUFLOW flood model for the final void was assessed for the 1% annual exceedance probability (AEP), 0.1% AEP, and probable maximum flood (PMF) flood events.

The flood results show the final void is not inundated from flooding in Targinie Creek (stream order 3 under the Strahler stream order classification system) up to and including the PMF event and therefore does not pose a flood risk to the final void pit lake.

Flooding in the concept layout of the lagoon system around the final void shows the peak flood wave is highly attenuated and does not result in excessive flood velocity. This indicates the lagoon system will manage catchment runoff entering the pit lake; however, detailed design and implementation is required during the operational phase of the mine to confirm the arrangement and performance.

Peak flow out of the final void lake is 18.5 m³/s in the 0.1% AEP while the pre-mining Gully E 0.1% AEP peak flow at the void overflow location is 22.8 m³/s. This shows the additional catchment reporting to Gully E via the pit lake overflow location is highly attenuated and are not expected to result in increased flow rates in Gully E causing erosion or downstream flood impacts.

6. Community consultation

PRCP Guideline (Section 3.5)

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

- *Section 126C(1)(c)(iii) of the EP Act:*
- *Details of the consultation undertaken by the applicant in developing the proposed PRC plan.*
- *Section 126C(1)(c)(iv) of the EP Act:*
- *Details of how the applicant will undertake ongoing consultation in relation to the rehabilitation to be carried out under the plan.*

6.1. Community consultation register

Due to the historical nature of the site (ML 80003 commenced in 1996), and as a result pre-existing PMLUs nominated in LODs for the site, formal community consultation undertaken in relation to rehabilitation outcomes is predominantly historic. The EIA contains references to consultation with:

- State government
- local government (i.e. Calliope Shire Council and Gladstone City Council)
- Gladstone Area Water Board
- Gladstone Port Authority
- Gladstone Harbour Master
- Bundaberg Land Council, in relation to Aboriginal heritage
- affected landowners
- Community groups (i.e. Concerned Citizens for Industrial Control and Yarwun Targinie Fruit Growers Association)
- Queensland and Capricornia Conservation Councils
- Queensland Commercial Fishermen's Association
- Queensland Sport and Recreational Fishing Council (now Sunfish Queensland Incorporated)
- Queensland Cement Limited
- ICI Australia Operations Pty Ltd
- Minproc Resources Pty Ltd

In the past 18 months, landowners within ML 80003 and neighbours have been consulted regarding the QER's PRC plan. These interactions include contact with Queensland Parks and Wildlife Service (DESI), Cement Australia and the Office of the Coordinator General.

In regard to State Forest land, QER will providing a copy of this PRC plan to the Owner's contact on the same date as lodgement. Any further comments received will be considered post-lodgement. Also of note, under special condition (6) of the State Forest Compensation Agreement: *'Upon reviewing a proposed PRC Plan or amendment under Special Condition 3, the Owner may notify the Miner of any existing or proposed mine infrastructure that the Owner requests to remain as permanent infrastructure and, if agreed with the Miner, promptly grant formal written consent for the infrastructure to remain, having regard to the statutory timeframe for finalising the proposed PRC Plan or amendment.'*

While the Compensation Agreement already consents to a residual final void (the freshwater wetland), there are additional items of permanent infrastructure which are assumed by Schedule E Table 2 to remain on the Project site (including within State Forest). Written consent will be sought.

In addition, the Project site is entirely within the Gladstone SDA Development Scheme administered by the Coordinator-General as well as including part of a lot owned in freehold by the Minister for Economic Development, Queensland. Relevant extracts of this PRC plan relating to the interface with the Development Scheme will be provided to QER's contacts for the Gladstone SDA at about the same time as lodgement with the administering authority. Similar to the position with State Forest, comments on the final PRC plan will be considered post-lodgement.

Included as Appendix O is a Community Consultation Register prepared to address the requirements of this PRC plan. This register is intended to be a live document and it is to be updated throughout the life cycle of the Project to reflect ongoing consultation with the community regarding rehabilitation outcomes for the sites.

Future community consultation will be carried out in accordance with the Community Consultation Plan (Section 6.2).

6.2. Community consultation plan

6.2.1. Objectives

The primary purpose of the Community Consultation Plan is to provide a program for the engagement and consultation with relevant stakeholders in relation to rehabilitation. The Community Consultation Plan is to be implemented prior to any PRCP schedule amendments that may affect the community. The Community Consultation Register (Appendix O) is to be updated whenever consultation is undertaken.

The objectives of the Community Consultation Plan are to:

- Identify key stakeholders relevant to the site.
- Establish mechanisms and frequencies for formal engagement with stakeholders about the PRCP schedule.
- Provide relevant stakeholders with the information necessary to enable an understanding of the rehabilitation that will take place.
- Enable a collaborative approach to work with stakeholders in relation to the rehabilitation proposed.
- Establish relationships between QER and stakeholders, and enable stakeholder feedback where appropriate.
- Address stakeholder interests and concern.
- Document how records of community consultation are to be kept.

6.2.2. Key stakeholder identification

Key stakeholders are to be identified in the Community Consultation Register (Appendix O).

As the key stakeholders and contact information will change over time, the register will be a live document that will be updated where necessary to reflect any changes to the relevant stakeholders.

In summary, stakeholders generally fall into the following broad stakeholder groups:

- administering authorities relevant to the MLs and EA (i.e. DESI, and the Department of Resources, or subsequent Departments as renamed)
- local government agencies (i.e. Gladstone Regional Council)
- local and State members of Parliament
- landowners for the background tenure relevant to the MLs (for both surface area and access)
- adjacent landowners
- local community groups

ML 80003 overlies freehold land over which Native Title has been extinguished. However, an area of Native Title exists within Targinie State Forest in association with the First Nations Bailai, Gurang, Gooreng Gooreng, Taribelang Bunda People Aboriginal Corporation registered native title bodies corporate (RNTBC) (Tribunal file # QC2001/029-6), which was determined on 28 November 2017.

QER and the RNTBC have an ILUA in place with the RNTBC for the non-freehold parts of the Project site. The ILUA already consents to rehabilitation in sufficiently broad terms that this covers this PRC plan.

6.2.3. Community engagement strategy

A summary of the proposed consultation and frequency is provided in Table 6.1.

Table 6.1 Stakeholder consultation requirements

Stakeholder	Consultation requirements	Proposed frequency of consultation
DESI	Reporting in accordance with the EA and relevant legislative requirements of the EP Act as required.	In accordance with the frequencies prescribed under the EA and EP Act.
State of Queensland	Consultation as per the Compensation Agreement between QER and the State of Queensland regarding State Forest land. While the Compensation Agreement already consents to a residual final void (i.e. water storage [freshwater wetland]), there are additional items of permanent infrastructure which are assumed by Schedule E, Table 2 to remain on the Project site (including within State Forest).	QER is providing a copy of this PRC Plan to the Owner's contact on the same date as lodgement under the EP Act. The draft PRC Plan could not be finalised before then because it was dependent on an EA amendment for consistency between the two documents. Therefore, any comments will need to be considered post-lodgement.
		Written consent will be sought for permanent infrastructure within the State Forest.
Department of Resources	Reporting in accordance with relevant legislative requirements of the <i>Mineral Resources Act 1989</i> , as required.	In accordance with the frequencies prescribed under the <i>Mineral Resources Act 1989</i> .
Department of State Development, Infrastructure, Local Government and Planning Minister for Economic Development, Queensland	The Project site is entirely within the Development Scheme administered by the Coordinator-General for the Department of State Development, Infrastructure, Local Government and Planning, as well as including part of a lot owned in freehold by the Minister for Economic Development, Queensland.	Relevant extracts of this PRC plan relating to interface with the Development Scheme will be provided to QER's contacts for the Gladstone SDA at about the same time as lodgement under the EP Act. Similar to the position with State Forest, there was no available time to consider any comments prior to lodgement, so any comments will need to be considered post-lodgement.
Gladstone Regional Council	Communicate as required in relation to the realignment of Forest Road.	Based on need.
Traditional owners	Consultation as per the ILUA between QER and First Nations Bailai, Gurang, Gooreng Gooreng, Taribelang Bunda People Aboriginal Corporation RNTBC	Based on need, and as per the requirements of the ILUA.
Landowners	Communicate as required in relation to the proposed rehabilitation for the sites.	Based on need.
Local community groups		
Traditional owners		

6.2.4. Communication methods and information to be released

The methods and content of information to be released will vary according to each stakeholder group's information needs. Examples of communication medium that may be used are provided in Table 6.2. The type of information that will be released via the above methods will be limited to matters relevant to the PRC plan, such as:

- summaries of PRC plan content relevant to any change of a PMLU
- details of any amendments to PRCP schedule that may be required over the life of the Project
- proactive advice and messaging to the community during progressive rehabilitation

Table 6.2 Communication methods

Medium	Description
Social media updates	This could include social media and company website hosting relevant Project information. This would enable positive messaging to stakeholders and proactive solutions via monitoring of engagement.
Dedicated phone number	Discussion over the phone with stakeholders to reach a mutual understanding. This offers an efficient resolution process due to the ability to obtain immediate feedback and responses.
Emails	Distribution of relevant content via electronic mail to enable rapid delivery of messaging in relation to rehabilitation. Emails may be used for distribution of print materials in lieu of hard copy mail outs for efficiency and to reach a wider audience.
Printed materials	This could include, but is not limited to: • newsletters • information brochures • flyers • fact sheets Print materials are relevant for delivering specific and/or targeted messages to keep the stakeholders informed of Project updates.
Focus groups/ Workshops	This enables stakeholders with the same interest to attend a single meeting to discuss common matters and potential issues.
Face to face meetings	Meetings with individual stakeholders, such as landowners or agencies, may be carried out by one-on-one meetings where required to communicate regarding the proposed rehabilitation of the sites and to obtain feedback.

6.2.5. Consideration of feedback and comments

The communication medium identified at Section 6.2.4 will provide stakeholders with an opportunity to provide feedback regarding the rehabilitation of the Project. Contact details of the nominated QER representative are to be provided in any communication medium to enable the community to provide feedback on the Project.

QER would analyse feedback and comments provided by the stakeholders in response to each separate consultation and/or feedback event. This analysis would include:

- a summary of items raised by the stakeholders
- consideration of any relevant legislation and/or regulations relevant to the feedback
- if applicable, potential solutions and resources required to address/resolve the feedback

The analysis would determine if, and how, the matters raised should be used to inform site rehabilitation activities, with an electronic record of community feedback and comments to be maintained using the template provided in Appendix O. A conceptual flow chart of the feedback and comment handling process is provided in Figure 6.1.

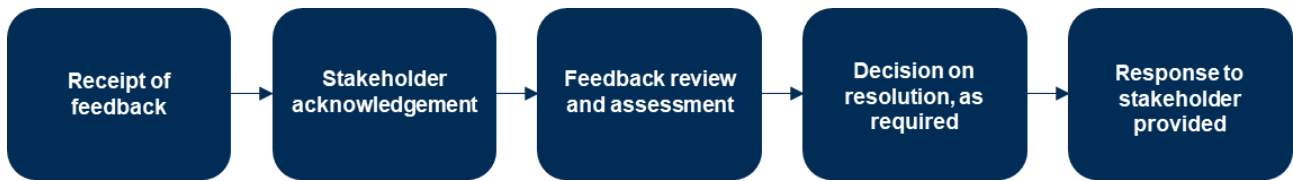


Figure 6.1 Process for handling feedback and comments

Where relevant, the feedback of the analysis findings is to be used by QER to develop and implement rehabilitation activities for the sites.

QER would provide a response to all feedback received in line with the methods of communication outlined at Section 6.2.4.

7. Rehabilitation and management methodology

Legislative Requirement

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

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

PRCP Guideline (Section 3.6)

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

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

7.1. General rehabilitation practices

PRCP Guideline (Section 3.6.1)

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

7.1.1. Hydrogeology

PRCP Guideline (Section 3.6.1)

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

A hydrogeological conceptual model has been completed as part of the Hydrogeological Report (AGE 2023). The hydrogeological conceptual model and groundwater assessment for the Project is contained in Appendix L and the results are summarised below.

A calibrated numerical groundwater model is proposed to be developed once pit void progression has commenced, because calibration of such a model requires that the void be progressed further so that a drawdown response can be used to calibrate the model. Modelling will be commissioned at the start of full production.

7.1.1.1. Conceptual hydrogeological model

In order to conceptualise the groundwater system in the Project site, existing data for ground elevation, infrastructure, geology, and groundwater levels were collated to produce interpreted hydrogeological cross sections (Figure 7.1, Figure 7.2 and Figure 7.3).

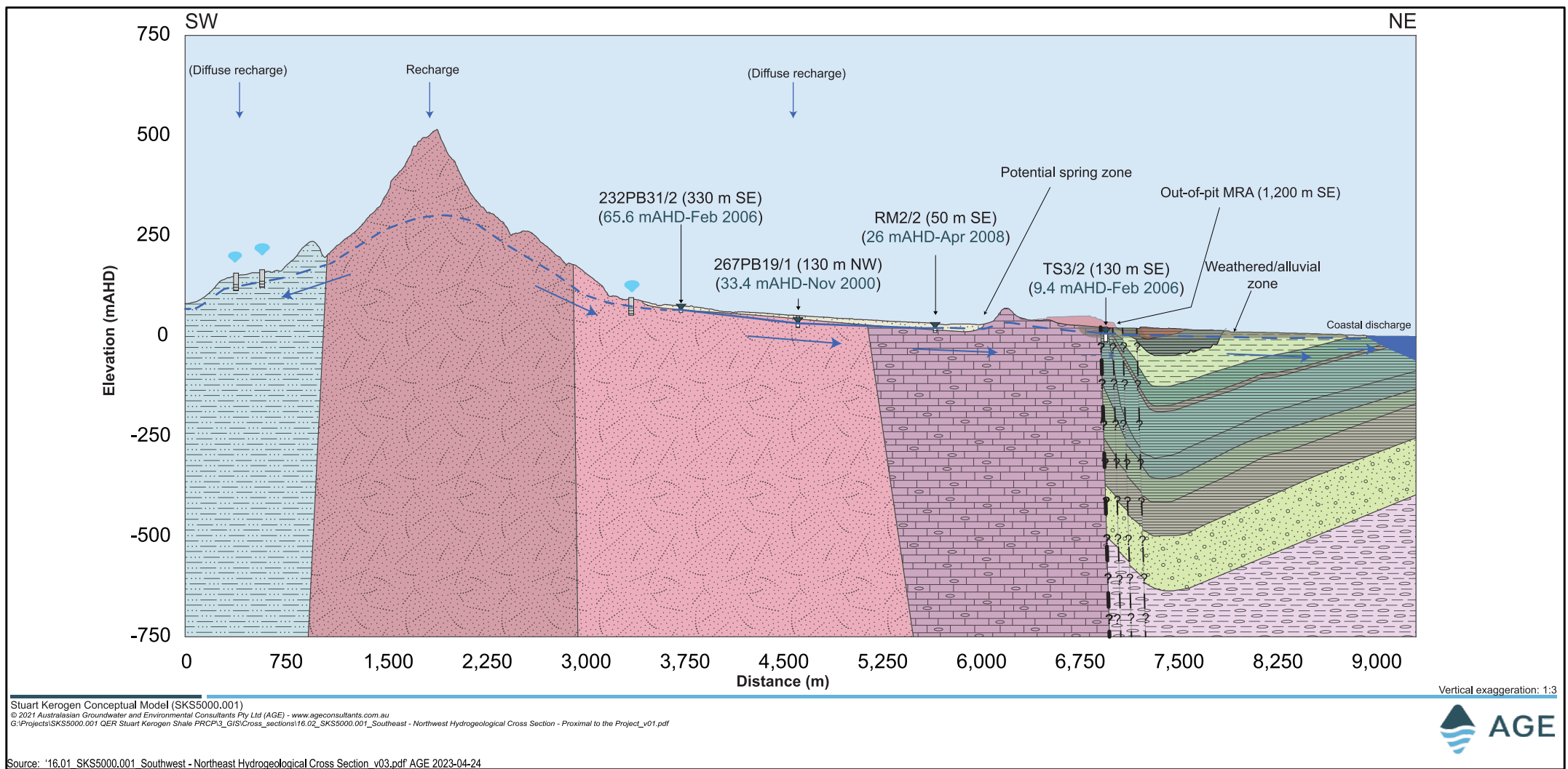
Groundwater monitoring has been undertaken in the Project site since the early 1980s and the water level database is comprised of over 14,000 records from more than 100 bores. A subset of the groundwater monitoring bores, of over 14,000 records from more than 100 bores, was selected as representative for use in the conceptual groundwater model on the basis of availability of recent monitoring records, length and duration of the record and availability of bore construction details. The construction details for the selected bores is provided in Table 9.1 (*Construction details for representative bores*), and shown on Figure 9.1 (*Locations of representative bores*) of Appendix L. This includes identification of relevant information gaps. In addition, bore logs have been provided in Appendix B (*Bore logs for representative bores*) of Appendix L. All cross sections are in the same location, which is shown in Figure 4.5 (*Project site topography and natural drainage*) of Appendix L.

The cross section is oriented approximately perpendicular to the strike of the formations of The Narrows Group and the trend of the Western Faulted Zone. The major hydrogeologic features in this cross section are recharge in the Hinterland; a generalised flow direction towards the coast in all major hydrostratigraphic units, consistent with topographic gradients; and a cone of depression around the existing pit void, with a maximum radius of influence of approximately 1,500 m (Figure 7.1, Figure 7.2 and Figure 7.3).

The cross section also illustrates the presence of irrigation bores in the area of the Targinie Quartz Monzonite (previously named as granite), the potential spring zones along Humpy Creek and Targinie Creek, and discharge to the marine environment (Figure 7.1).

The scale of the cross section of Figure 7.2 is insufficient to show all Project detail; therefore, a smaller scale section was created, and details are depicted on Figure 7.2. The Western Faulted Zone is conceptualised as a barrier to flow.

Hydrogeological conditions of the Project site are conceptualised for closure conditions in the third cross section (Figure 7.3), with the primary difference between Figure 7.2 (current conditions) and Figure 7.3 (closure conditions) being the presence of the final void. The final pit void is depicted as a groundwater source, based on the results discussed in this section.



QUEENSLAND ENERGY RESOURCES

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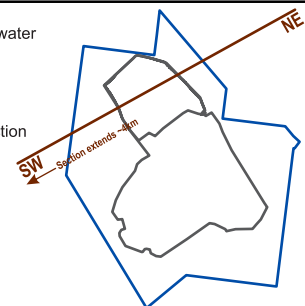


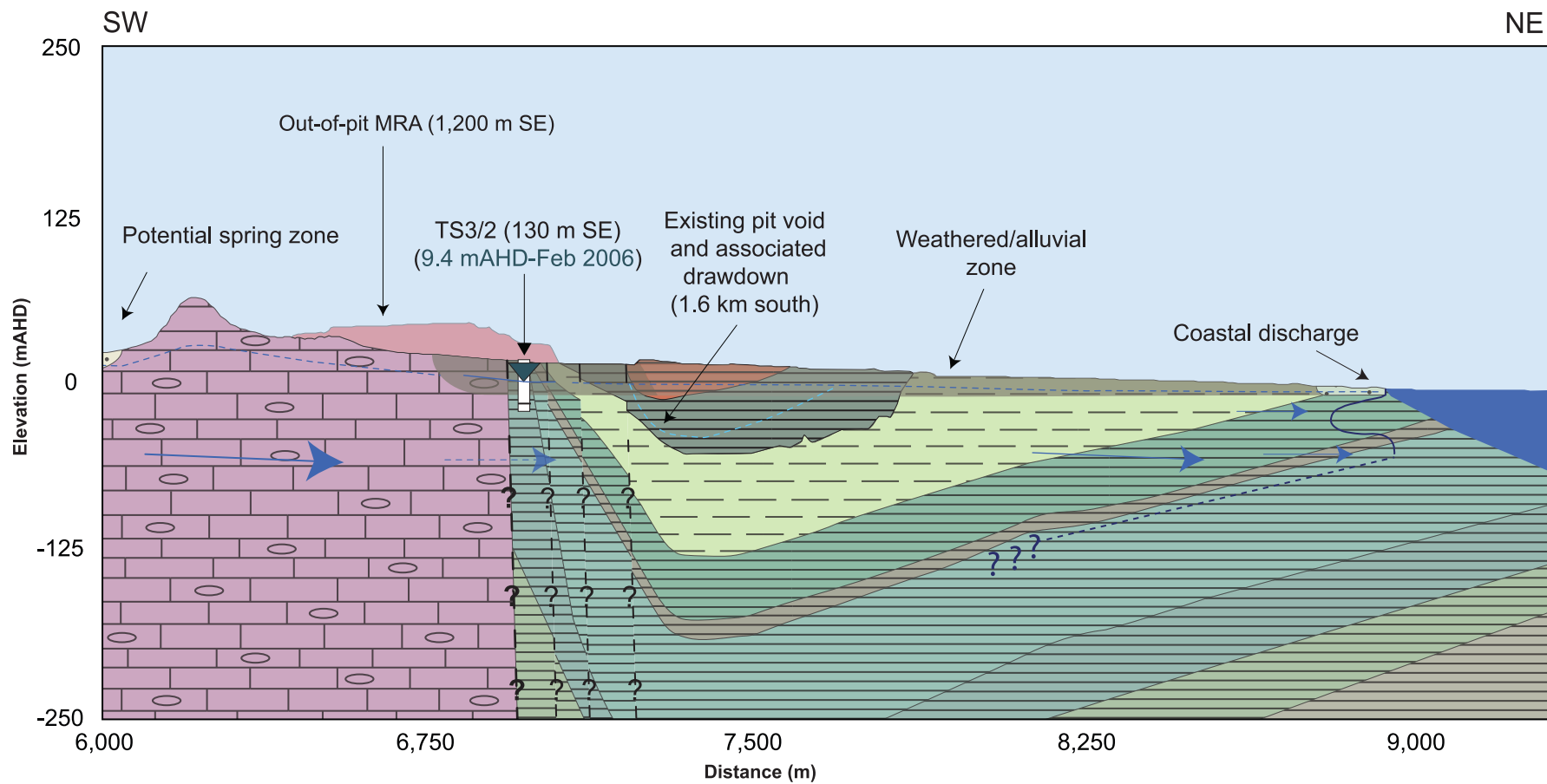
Figure 7.1
Southwest to Northeast
Hydrogeological Cross Section
(AGE, 2024)

Legend

- | | | | |
|--|-----------------------------------|--|-------------------------------------|
| | Quaternary Alluvium | | Teningie Creek Member |
| | Holocene Unconsolidated Sediments | | Monte Christo Member |
| | Curlew Formation | | Worthington beds |
| | Kerosene Creek Member | | Targinie Quartz Monzonite |
| | Telegraph Creek Member | | Targinie Quartz Monzonite (Altered) |
| | Munduran Creek Member | | Chalmers Formation |
| | Humpy Creek Member | | Wandilla Formation |
| | Brick Kiln Member | | Doonside Formation |
| | Ramsay Crossing Member | | Inferred potentiometric surface |

- Groundwater bore with groundwater elevation
- Representative irrigation bore
- Inferred groundwater flow direction
- Fault zone (minor)
- Fault zone (major)





Stuart Kerogen Conceptual Model (SKS5000.001)
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Vertical exaggeration: 1:3



Source: '16.02 SKS5000.001 Southwest - Northeast Hydrogeological Cross Section - Proximal to the Project v03.pdf AGE 2023-04-24

QUEENSLAND ENERGY RESOURCES

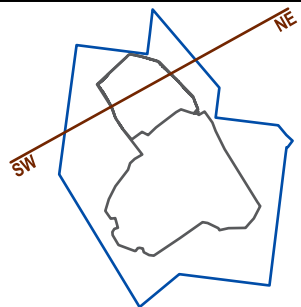
Stuart Kerogen Shale Project

Figure 7.2
Southwest to Northeast
Hydrogeological Cross Section
- Proximal to the Project
(AGE, 2024)

Legend

- | | |
|-----------------------------------|---|
| Holocene Unconsolidated Sediments | Brick Kiln Member |
| Curlew Formation | Ramsay Crossing Member |
| Kerosene Creek Member | Teningie Creek Member |
| Telegraph Creek Member | Monte Christo Member |
| Munduran Creek Member | Doonside Formation |
| Humpy Creek Member | Cone of depression from existing pit void |

- | |
|---|
| Inferred potentiometric surface |
| Groundwater bore with groundwater elevation |
| Inferred groundwater flow direction |
| Fault zone (minor) |
| Fault zone (major) |
| Inferred sea water interface zone (Coffey, 2014b) |

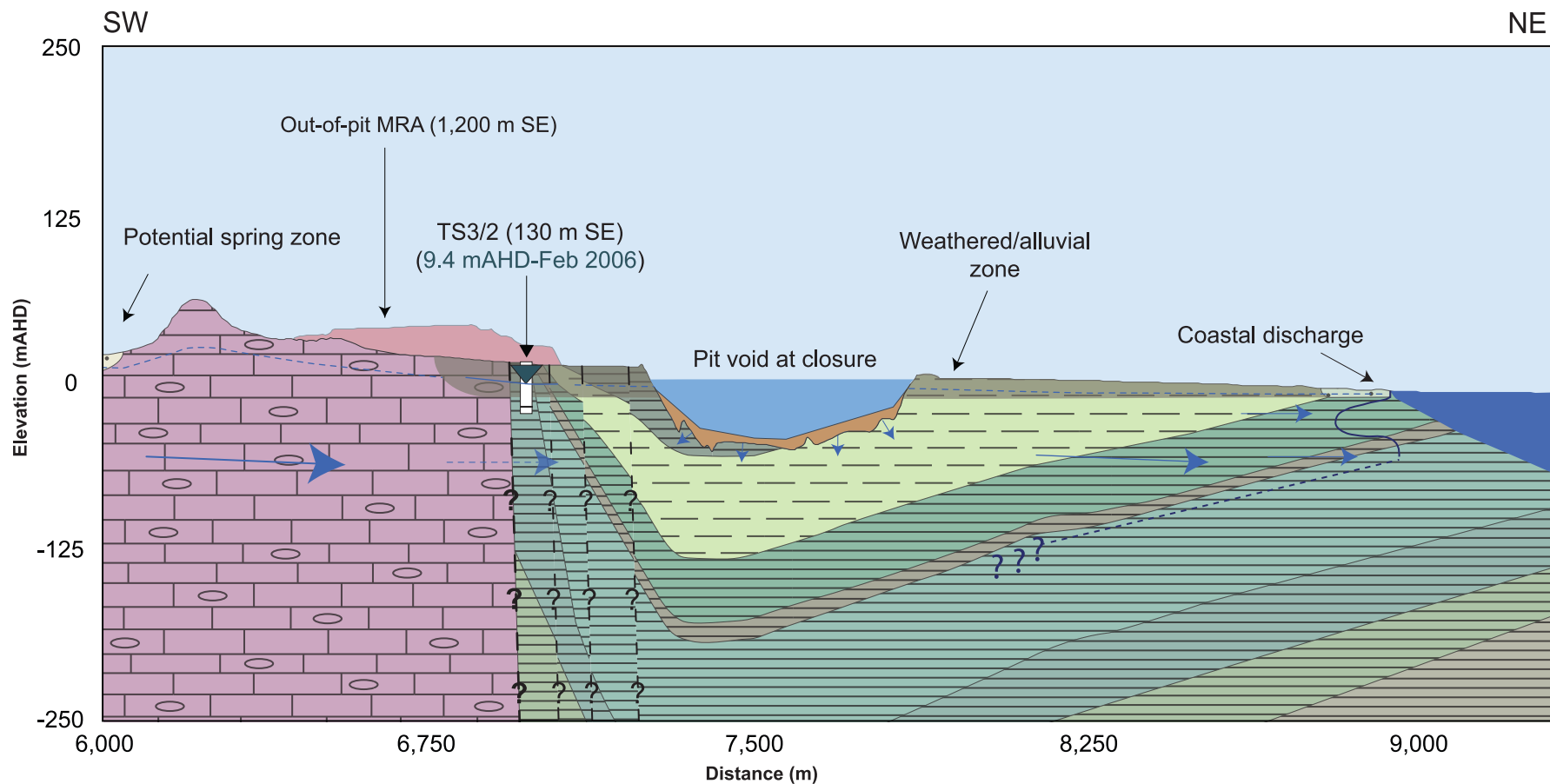


Date: 26/04/2023

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Requested by: John Linden



Stuart Kerogen Conceptual Model (SKS5000.001)
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Vertical exaggeration: 1:3



Source: '16.03 SKS5000.001 Southwest - Northeast Hydrogeological Cross Section of Closure Conditions_v03.pdf' AGE 2023-04-24

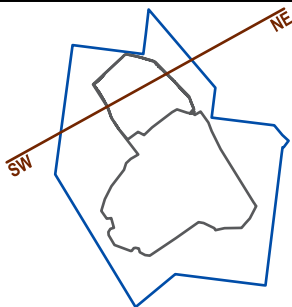
QUEENSLAND ENERGY RESOURCES

Stuart Kerogen Shale Project

Figure 7.3
Project Southwest to Northeast
Conceptual Hydrogeological Cross
Section of Closure Conditions
(AGE, 2024)

Legend

- | | | |
|-----------------------------------|---------------------------------|---|
| Reworked fill | Brick Kiln Member | Inferred groundwater flow direction |
| Holocene Unconsolidated Sediments | Ramsay Crossing Member | Groundwater bore with groundwater elevation |
| Kerosene Creek Member | Teningle Creek Member | Fault zone (minor) |
| Telegraph Creek Member | Monte Christo Member | Fault zone (major) |
| Munduran Creek Member | Doonside Formation | Inferred sea water interface zone (Coffey, 2014b) |
| Humpy Creek Member | Inferred potentiometric surface | |



Date: 26/04/2023

Drawn By: AGE

RTPL_QER_STPRC_PRCMAP0016_B

Requested by: John Linden

7.1.1.2. Hydrostratigraphic units (aquifers and aquitards)

The main Hydrostratigraphic units that have been identified for the Project site are described below and consist of:

- Quaternary alluvium and colluvium
- weathered Tertiary material
- fresh kerogen shale members of the Curlew Formation and the Rundle Formation
- pre-Tertiary volcanic, metamorphic, and fractured rocks (the Hinterland and basement units)
- the Western Faulted Zone (which includes components of the former units)

The Quaternary alluvium forms a shallow, unconfined aquifer, with variable hydraulic conductivity. There is limited connectivity between the alluvial units and the existing pit void. Weathered Tertiary is essentially comprised of a pale, stiff clay of low permeability and is considered a hydraulic barrier between the Quaternary and the underlying fresh kerogen shale.

The Rundle Formation is a deeper, semi-confined fractured rock aquifer with low hydraulic conductivity and limited hydraulic connectivity to other Hydrostratigraphic units.

The fractured metasediments of the Western Faulted Zone and the basement units also host fractured rock aquifers. Field tests to determine hydraulic conductivity are available from a large number of tests from these various units; this includes historical pumping test results.

The conceptual model discussed in Section 7.1.1.1 assumes a single hydrostratigraphic unit hosts the final void, whereas the void wall will intersect two members of the Rundle Formation (i.e. the Kerosene Creek and Telegraph Creek members), as well as the weathered Tertiary. As the Quaternary Alluvium does not intersect the final void, this hydrostratigraphic unit is not considered in the analytical model.

Though there may be some hydrogeological differences between these three units, the data presented in Section 12.3 (*Connectivity between hydrostratigraphic units*) of Appendix L strongly suggests that the Rundle Formation and the weathered Tertiary have indistinguishable hydraulic properties. Similarly, the hydraulic properties of processed shale overlap with those of the host rocks. As such, these are modelled as a single hydrostratigraphic unit (Figure 7.4).

Connectivity between the various hydrostratigraphic units is discussed in Section 12.3 (*Connectivity between hydrostratigraphic units*) of Appendix L. This is based on collection of new groundwater level data at three bore locations, with details summarised in Table 7.1.

Table 7.1 Details of bores used to understand connectivity between hydrostratigraphic units

Sample Point	Easting*	Northing*	TD (mBGL)	Screen Interval (mBGL)	Aquifer Unit
SRH089	309964.68	7368842.9	20.8	18.8 – 20.8	Rundle Formation
TS1/1	310634.15	7368426.12	6.4	2.4 – 5.4	Quaternary Alluvium
TS1/2	310630.33	7368423.93	32.6	28.6 – 31.6	Weathered Tertiary

7.1.1.3. Groundwater recharge and discharge

The recharge mechanisms for groundwater in the Project site are diffuse drainage of rainfall, point source recharge along drainage depressions, and interaquifer leakage. The relative importance of each process differs for the various Hydrostratigraphic units.

The discharge processes for the Project site are evapotranspiration from the shallower areas of the water table, lateral through-flow, discharge to the costal environment, and interaquifer leakage. An additional discharge process is extraction from the areas of mine dewatering.

There are no known surface expressions of groundwater within ML 80003, although baseflow occurs to creeks in the region during flow events. There are potential springs outside ML 80003 (Coffey, 2014) (Section 2.2.8.3), but these have not been documented.

7.1.1.4. Groundwater flow and velocity

Current and future groundwater flow direction is generally to the northeast, towards the coast. The area near the existing pit void is dominated by a cone of depression, locally drawing groundwater towards the void.

Groundwater velocity was calculated for the Quaternary alluvium and the Rundle Formation. Results vary across a wide range, but the flow velocity within the Rundle Formation is generally slow, relative to the coarser grained (more transmissive) alluvial units. Maps and cross sections depict general flow direction, the cone of depression, and groundwater flow directions relative to site infrastructure (sources) for both present and future conditions.

7.1.1.5. Groundwater quality

Groundwater is naturally acidic to circum-neutral with variable salinity. Water is generally more saline in the Rundle Formation and in proximity to the coast, where mixing with marine water occurs. Waters from representative bores generally have a sodium-dominated cation composition, with a chloride-dominated anion composition, reflecting the influence of sea salts. The concentration of dissolved metals in groundwater is generally low.

7.1.1.6. Impact assessment (source, pathway, and fate)

Several numerical models have been developed in the past to address potential impacts from the Project (or related projects). The results of these models differ in detail, but the overarching conclusions of these models is that risks associated with either drawdown or contaminant transport are relatively low. These conclusions are supported by the assessment completed by AGE (2024) (Appendix L).

In combination with Engeny (2024), a final void water balance was created. This model predicted that the final void will act as a source to groundwater. The modelled final void EC is predicted to be lower than that of surrounding groundwater, and the void is predicted to seasonally overflow in approximately 26% of all years (i.e. approximately once every four years on average).

A source-pathway-receptor summary is provided to assess potential impacts for the Project site, the analysis summarises the critical impact assessment data for the Project site in Table 17.4 (*Source-Pathway-Receptor analysis for the Project*) of Appendix L.

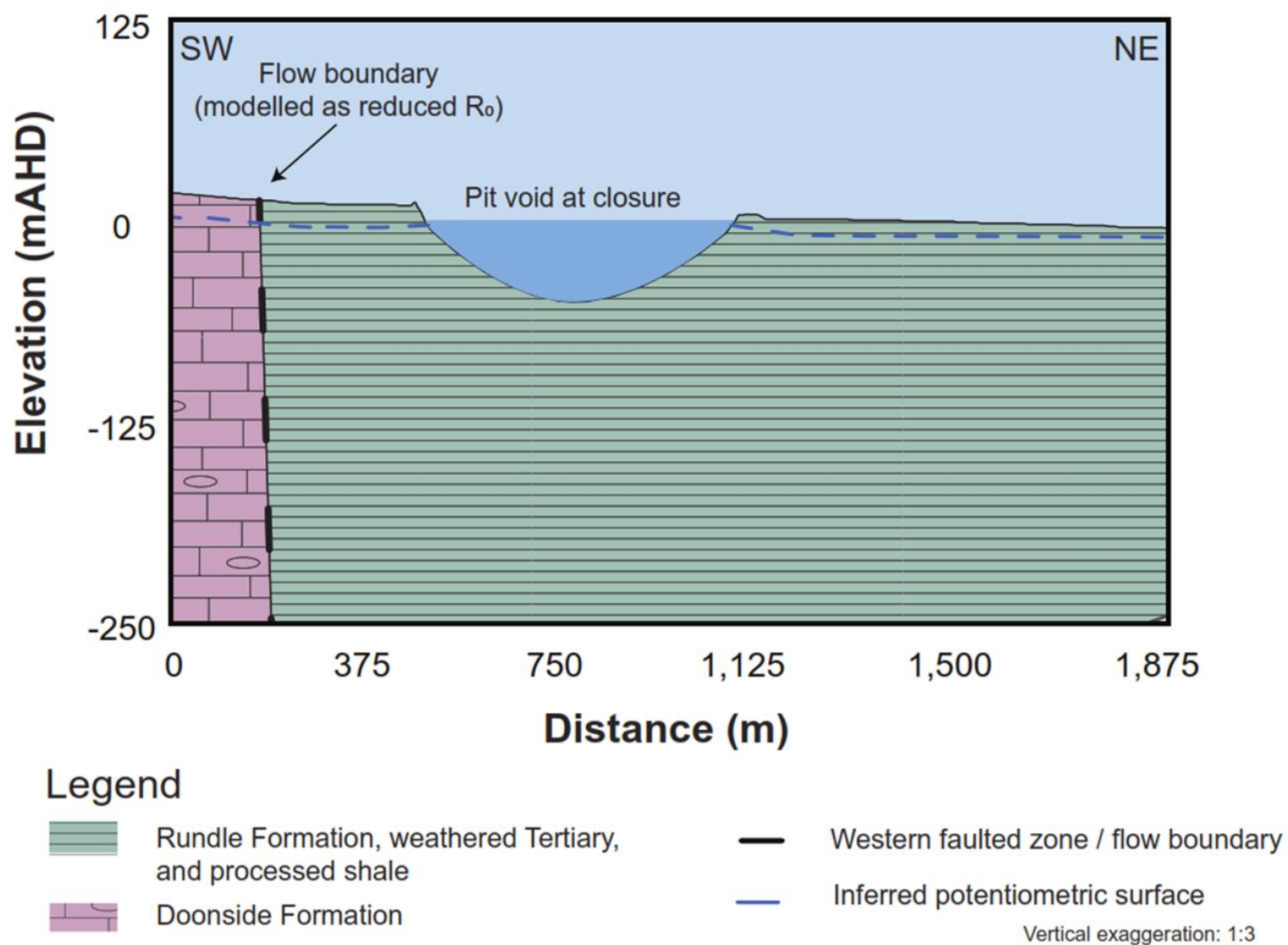


Figure 7.4 Conceptual cross section of the final void showing model assumptions

Sources

Sources of potential groundwater impacts include:

- drawdown, as ongoing or future water level changes have the ability to remove water from a usable depth
- changes in water quality as a result of lithological sources of solutes to groundwater
- site infrastructure that has the potential to be a source of solutes to groundwater includes the onsite water storages, laydown areas, the MRAs (i.e. the Out-of-pit MRA and In-pit MRA), and the existing/future void

The most important potential solutes from site infrastructure areas are salinity, acidity, sulphate, associated dissolved metals, and soluble organic and nitrogen compounds. The sources of solutes may change or become benign as rehabilitation is undertaken prior to closure. Historical (Terrenus, 2015) and concomitant (Terrenus, 2023) assessment of the solutes derived from the future void and the MRAs suggest that the concentrations of solutes released will be comparable to, or lower than, concentrations that are reported from groundwater. Despite this, a cautionary approach was applied in this risk assessment, and these are considered potential sources of impact.

Pathways

The only pathway considered is groundwater and this is only considered a potential pathway if changes in groundwater flow, level, or quality (either present or future) connects the source to the receptor.

Receptors

The potential receptors include:

- an artificial dam mapped as having potential for aquatic GDE status located southeast of the Project site (Figure 2.11)
- stygofauna in the Project site
- areas of potential springs along Humpy Creek and Targinie Creek (Figure 2.11)
- area of mapped potential terrestrial GDEs northeast of ML 80003 (Figure 2.11)
- potential terrestrial GDEs within specific (of concern) RE types mapped on ML 80003 (Figure 2.11)
- groundwater bores used for irrigation and livestock watering
- water used for industrial purposes

Identification of potential receptors was informed by:

- A review of registered groundwater bores within 3 km of the Project, with the results summarised in Table 15.1 (*Registered bores within 3 km of the Project location*) of Appendix L.
- A survey of groundwater use by landowners within a 5 km radius of ML 80003 undertaken in December 2023 and January 2024, with the full details of this survey provided in Appendix C (*Regional survey of groundwater*) of Appendix L. The results of this survey indicates groundwater use near ML 80003 is very limited, and that the nearest utilised bore is located approximately 3 km from the final void centroid.

7.1.1.7. Results of the impact assessment

The impact assessment presented in Table 17.4 (*Source-Pathway-Receptor analysis for the Project*) of Appendix L indicates that:

- There is generally no past or future impact predicted for potential aquatic GDEs regarding water access or water quality from any source, with the exception of very unlikely potential water level impacts to GDEs (that may or may not exist) along potential spring zones along Humpy and Targinie Creeks.
- Stygofauna are likely present but limited to species unlikely to be considered unique in a regional context (Ecosure, 2014c) and as such, any impact is considered to have minimal consequence.
- There is no past or future impact predicted for potential terrestrial GDEs as a result of groundwater drawdown or groundwater quality changes, with the exception of very unlikely potential impacts to:
 - REs that are unlikely to be groundwater dependant and are located on ML 8000
 - to mapped potential GDEs located northeast of ML 80003
- There is no past or future impact predicted for groundwater bores used for irrigation or livestock watering regarding water access or water quality from any source.
- Drawdown from the Project theoretically could have impacted industrial users with records showing that moderate groundwater level decline is present in areas where groundwater has been extracted near the existing pit void. However, this impact would have been inconsequential and will not be present following groundwater recovery post-closure. Furthermore, the final void is predicted to be a groundwater source, which will prevent groundwater drawdown in the long term (post-closure).
- There are no past or future impacts for groundwater used for industrial uses regarding water quality for beneficial use.

7.1.2. Flooding

PRCP Guideline (Section 3.6.1)

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

For transitional PRC plans, where a land outcome document has a pre-approved land outcome for a void with a location specified, flood plain modelling is not required (note that an assessment of the flooding susceptibility and influence is still required).

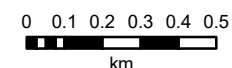
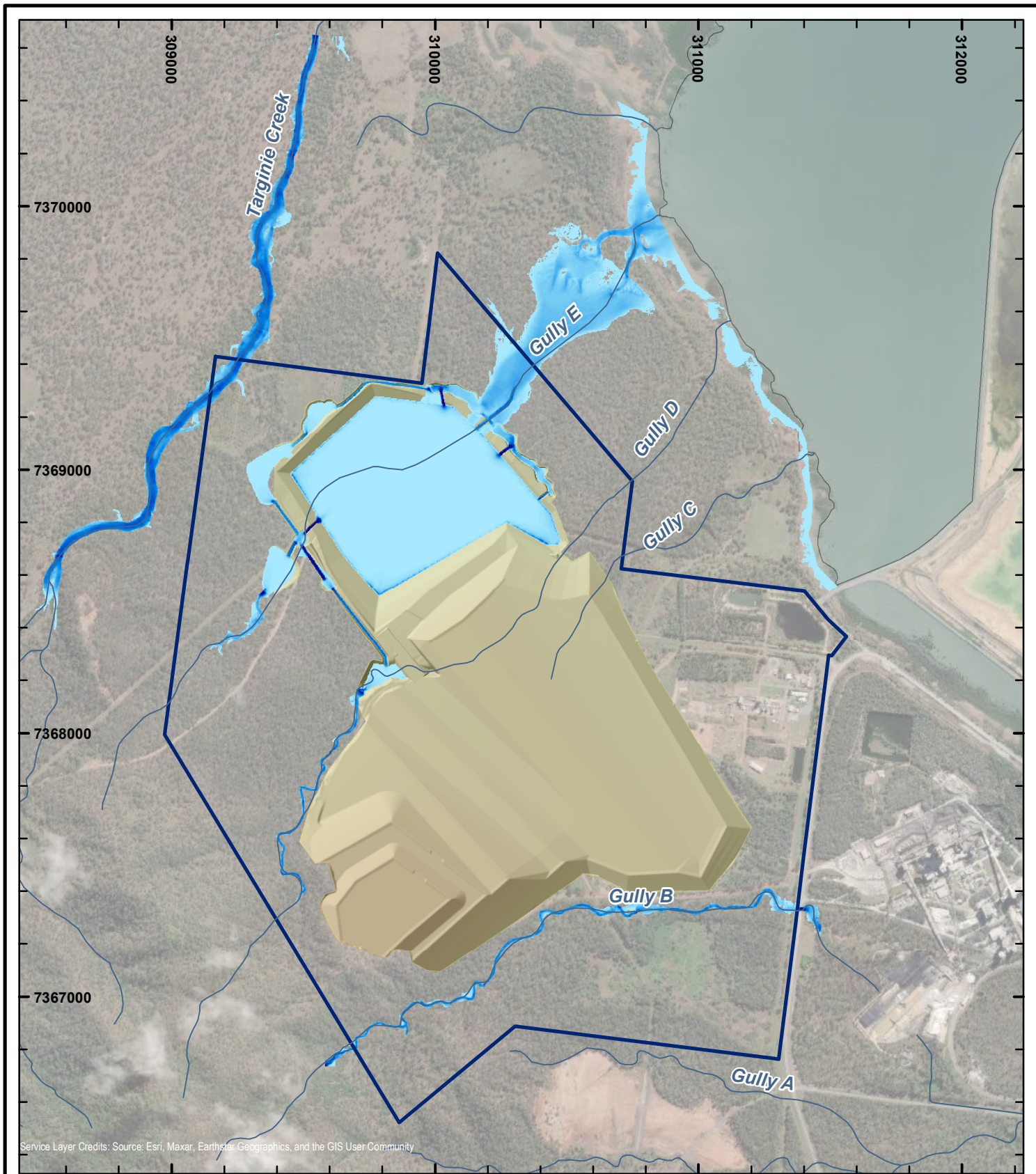
Technical studies into flooding and water management were undertaken as part of the Hydrology and Water Management Technical Study completed by Engeny (2024). The closure water management and flooding assessments for the Project are contained in Appendix K and the flooding results are summarised below.

As discussed in Section 5, the Project site is not located on a flood plain, as defined under Section 41C of the *Environmental Protection Regulation 2019*. There is no 'relevant watercourse' for the Project site, as defined in Section 41C. Even if there had been a flood plain, the residual void is proposed to be rehabilitated to a stable condition, with the PMLU of 'freshwater wetland'. Consequently, flood modelling is not required. Nevertheless, for background information:

- The assessment of flood susceptibility used the two-dimensional modelling software TUFLOW to quantify the flood behaviour and characteristics for the final landform and final void for the 1% AEP, 0.1% AEP and PMF flood events. The flood results for the 1% AEP, 0.1% AEP and PMF are shown in Figure 7.5, Figure 7.6, and Figure 7.7 respectively.
- The maximum flood height, depth and velocity results from the model simulation were output to assess the flood behaviour with the final landform and interactions with the final void.

The flood results show:

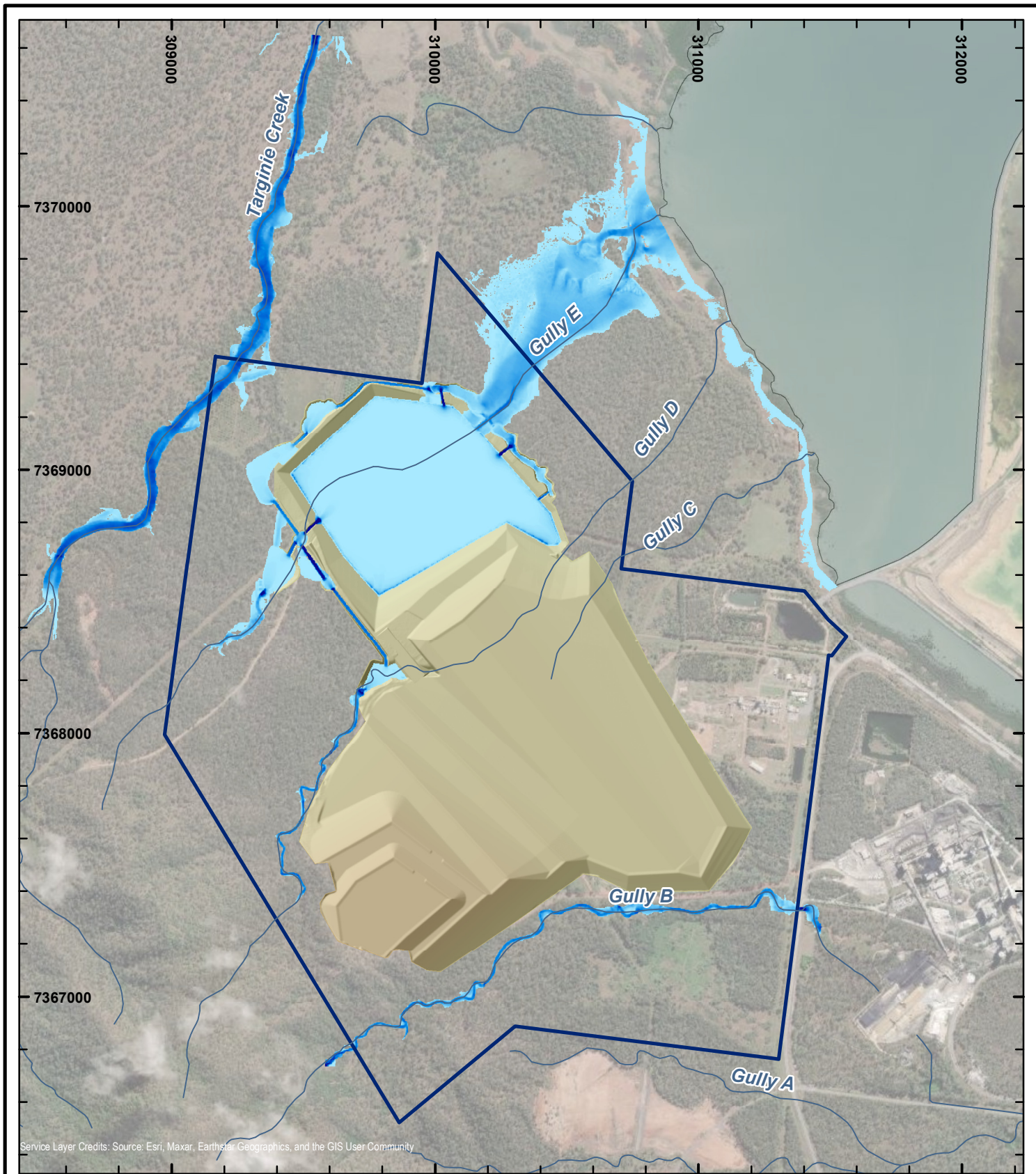
- The final void is not inundated from flooding in Targinie Creek up to and including the PMF event. Therefore, Targinie Creek is unaffected from the final landform and does not pose a flood risk to the final void pit lake.
- Flooding in Gully B and Gully D around the rehabilitated Out-of-pit MRA do not interact with the landform up to and including the PMF event.
- Peak flood velocity in the natural gullies is generally between 1 m/s and 2 m/s with isolated locations reaching 2.8 m/s in the 1% AEP flood event. Therefore, the natural drainage paths around the landform are not expected to receive excessive flows resulting in erosion or scour.
- Flooding in the concept layout of the lagoon systems shows the peak flood wave is highly attenuated and does not result in excessive flood velocity. Therefore, the lagoon system will manage catchment runoff entering the pit lake. Detailed design and implementation is required during the operational phase of the mine to confirm the arrangement and performance.
- Peak flow out of the final void lake is 18.5 m³/s in the 0.1% AEP while the pre-mining Gully E 0.1% AEP peak flow at the void overflow location is 22.8 m³/s. This shows the additional catchment reporting to Gully E via the pit lake overflow location is highly attenuated. Therefore, the reduced pit lake overflow frequency and peak flow rate during extreme events means peak flood velocities in Gully E will not be increased and not impact the condition of the downstream ephemeral waterway (Gully E).



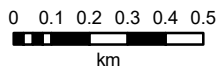
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	Figure 7.5 1% AEP flood extent velocity (Engeny, 2024)	Legend - ML 80003 - Watercourse Velocity 4.92 0
Date: 8/03/2024	Drawn By: Chris Schlebusch	
RTPL_QER_STPRC_PRCMAP0017_C	Requested by: John Linden	Sources: © State of Queensland, Department of Resources



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

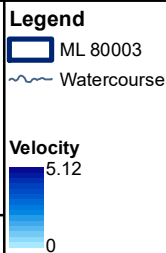


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Figure 7.6
0.1% AEP flood extent
velocity
(Engeny, 2024)



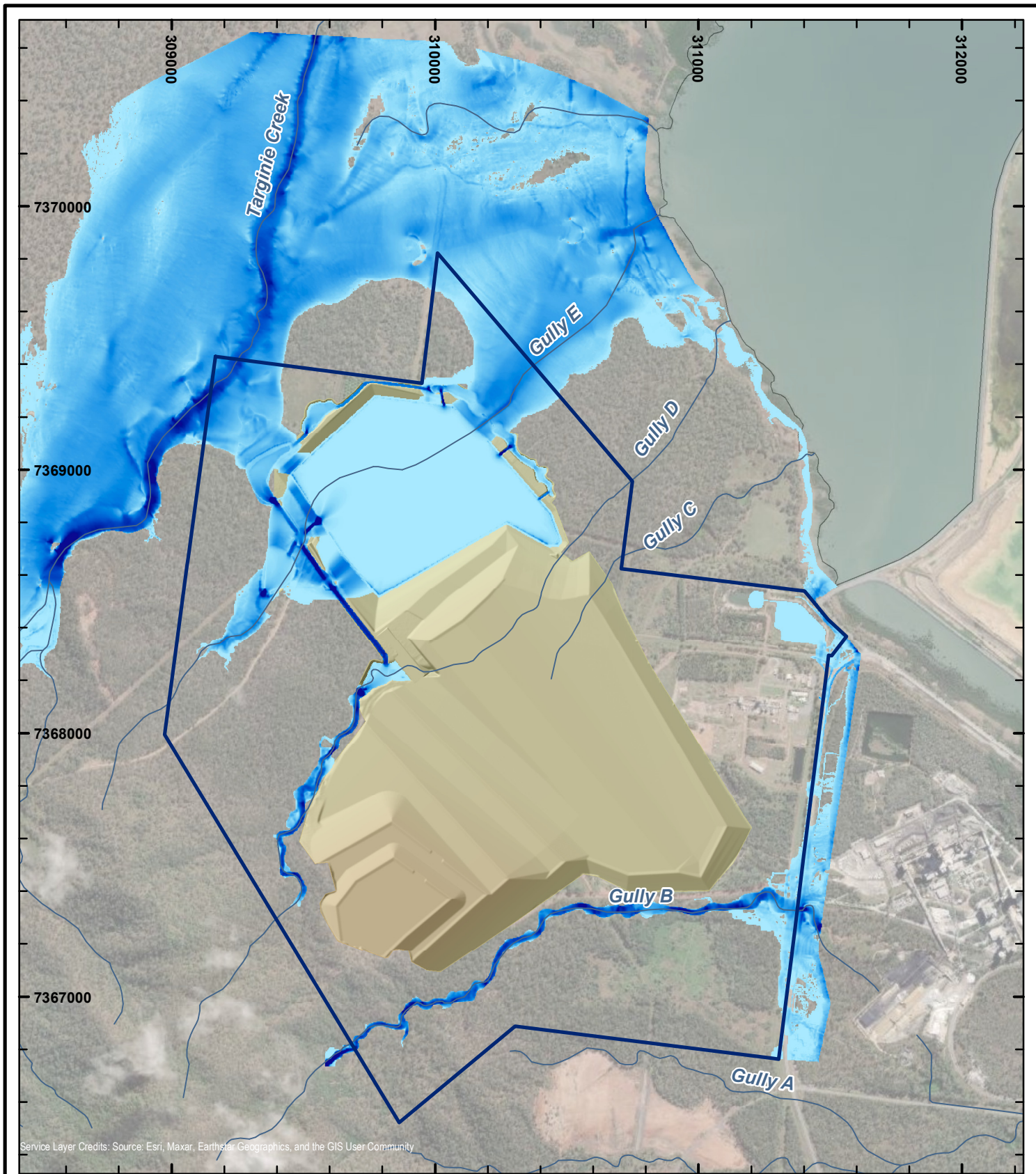
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	Figure 7.7 PMF flood extent velocity (Engeny, 2024)	Legend - ML 80003 - Watercourse Velocity 9.33 0
Date: 8/03/2024	Drawn By: Chris Schlebusch	
RTPL_QER_STPRC_PRCMAP0018_C	Requested by: John Linden	Sources: © State of Queensland, Department of Resources

7.1.3. Waste characterisation

PRCP Guideline (Section 3.6.1)

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

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

A dedicated *Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste* (Terrenus, 2023) was undertaken to inform this PRC plan (Appendix F), with the result summarised below.

7.1.3.1. Site geochemical context

Approximately 90% of the waste rock to be excavated will be collectively comprised of Qa and weathered Tertiary units (Tw1, Tw2 and Tw3), with the remaining approximately 10% of waste rock primarily being KCK-B2 sub-member. The KCK member is the primary kerogen shale unit to be mined and represents approximately 95% of ROM ore.

The Telegraph Creek unit underlying KCK will also be mined in very small quantities due to its uplifted presence within the Western Faulted Zone, which essentially forms the western wall of the In-pit MRA. Telegraph Creek upper (UTC) and lower (LTC) sub-members comprise less than 0.1% of waste rock. The characteristics of the waste rock materials (Qa, Tw1, Tw2, Tw3, KCK-B2 and UTC/LTC) are described in Table 7.2.

The KCK has four sub-members (KCK-A, B, C and D) and each sub-member has an upper and lower ply (nominated as 1 and 2). For example, KCK-A1 and KCK-A2. All KCK sub-members are ore, except for the B2 sub-member, which is waste rock. The CF immediately above the KCK (and where present, is situated between the Tw3 and the KCK members) is mined as ore and represents approximately 5% of ROM ore.

Table 7.2 Summary characteristics of the key waste rock materials

Age	Designation	Approximate proportion expected to be mined (%)	Characteristics	Depositional Environment
Quaternary	Qa	40	• Uppermost undifferentiated sediments (incl. soils) • Generally unconsolidated • Claystone with sporadic boulder, cobble, gravel, and sand-rich layers • common reddish ferruginous mottling, sporadically laterised and silicified	• Colluvial and alluvial • Highly to extremely weathered
Tertiary	Tw1	28	• Undifferentiated consolidated claystone • Absence of bedding structures • Common goethite and limonite mottling and staining, sporadically silicified.	• Freshwater lacustrine • Highly to extremely weathered
	Tw2	13	• Bedded consolidated claystone • Sedimentary structures visible and indicative of kerogen shale, claystone, etc. • Frequent reddish goethite and lesser yellowish limonitic mottling and staining, sporadically silicified	• Freshwater lacustrine • Moderately weathered

Age	Designation	Approximate proportion expected to be mined (%)	Characteristics	Depositional Environment
	Tw3	9	- Weathered kerogen shale (or claystone, lignite, etc) (essentially a transition zone between mod. To highly weathered and fresh strata) - Generally organically (carbonaceous) mottled - Strata frequently clayey, grading to claystone - Sporadic goethite and limonite staining - Some oil yield, but significantly less than unweathered stratigraphic equivalent	- Freshwater lacustrine - Slightly to moderately weathered
	KCK-B2	10	- Green-grey claystone with minor clayey kerogen shale - Thickness 2.9 to 5.7m (average 4.2m) - Fossiliferous	- Freshwater lacustrine; - Fresh (unweathered)
	UTC/LTC	<0.1	- Green claystone breccias - the upper part comprises well laminated claystone - Fossiliferous	

The geochemical characteristics and potential hazards associated with mine waste materials are discussed by materials type:

- **Waste rock:** At closure, is expected to comprise approximately 40% of all mineral waste at the Project and includes weathered and fresh waste, including:
 - moderately to extremely weathered waste rock (Qa, Tw1 and Tw2): comprises 81% of waste rock
 - slightly to moderately weathered waste rock (Tw3): comprises 9% of waste rock
 - unweathered (fresh) waste rock (KCK-B2 and UTC/LTC): comprises 10% of waste rock
- **Processed shale:** At closure, is expected to comprise approximately 60% of all mineral waste at the Project, and includes:
 - ATP-type processed shale: Comprises approximately 5% of processed shale and is located in the Out-of-pit MRA
 - Paraho-type processed shale: Comprises approximately 95% of processed shale and will predominantly be located in the In-pit MRA, with a small amount of processed shale in the Out-of-pit MRA from the newer 'Paraho' processing technology

Ore (kerogen shale) is also included in the assessment; however, ore is not considered mineral waste, except for:

- very small quantities of sub-economic 'ore' units that may report to the MRAs (amongst mine waste)
- remnant kerogen shale exposed on the walls and floor of the final void

The environmental geochemical characteristics of the materials are summarised in the following sub-sections and relate to the characteristics of mineral waste materials likely to be mined/ produced by the Project.

7.1.3.2. Geochemical characteristics of waste rock

Acid generating potential of waste rock

The Acid-Base Account is the theoretical balance between the potential for a sample to generate acid and neutralise acid, and in Australia is commonly expressed in units of kilograms of sulfuric acid per tonne of sample (kg H₂SO₄/t).

Acid-Base Account results are available for 113 samples designated as waste rock. One KCK-B2 sample was collected from a bulk sample from the existing mine pit. The remaining 112 samples were collected from drill-core. Based on the results:

- Potentially acid forming (PAF) waste rock, which represents potentially (and conservatively) up to 10% of the total waste rock, will be thoroughly well mixed during mining with non-acid forming (NAF) waste rock.
- As a bulk material, waste rock has a very low potential to generate acid drainage (AD) and/or pH-neutral and metalliferous drainage (NMD).
- A very small proportion of waste rock, primarily from the Tw3 unit, has a low to moderate potential to generate acid mine drainage (AMD).
- Due to the generally very low total S (and sulphide) concentrations, the potential for sulphide-derived saline drainage (SD) is also very low.

Total metal and metalloid concentration in waste rock

Waste rock generally had low total concentrations of metals, well below the applied NEPC (2013) health-based investigation level (HIL[A]) and generally below or equivalent to the NEPC (2013) ecological investigation levels.

There was no correlation found between AMD classifications of waste rock samples compared to elemental enrichment. In summary, waste rock (as a bulk material) has low enrichment in total metals and metalloids compared to unmineralised rocks.

Salinity of waste rock

Waste rock, as a bulk material, is expected to generate low salinity surface run-off and seepage following surface exposure. Initially, when first mined and placed (disposed), waste rock could generate higher salinity (EC) run-off and seepage potentially up to 5,000 $\mu\text{S}/\text{cm}$; however, salinity of this level will be expected to be limited to initial (immediate) run-off/seepage and will not be expected to continue for any significant period.

Unweathered material, which accounts for about 90% of the waste rock, is predominantly classified as non-saline. Weathered material is classified as slightly saline.

Nitrogen and organic compounds in waste rock

Solubility data from column leaching indicates that waste rock is expected to release low concentrations of nitrogen compounds, such as ammonia, nitrate, and nitrite; with the weathered materials having lower release rates compared to the unweathered materials. Nitrate is the main nitrogen component for the weathered materials and ammonia is the main component for the unweathered materials. Where ammonia is leached (from the unweathered materials), it quickly oxidises to nitrite and then to nitrate.

The total concentration of various organic compounds (polynuclear aromatic hydrocarbons (PAH) and phenolic compounds) in waste rock was negligibly low (less than the laboratory limit of reporting [LOR]). Additionally, the total concentration of hydrocarbons (total petroleum hydrocarbons and total recoverable hydrocarbons), carboxylic acids, aldehydes, and ketone compounds in a bulk KCK-B2 (unweathered) waste rock samples was also negligibly low (less than the laboratory LOR). The results show that the concentration of organic compounds in waste rock is very low.

Cation exchange capacity of waste rock

Waste rock had generally high cation exchange capacity values and generally high ESP values, resulting in most samples being classified as 'strongly sodic'.

As such, a significant proportion of waste rock at the Project can be expected to have potential for dispersion (based on the high sodicity values).

Solubility characteristics of waste rock

Solubility data from column leaching indicates:

- Waste rock released low concentrations of organic compounds, typically at concentrations less than or close to the laboratory LOR.
- waste rock, as a bulk material, is expected to release low concentrations of metals and metalloids, with:
 - NAF waste rock generating pH-neutral leachate is expected to produce low soluble metals concentrations.
 - PAF waste rock produces weakly acidic leachate with low to moderate soluble metals concentrations (such as Mn, nickel (Ni) and Zn) when exposed to oxidising conditions. Most Tw3 'PAF' samples also have high organic carbon concentrations. Therefore, they may be influenced to some degree by the presence of organic acids, which may account to some degree for the weak acidity and slightly elevated soluble metals and metalloid concentrations (and sulphate concentration) evident from the Tw3 PAF samples.

7.1.3.3. Geochemical characteristics of processed shale

Acid generating potential of processed shale

Applying the same geochemical (acid-base) classification to the processed shale samples as for the waste rock (and ore) samples, the processed shale samples (Paraho and ATP) are classified as either NAF-Sulphur (NAF-S) or Uncertain(NAF).

Leachate from Paraho processed shale was pH-neutral throughout a 3-year leaching program, with leachate from bulk processed shale expected to be pH-neutral, with very low acidity and very low alkalinity (i.e. effectively zero net alkalinity). Therefore, Paraho processed shale is expected to have limited capacity to generate significant acidity but equally is expected to have limited capacity to neutralise any acidity that could be developed. On this basis, and supported by the low sulphate release rates, low residual sulphide and moderate residual acid neutralising capacity, Paraho processed shale has been confirmed as NAF, and will be expected to remain so.

Processed shale generated by the Project, as a bulk material, is expected to generate pH-neutral to -alkaline contact water (run-off and seepage).

Total metal and metalloid concentration in processed shale

Processed shale has low total concentrations of metals, well below the applied HIL(A). Samples were 'enriched' with Bi and Se compared to 'average background' concentrations in shale rocks, with the degree of enrichment (in regard to Bi and Se) consistent with the concentration of these elements occurring naturally in waste rock at the Project.

Solubility data from bottle leaching and column leaching showed that processed shale (from both Paraho and ATP processing) is expected to release low concentrations of metals and metalloids. Only Al, iron (Fe), barium (Ba), cobalt (Co), Mn, Ni and Zn were routinely present in column leachate at concentrations above the laboratory LOR.

For some elements, such as Al, Mn and/or Zn, processed shale has the potential to release slightly elevated soluble metals concentrations. However, with respect to groundwater or surface water impacts, run-off and leachate from processed shale is not expected to result in any significant water quality issues on site at field-scale.

Salinity of processed shale

As a bulk material, processed shale generated by the Project is expected to generate low salinity surface run-off and seepage following surface exposure.

In-place processed shale as a bulk material is expected to generate relatively low salinity and the salinity generated by Paraho processed shale is expected to be below the background salinity of the alluvial and Rundle groundwater aquifers.

Nitrogen compounds in processed shale

TN concentrations were 'high' in the processed shale samples, while Total Kjeldahl nitrogen concentrations were essentially equal to TN; and ammonia, cyanide, nitrite, and nitrate concentrations were all very low, indicating that organic nitrogen is the source of almost all nitrogen in processed shale materials.

Organic compounds in processed shale

The total concentration of total petroleum hydrocarbons, BTEX (i.e. benzene, toluene, ethylbenzene, xylene), PAH, phenolic and dioxin compounds in processed shale was low (generally less than or equal to the laboratory LOR) and well below the applied HIL(A), where applicable. Paraho processed shale has a maximum lower-bound dioxin concentration of approximately 4 picograms TEQ per gram of solid (pg TEQ/g) (median lower-bound = 0.043), which is well below the lower-bound dioxin concentration limit in the EA of 10 pg TEQ/g. The results show that the concentration of organic compounds in processed shale is very low.

Solubility characteristics of processed shale

Solubility data from bottle leaching and column leaching showed that processed shale rock (Paraho) released very low concentrations of nitrogen compounds, and commensurately low ammonia, nitrite, and nitrate concentrations. ATP processed shale moistened with stripped sour water (SSW) release higher concentrations of nitrogen, ammonia and nitrite compared to Paraho processed shale and compared to unmoistened ATP processed shale. This indicates the SSW used to moisten (cool) this particular ATP processed shale sample/material was the source of the nitrogen compounds, not the processed shale solid. Most of the ATP processed shale currently in the Out-of-pit MRA was moistened (cooled) with SSW.

Processed shale (Paraho and ATP) released low concentrations of organic compounds, typically at concentrations less than or close to the laboratory LOR.

Processed shale (Paraho and ATP) is expected to release low concentrations of metals and metalloids. Only Al, Fe, Ba, Co, Mn, Ni and Zn were routinely present in column leachate at concentrations above the laboratory LOR. Processed shale has the potential to release slightly elevated soluble metals concentrations for some elements (such as Al, Mn and/or Zn); however, run-off and leachate from processed shale is not expected to result in any significant water quality issues on site at field-scale, with respect to groundwater or surface water impacts.

7.1.3.4. Geochemical characteristics of Ore (kerogen shale)

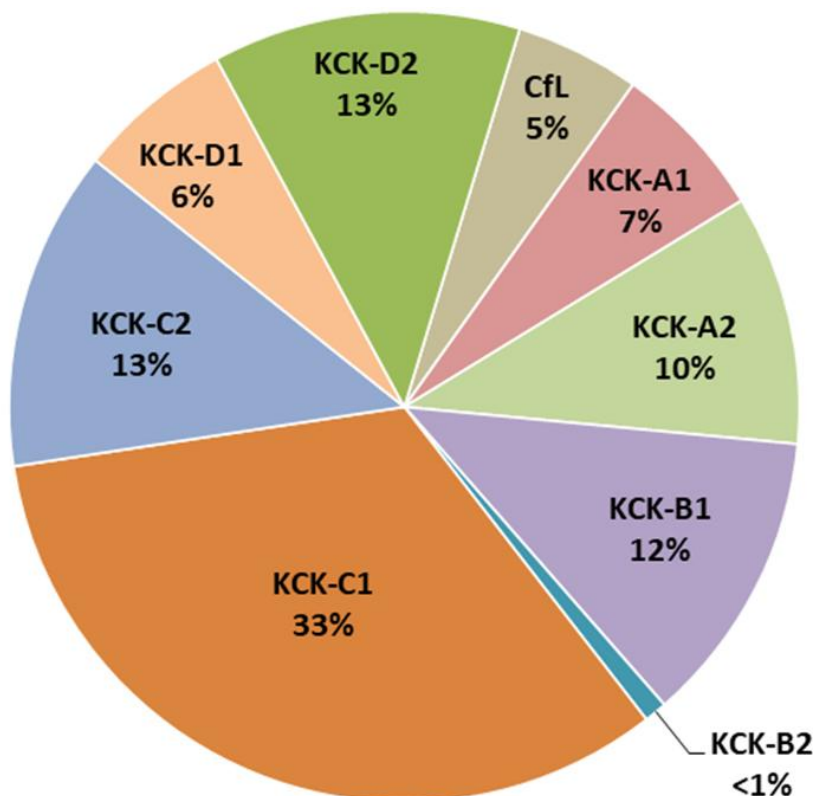
Ore (kerogen shale) is not regarded as mineral waste and is not subject to disposal and potentially on-going or long-term environmental management in the way that waste rock and processed shale materials are. The relative proportions of each ore unit (sub-member) to be mined are shown in Figure 7.8.

to highlight that ore is comprised of many sub-members.

Minor quantities of kerogen shale will remain as residual ore on the walls and floor of the final void at closure, which will ultimately be submerged by water. As also previously discussed, the geochemical characteristics of kerogen shale do not infer similar characteristics to processed shale.

Furthermore, due to the way kerogen shale is processed (high-temperature retorting), there is very little geochemical similarity between kerogen shale and processed shale for most geochemical parameters. Therefore, the geochemical characteristics of kerogen shale cannot be used to infer potential geochemical characteristics of processed shale.

The waste rock and kerogen shale (ore) materials were all found to contain very low total concentrations of organic compounds, below or approximating the laboratory LOR for the various organic compound parameters.



Source: Terrenus (2023)

Figure 7.8 Proportion of ore units expected to be mined

Similarly, bottle leaching and column leaching of these materials has also shown leachate to have very low concentrations of organic compounds, below or approximating the laboratory LOR for the various parameters.

7.1.3.5. Geochemical source hazard assessment of material types

A geochemical source hazard assessment was applied to the source material types comprising weathered and unweathered waste rock, processed shale, and kerogen shale (ore). The source hazard score is a formula that accounts for the propensity (ability) to generate AMD, the AMD capacity (severity) and the quantity (volume/tonnage) of material that could produce AMD. The AMD source hazard scores are as follows:

- moderately to highly weathered Quaternary and Tertiary (Tw1 and Tw2) material: AMD source hazard score = **Low to Moderate**
- slightly to moderately weathered Tertiary kerogen shale (Tw3): AMD source hazard score = **Moderate**
- unweathered waste rock (predominantly KCK-B2): AMD source hazard score = **Low**
- ATP processed shale: AMD source hazard score = **Low to Moderate**
- Paraho processed shale: AMD source hazard score = **Low to Moderate**
- Ore (kerogen shale): AMD source hazard score = **generally Moderate and Moderate to High**

When combined and taking into account the proportion of PAF material of each type relative to the total proportion of all materials in a final landform (i.e. In-pit or Out-of-pit landform) and the final void, the AMD hazard score for the landforms and void walls/floor at closure has been determined.

All mineral waste materials, and most kerogen shale, had low soluble concentrations of organic compounds and hydrocarbons (based on available data). As such, the mineral waste materials were assigned an organo-chemical drainage (OD) hazard score of **Low**.

Final landforms

There are two mineral waste landforms that will be present at closure:

- Out-of-pit landform
- In-pit landform

The Out-of-pit landform will be at the location of the current Out-of-pit MRA and currently comprises ATP processed shale and mined waste rock. The Out-of-pit MRA is comprised of about 17% ATP processed shale, and the remaining 83% being waste rock (excluding a very small proportion of Paraho processed shale). During the early years of operations (when mining resumes), the Out-of-pit MRA will receive a small amount of additional waste rock and Paraho processed shale. Once full, mineral waste disposal will continue as in-pit placement, and the Out-of-pit MRA will be reshaped to form an Out-of-pit final landform.

The In-pit landform is comprised of mined waste rock and Paraho processed shale disposed behind the active mining face to form an In-pit dump, which will be reshaped to form a final In-pit landform.

- Out-of-pit landform poses a **Low** AMD and OD source hazard, with AMD and OD generation rated as **Highly Unlikely**.
- In-pit landform poses a **Low to Moderate** AMD source hazard and a Low OD source hazard, with AMD and OD generation rated as **Unlikely**.

Final void

At the end of mining a single void will remain at the northern end of the mined area. Environmental geochemical data and geological resource model data have been used to aid in the assessment of AMD risk associated with final void walls and floors (exposed rock) under two scenarios:

- end of mining when all walls and floor are exposed
- post-closure when the final void is almost full of water (normal post-closure water level)

End of mining scenario – prior to any wall/floor rock being covered/capped (which is proposed), the final void wall/floor assessment found that approximately 47% of the final void walls/floor (combined) is estimated to be PAF, which includes material classified as uncertain (UC[PAF]), PAF low capacity (PAF-LC) and NAF-S. As such, the assessment has found that AMD generation from the completely exposed walls/floor is **Moderate** and AMD generation from the completely exposed walls/floors is **Likely** until such time that the walls/floor are covered with waste rock (pre-closure remediation) and/or become submerged by water reporting to the final void as run-off and groundwater (post-closure).

Post-closure scenario – after wall/floor rock has been covered/capped and the final void has filled with water to 'normal' post-closure water level (approximately 8.1 mAHD), the final void wall/floor assessment found that approximately 12.5% of the exposed void walls/floor (combined) is estimated to be PAF, which includes material classified as UC(PAF), PAF-LC and NAF-S. As such, the assessment has found that AMD generation from the partially exposed final void walls/floor (exposed above water level) is **Low to Moderate** and AMD generation from the partially exposed walls/floors is **Highly Unlikely**.

7.1.3.6. Geochemical source-pathway-receptor assessment

The source-pathway-receptor (SPR) assessment includes the likelihood of the event occurring (e.g. the likelihood of AMD and/or OD impacting a local creek), the severity of the event (should it occur) and the calculated risk rating (likelihood times severity). A risk rating was calculated for the final landforms and the final void with respect to plausible surface water and groundwater receptors.

Groundwater flow is generally in a northeasterly direction towards the coast. There is a distinct cone of depressurisation around the existing mine pit which is largely constrained to the west by the Western Faulted Zone and to the east by the coast.

Groundwater modelling undertaken by AGE (2024) shows the final void will initially be a groundwater 'sink'. That is, the final void will be a receptor of groundwater inflow, run-off and seepage from the landforms and run-off from final void walls. The In-pit landform is located within the pit shell and will drain into the final void. Seepage from the In-pit landform and the walls of the final void will report to the final void. As such, during the initial post-mining period whilst the final void is a 'sink', the floor and walls of the final void are implausible sources of AMD, OD, or salinity for groundwater or surface water receptors.

Post-closure, once the final void has mostly filled with water, the final void will be in approximate hydraulic equilibrium with groundwater before acting as a source to local groundwater (pushing water out) when final void water levels are high. During major drought periods the final void may temporarily become a sink (i.e. receiving groundwater) and may also potentially act as a flow-through system at times, depending on the water levels in the final void.

Relative to assumed regional groundwater levels of approximately 4 mAHD, at 'normal' (average) post-closure water level (approximately 8.1 mAHD), the final void is expected to be a source to groundwater.

Plausible pathways and receptors

The plausible mechanisms for AMD affected water and/or OD and/or non-oxidative salinity, if any, to report to receptors are:

- surface water run-off from landforms into water storages and ephemeral gullies (various gullies and dams, depending on the proximity to the landforms)
- seepage from the landforms via shallow permeable strata into water storages and gullies (various dams and gullies, depending on the proximity to the landforms)
- seepage from the landforms into the alluvial aquifer and into the final void
- surface water run-off and seepage from void walls into the final void

SPR risk rating of final landforms

There are plausible surface water and final void receptors; and the run-off and seepage pathways linking the sources (final landforms) to these receptors have been identified. With respect to AMD and OD, the overall SPR risk rating from final landforms is **Low**. With respect to non-oxidative salinity the overall SPR risk from final landforms is also rated as **Low**.

SPR risk rating of final void (end of mining)

The final receptor for run-off from the walls of the final void is the final void. The AMD assessment has found that – prior to covering in-situ wall/floor rock with re-worked material or mineral waste material (and/or inundation), run-off from the exposed final void walls and floor will likely generate moderate-level AMD, which will impact water quality in the final void – until such time that the CF and KCK units are covered/capped and/or submerged. As such, the AMD SPR risk rating on the overall water quality of the post-mining final void (prior to capping and flooding) is **Medium** and **Medium to High**.

To mitigate the potential for acid generation (and to also reduce geotechnical risks of the final void walls), the final void will undergo reshaping and cover/capping works to the wall and floor to lower the slope angles. This will be undertaken with NAF overburden and interburden so that all PAF materials are covered with NAF waste. These reshaping works would be undertaken during the first three years after completion of mining and ensure the final void (end of mining) period during which potential AMD to occur is minimised.

After the CF and KCK members are covered/capped as proposed and most of the kerogen shale is no longer exposed during the early years post-closure (whilst the void is beginning to fill with water), the overall SPR risk rating of the post-closure final void will be **Low** and **Low to Medium**.

SPR risk rating of final void (post-closure)

The final void (post-closure) period follows reshaping and cover/capping works to the void walls and floor with NAF overburden and interburden (i.e. when all PAF materials are covered with NAF waste). There are plausible surface water and groundwater receptors from the final void (post-closure); and the pathways linking the source (final void post-closure) to these receptors have been identified. With the completion of the cover/capping works and flooding of the final void, there will be very low (negligible) potential for exposure of PAF rock. As such, the freshwater wetland (lacustrine) PMLU is not expected to be impacted by AMD, and the overall SPR risk rating from the final void post-closure is **Low**.

7.1.4. Soil and capping material

PRCP Guideline (Section 3.6.1)

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

Review of topsoil materials has been completed as part of the cover and final landform designs completed by Landloch (2023a and 2023b) contained in Appendix H and Appendix I respectively, with the results summarised below.

7.1.4.1. Topsoil stripping

Topsoil availability on-site and the amount required for rehabilitation activities in this PRC plan are detailed in Table 7.3, identifying available resources from existing stockpiles and future disturbance areas, as well as future requirements for native ecosystem (bushland) and water storage (stock use and freshwater wetland) PMLUs.

Table 7.3 Topsoil availability and rehabilitation requirements on-site

Available/ required	Source/PMLU type	Source/requireme nt areas	Approximate area (ha)	Approximate depth (m) ¹	Approximate total (m³)
Available	Existing topsoil stockpiles	Existing topsoil stockpiles	N/A	N/A	126,800
	Future disturbance areas (Ras)	Undisturbed area of Out-of-pit MRA (RA01)	37.2	0.2	74,400
		Undisturbed area of In-pit MRA (RA02)	58.6	0.2	117,200
		Future MWSP (RA03)	5	0.2	10,000
		Detention ponds (RA05)	3.3	0.2	6,600
		Infrastructure (RA08)	6.8	0.2	13,600
		Future Forest Road realignment (RA07)	10.8	0.2	21,600
		Final void and wetlands (RA08 and RA12)	73.8	0.2	147,600
Total topsoil resources available					517,800
Required	Native ecosystem (bushland) PMLU	Out-of-pit MRA (RA01)	79.9	0.3	239,700
		In-pit MRA (RA02)	88.5	0.3	273,300
	Native ecosystem (bushland) PMLU	Infrastructure (RA08)	1	0.3	3,000
		Exploration tracks and pads (RA11)	0.4	0.3	1,200
		Final void and wetlands – clean water diversion to Targinie Creek (RA08)	5.3	0.3	15,900
	Water storage (freshwater wetland) PMLU	Final void and lacustrine wetlands – area outside void equilibrium lake area (RA12)	28.4	0.3	85,200
Total topsoil resources required					618,300

Topsoil depths for available resources are based on Envirosciences (1993), while minimum depth of topsoil application for rehabilitation is a minimum of 0.3 m.

Therefore, with topsoil requirements for rehabilitation being approximately 618,300 m³ and only approximately 517,800 m³ available from existing topsoil stockpiles and future disturbance areas, it is likely there will be a topsoil shortfall of approximately 100,500 m³. However, the topsoil resources will be progressively determined and the mine waste materials (to be used as capping material) will be progressively characterised for all areas to be disturbed by mining and related to operations on the lease. The aim of these investigations is to facilitate mine and rehabilitation planning and to ensure that suitable materials are available for all rehabilitation works.

In addition, this shortfall will be reduced by:

- combining mulched vegetation with the topsoil during stockpiling to add to the quality of the topsoil
- manufacturing a growth media from available subsoil on-site that can be suitably amended

7.1.4.2. Topsoil management

Stripped topsoil will be respread in areas available for rehabilitation or transferred to topsoil stockpiles which will be established in existing disturbed areas on-site, including at the ROM pad. Topsoil stockpiles will have a maximum height of 1.5 m to reduce soil degradation.

Compaction of topsoil will be minimised where possible by avoiding the use of machinery on stockpiles, such as graders or watercarts. All stockpiles will remain in a free-draining location to avoid long-term soil saturation. The stockpile surface will be left in a coarsely textured condition to promote infiltration and aeration and to minimise erosion until vegetation is established. Where necessary, sediment fences or vegetation (from clearing operations) will be installed around topsoil stockpiles as a form of erosion and sediment control.

7.1.4.3. Topsoil application

Topsoil will be replaced as areas become available for rehabilitation to achieve the PMLU of native ecosystem (bushland), freshwater wetland (lacustrine), and freshwater wetland (palustrine). All the stockpiled topsoil will be used as part of the rehabilitation activities.

Native ecosystem (bushland) PMLUs – Out-of-pit and In-pit MRAs (RA01 and RA02)

Rehabilitation will be undertaken progressively as the mining operations continue (Figure 7.9). The general sequence of works during each progressive rehabilitation campaign is described in Section 7.6.4.

Native ecosystem (bushland) PMLUs – Other areas (RA08, RA11, and RA13)

Rehabilitation will be generally undertaken within these areas as follows:

- **RA08:** required for operational activities until end of mining (i.e. in 2060), including diversion of upstream clean water to Targinie Creek during active mining, after which rehabilitation activities can commence.
- **RA11:** areas to be progressively rehabilitated from the R&D phase and ongoing during the active mining phase (i.e. 2043 to 2060) once pad and tracks are no longer required.
- **RA13:** this area has been subject to revegetation and is not required for further use. Therefore, ongoing rehabilitation activities will be conducted during the R&D phase.

The general sequence of works for each RA is described in Section 7.6.4.

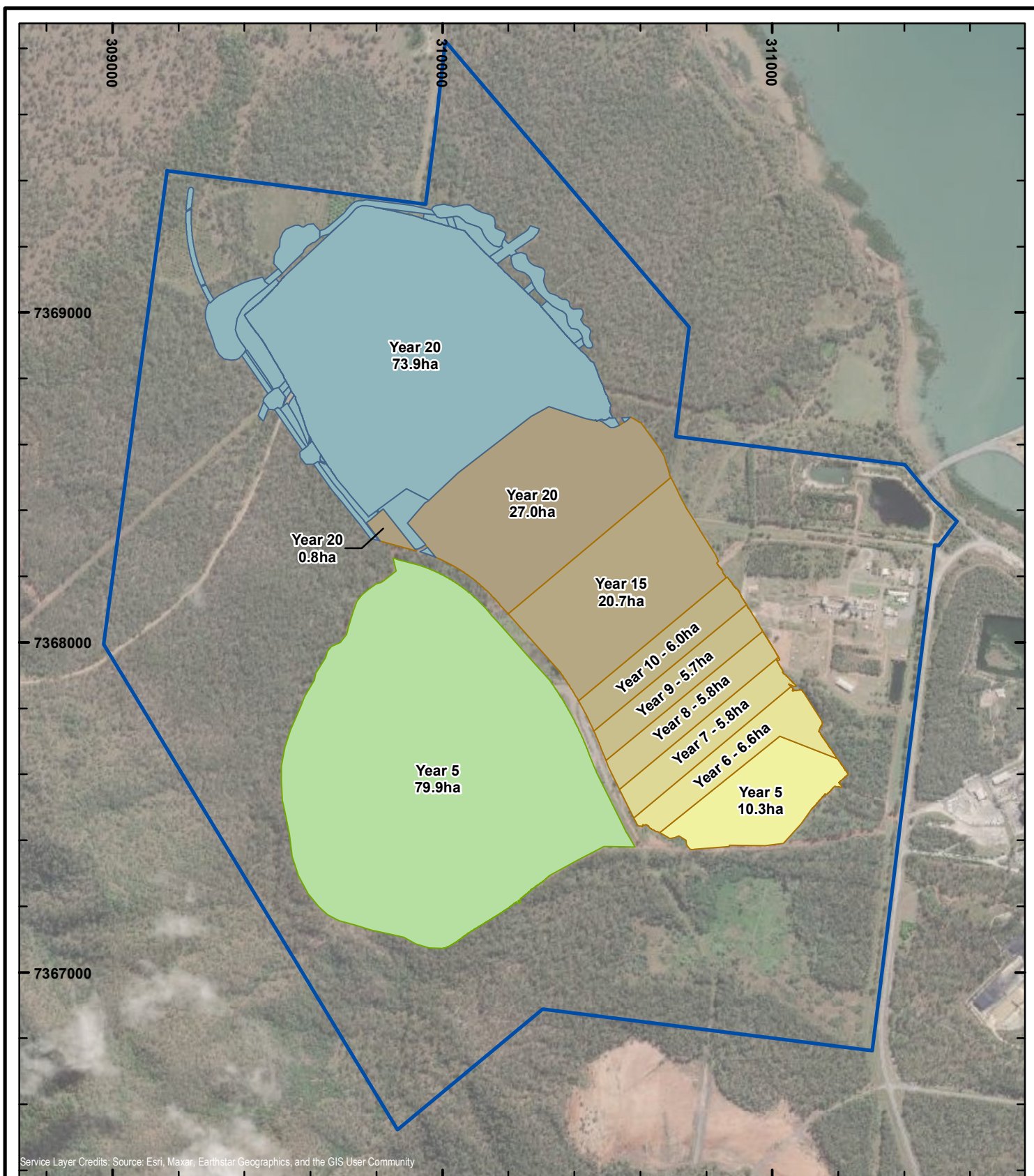
Freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs

Rehabilitation will be undertaken at the end of mining once the final void has been created and reaches equilibrium (likely to be around 18 years after Year 20 in the mining sequence under average rainfall conditions) (Figure 7.9). The general sequence of works is described in Section 7.6.4.

7.1.4.4. Amelioration requirements

Topsoil properties to support the target PMLU will have:

- Cation exchange capacity and major macronutrient (N, P, K, and organic C) concentrations in root zone (0 to 0.3 m) at least 80% of those measured at comparable reference sites (which may coincide with vegetation analogue sites) and indicate the soil is capable of sustaining required groundcover levels.
- pHw range of soil is between 5.0 to 7.0 to at least 0.3 m.
- Primary growth media (0 to 0.3 m) salinity (EC1:5) is less than 0.5 deciSiemens per metre (dS/m).



QUEENSLAND ENERGY RESOURCES

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Figure 7.9
Proposed availability for
rehabilitation (RM3)
(Landloch, 2024c)

Legend

- ML 80003
- Rehabilitation footprint - Out-of-pit MRA
- Rehabilitation footprint - In-pit MRA
- Rehabilitation footprint - Final void

Date: 8/03/2024

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0021_C

Requested by: John Linden

Sources:
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Given the significant period between the development of this plan and the point at which implementation will occur, it is recommended that assessment of stockpiled soil characteristics, amelioration requirements (to meet the above specifications) and application rates are further assessed by a suitably qualified person no earlier than six-months prior to rehabilitation being progressively implemented. These ameliorants could include fertilisers, biosolids and physical amendments such as gypsum.

Accurate application rates and amelioration requirements will be determined by a suitably qualified person prior to use in rehabilitation, with fertiliser and mulch/compost (if required) to be applied at seeding. It can be broadcast with a spreader or applied hydraulically or pneumatically. Spreaders are typically suitable for slopes with gradients <35%, and hydraulic or pneumatic applications will be required for 12° slopes.

7.1.4.5. Quality assurance and quality control requirements

Topsoil properties to support desired PMLUs (i.e. native ecosystem [bushland] and water storage [freshwater wetland]) will meet the requirements detailed in Section 7.1.4.4. Maximum rooting depths for the species present in the proposed target ecosystems are commonly in the order of 4 to 7 m. Therefore, it was concluded that a rehabilitation cover profile will contain a surface soil layer (primary growth media layer) of 0.3 to 0.5 m thick.

The soils were assessed as being suitable for use as a primary growth media (i.e. at the surface of the rehabilitated landform), with the proposed profile follows:

- **primary growth media**: establishment of an at least 0.3 m thick profile over the secondary growth media is recommended. The soil will be fertilised with a slow-release source of nitrogen at the time of seeding to support the rapid establishment and growth of vegetation.
- **secondary growth media**: with the exception of Tw3 material, overburden and interburden was assessed as being suitable for use as a secondary growth media layer that underlies the primary growth media layer. The underlying overburden and interburden will be required to provide additional water storage and structural support for use by deeper rooted vegetation. Overburden and interburden will not be placed within 0.3 m of the rehabilitated landform surface. Tw3 material will not be placed within 2 m of the rehabilitated landform surface.
- **processed shale**: processed shale will not be placed within 2 m of the rehabilitated landform surface.

The proposed profile is similar to that present for in situ soils at the Project, as confirmed by the soil surveys conducted to date. In addition, the soils that are currently stockpiled at the Project have similar properties to the in-situ soils that are currently supporting woodland vegetation species similar to the species within the target PMLUs. These soils have loamy textures, low salinity, and low sodicity. The stockpiled soils are satisfactorily fertile except for low nitrogen levels. Slow-release nitrogen sources such as coated urea or an organic compost is recommended to provide additional N to support rapid establishment of vegetation. Any composted material will comply with the Australian Standard for Composting (AS 4454-2012).

7.1.5. Landform design

PRCP Guideline (Section 3.6.1)

The final landform design must be based on the proposed PMLUs and NUMAs and demonstrate that the land will be safe and structurally stable.

A final landform design model has been completed as part of the Final Landform Report completed by Landloch (2024b) and informed by the pre-approved PMLUs contained in the EA (Section 3). The landform assessment, final landform design, and trial recommendations for the Project are contained in Appendix I, with the results summarised below.

7.1.5.1. Limitations on landform slope geometries

Limitations on landform slope geometries (combinations of slope gradient and length) were developed using the RUSLE (Renard *et al.* 1997) as outlined in Appendix I. The values of this assessment are given in Table 7.4. These slope geometries were used to develop the following rehabilitation design for the landform:

- Rehabilitated batter slopes of the landform used a maximum rehabilitation batter length of 150 m and gradient of 12°, equivalent to a maximum height of 33 m.
- Lower-gradient slopes on the top of the In-pit MRA, tops of the lifts on the Out-of-pit MRA, and the zone between the Out-of-pit MRA and the In-pit MRA used a maximum gradient of 3°. The slope length was not limited because very low erosion rates were predicted, even for slope lengths of up to 1,000 m.

Table 7.4 Erosionally stable batter geometrics

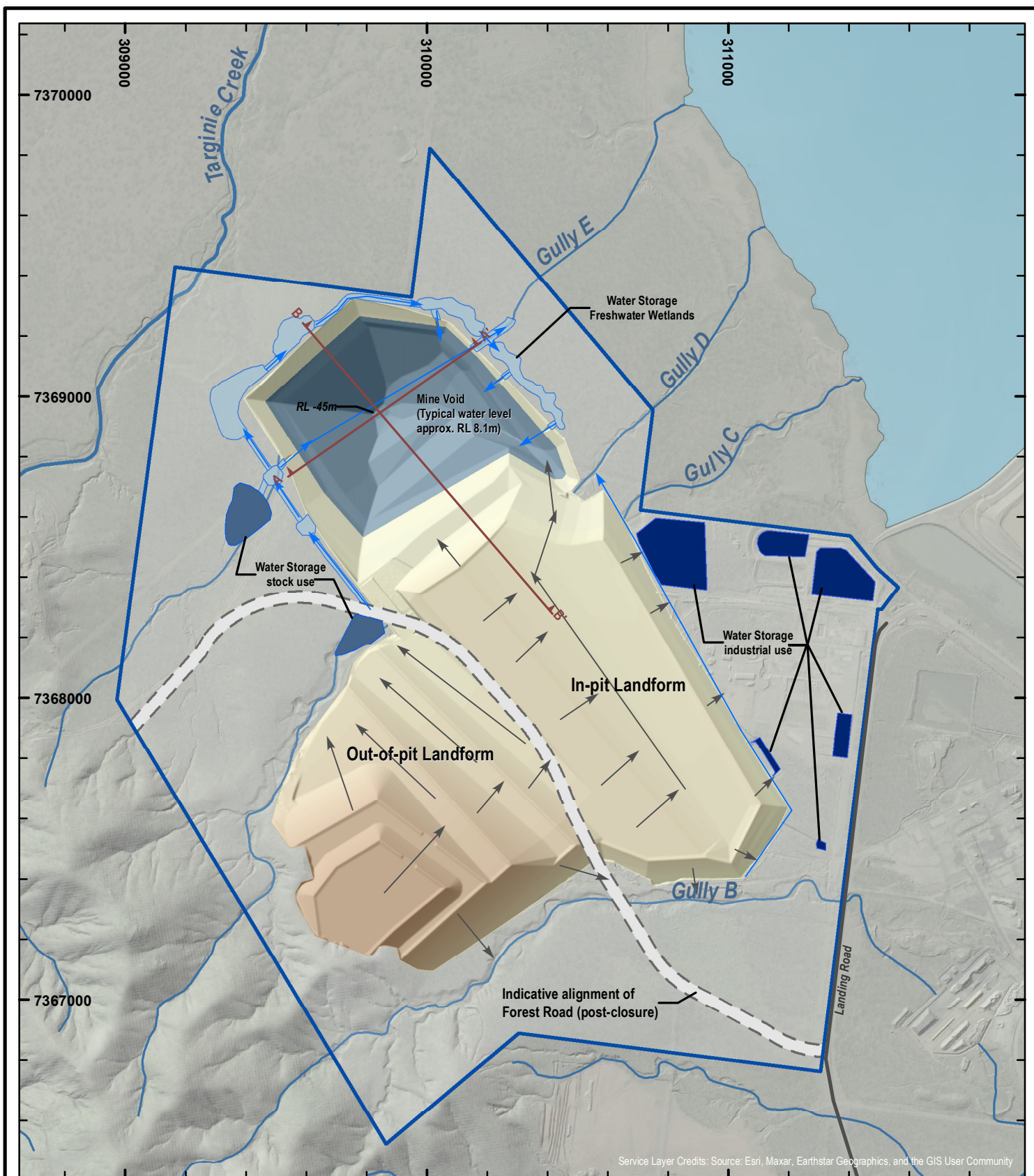
Slope gradient (%)	Slope length (m)	RUSLE predicted long-term average annual erosion (t/ha/y)
1	100	0.2
1	200	0.3
1	300 to 1000	0.3 to 0.4
5	100	1.5
5	200	1.9
5	300 to 1000	2.3 to 3.5
10	50	2.5
10	100	3.6
10	200	5.1
15	50	4.4
15	100	6.6
15	200	9.8
22	50	6.4
22	100	9.7
22	150	12

7.1.5.2. Final landform design

An overview of the final landform design is shown on Figure 7.10. The maximum gradient of the outer slopes of the Out-of-Pit and In-pit MRA design (12° or 21.3%) are slightly steeper than the gradients listed in Schedule E, Table 2 (i.e. 11.3° or 20%) and Condition G27 of the EA.

The maximum gradient of the outer slopes of the Out-of-Pit and In-pit MRA design (12° or 21.3%) are slightly steeper than the gradients listed in Schedule E, Table 2 (i.e. 11.3° or 20%) of the EA. The impact of this increase in gradient on long-term erosion potential was assessed using the RUSLE fitted with parameters outlined in Section 3.1 (*Erosionally stable slope geometries*) of Appendix I. The resultant predicted long-term erosion of the steeper gradient batter was similar to that of the shallower gradient, with predicted erosion being 4% larger for the steeper gradient batter. That said, even with this slight increase in predicted erosion, both the steeper and shallower gradient batter configurations produced long-term predicted erosion rates less than 12t/ha/y, consistent with natural erosion rates for the region.

Use of the steeper gradient would increase the surface area of the rehabilitated In-Pit MRA that will drain to the Final Void. This will reduce the time required to initially fill the Final Void and assist with the maintenance of the water level within the Final Void over time (the current surface water modelling includes runoff generated from the In-Pit MRA with the steeper gradient slopes).



0 100 200 300 400 500
m

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Figure 7.10
Final landform design



Legend

- ML 80003
- ~ Watercourse
- Water Storage - Freshwater Wetlands
- Water Storage - Stock Use
- Water Storage - Industrial Use
- Indicative Forest Road Alignment (post-closure)
- Overland drainage
- Drainage channel

Date: 11/03/2024

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0022_B

Requested by: John Linden

Sources:
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Out-of-pit MRA design

The Out-of-pit MRA design consists of an upper lift with a height of 10 m and gradient of 12°, with cross sections of the Out-of-pit MRA shown on Figure 7.11. This lift has a zero (0) gradient top surface, but any ponded water (rainfall excess) of sufficient depth will drain to the lift below via a wide (50 m) drainage zone on the south-eastern batter section. The lift is otherwise crest-bunded to minimise the risk of uncontrolled discharge of runoff and increased erosion risk for the lifts below.

The second uppermost lift has a variable height, with the highest section (approximately 26 m) occurring on the north-eastern part of the batter. The variable height is due to the presence of a lower lift that grades at a low gradient from south to north towards the existing surface water flow line. The gradient of this second uppermost lift is 12°. The top of this lift has a zero gradient, but any ponded water will drain to the lift below via a wide (50 m) drainage zone on the south-eastern batter section. The lift is otherwise crest bunded.

Below this lift are three lifts that grade from south to north at a gradient of 1 to 2°. The minimum width of these lifts is 50 m, and the maximum width is 100 m (except for the upper lift which widens out considerably on the northern end). These three lifts are shaped so that they discharge runoff to the existing flow line on the north of the landform that ultimately discharges water to the final void. These lifts are bunded on the south-eastern side to eliminate uncontrolled discharge occurring over the batters as this would increase erosion potential of the landform significantly. These lifts have been shaped in this way to allow for water shedding in an erosionally stable manner and to allow for an access road to be constructed in the future.

A 12° slope batter section exists on the southern side of the Out-of-pit MRA. It has a maximum height of 30 m and a gradient of 12°. This is the highest part of the rehabilitation design but remains within the design limits outlined in Section 7.1.5.1. The overall slope for the Out-of-pit MRA is 5° to 6°.

In-pit MRA design

The In-pit MRA consists of a low-gradient upper surface, with cross sections of the In-pit MRA shown on Figure 7.12. Approximately one third of the top surface on the western side has zero gradient. The western side is bunded to eliminate uncontrolled discharge occurring over the 12° slope batter to the west. However, any runoff that is generated will drain to the east and report to the drainage zone on the northern corner of the landform. The remaining two thirds of the upper surface of the In-pit MRA grades to the northern corner at a gradient of approximately 1°.

The outer batter slopes of the In-pit MRA on the north-eastern (excluding the drainage zone) have a maximum height 18 m and a gradient of 11°. The southern sides of the emplacement have a maximum height of 15 m and a gradient of 11°.

The drainage zone on the northern corner has been shaped to discharge water from the top surface of the In-pit MRA to the final void. The maximum height of the batter within the drainage zone is 19 m, and the gradient ranges from 6 to 8°. The overall slope of the In-pit MRA is 1° to 2°.

7.1.5.3. Method of construction

Out-of-pit MRA and road access area

The Out-of-pit MRA has been currently partially constructed as a result of previous mining activities. Prior to further placement of overburden or interburden materials, the existing built shape will be reshaped to construct the lower three lifts, including road access area. Following completion of the three lower lifts, the two uppermost lifts will be constructed.

The method of construction of the Out-of-pit MRA, including road access area, is described further in Section 7.6.4.

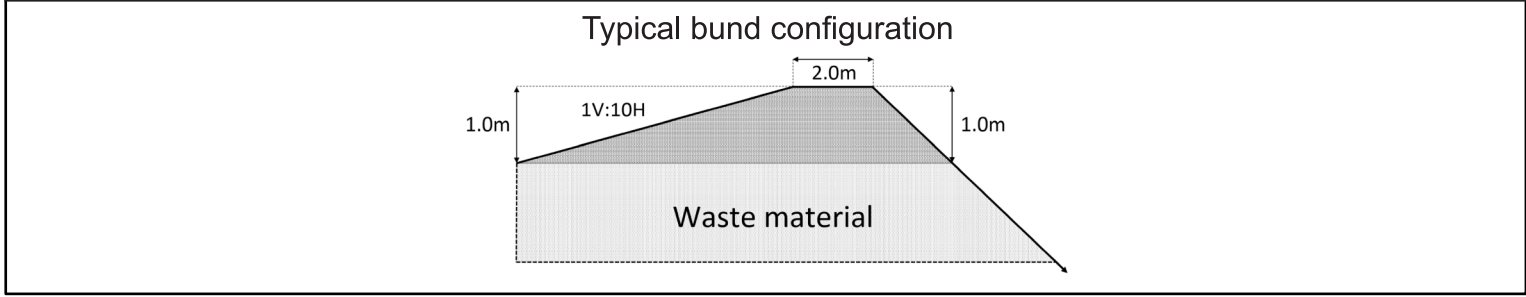
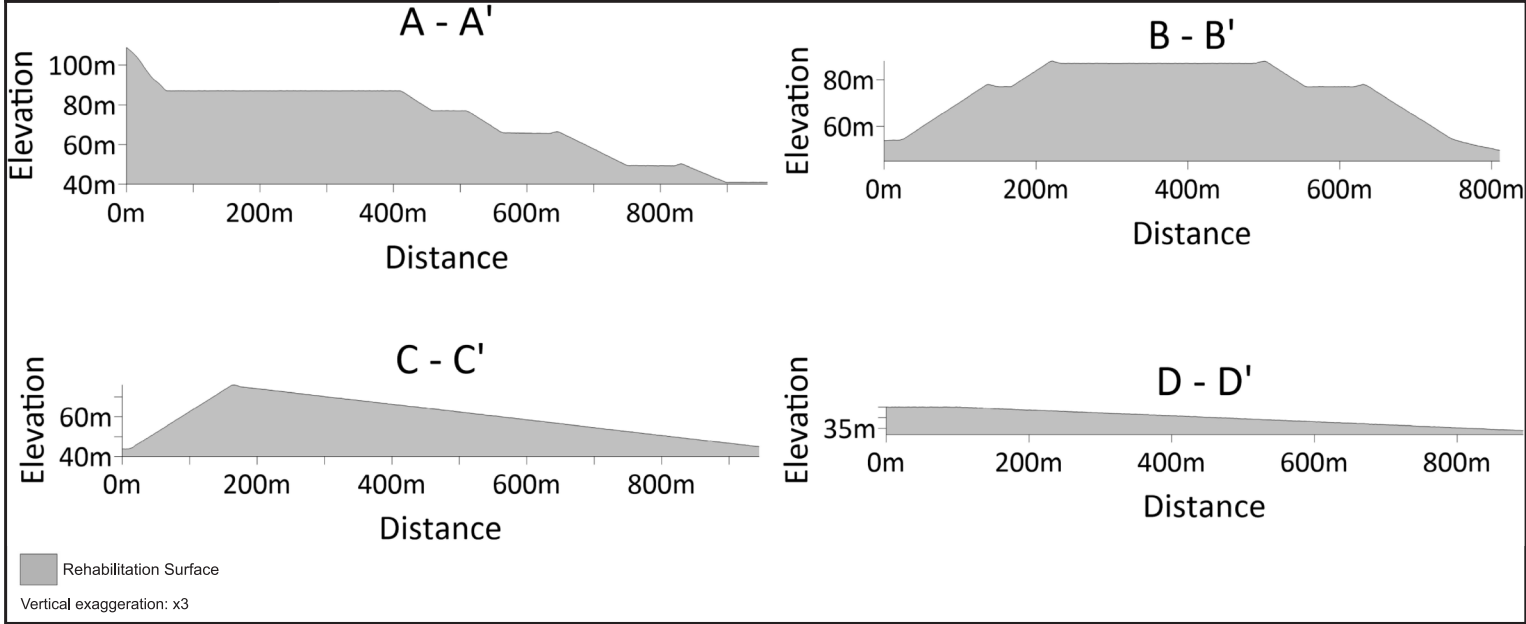
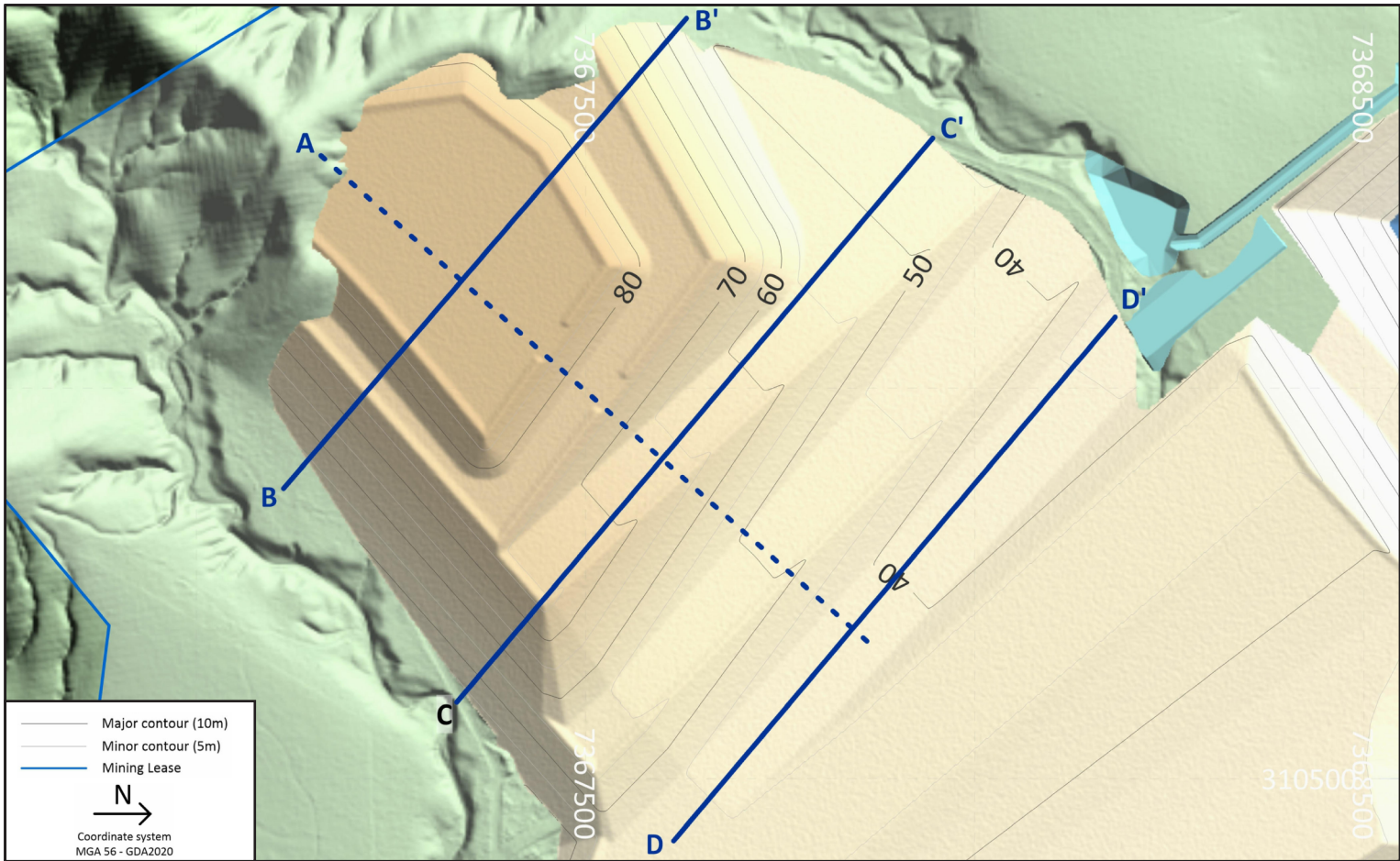
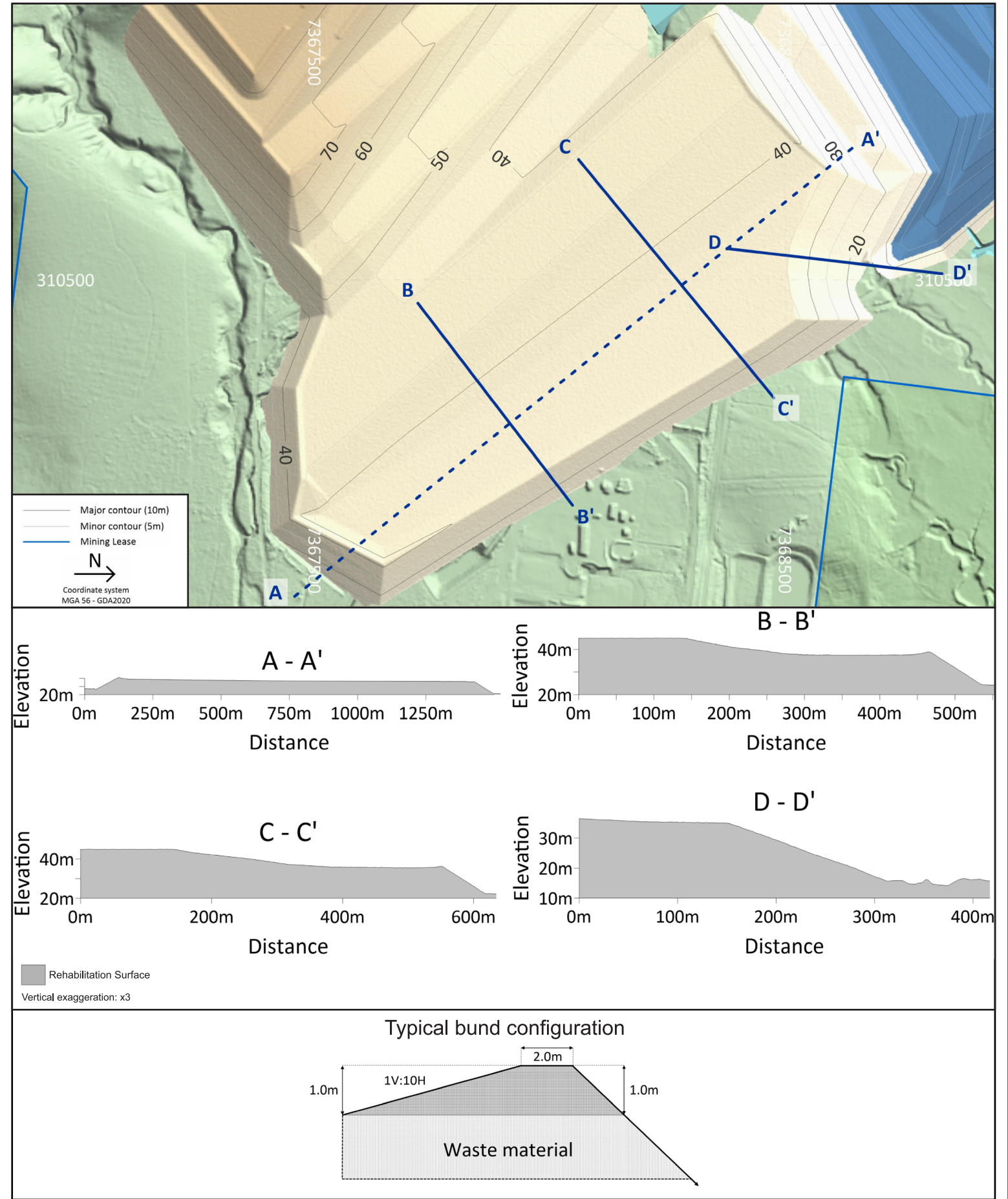


	Figure 7.11 Cross section locations for the Out-of-pit MRA & road alignment (top), and cross section views for these locations (bottom) (Landloch, 2024b)		QUEENSLAND ENERGY RESOURCES Stuart Kerogen Shale Project
	Date: 26/04/2023	Drawn By: Landloch	
	RTPL_QER_STPRC_PRCMAP0023_B	Requested by: John Linden	



 QER QUEENSLAND ENERGY RESOURCES		Figure 7.12 Cross section locations for the In-pit MRA & drainage zone (top), and cross section views for these locations (bottom) (Landloch, 2024b)	QUEENSLAND ENERGY RESOURCES Stuart Kerogen Shale Project
Date: 26/04/2023	Drawn By: Landloch		
RTPL_QER_STPRC_PRCMAP0024_B	Requested by: John Linden		

In-pit MRA

Following completion of emplacement at the Out-of-pit MRA, waste will be progressively placed into the In-pit MRA, and rehabilitation activities commenced in relevant sections as mining continues in a northerly direction (Figure 7.9).

The method of construction of the In-pit MRA is described further in Section 7.6.4.

7.1.5.4. Landform evolution modelling results

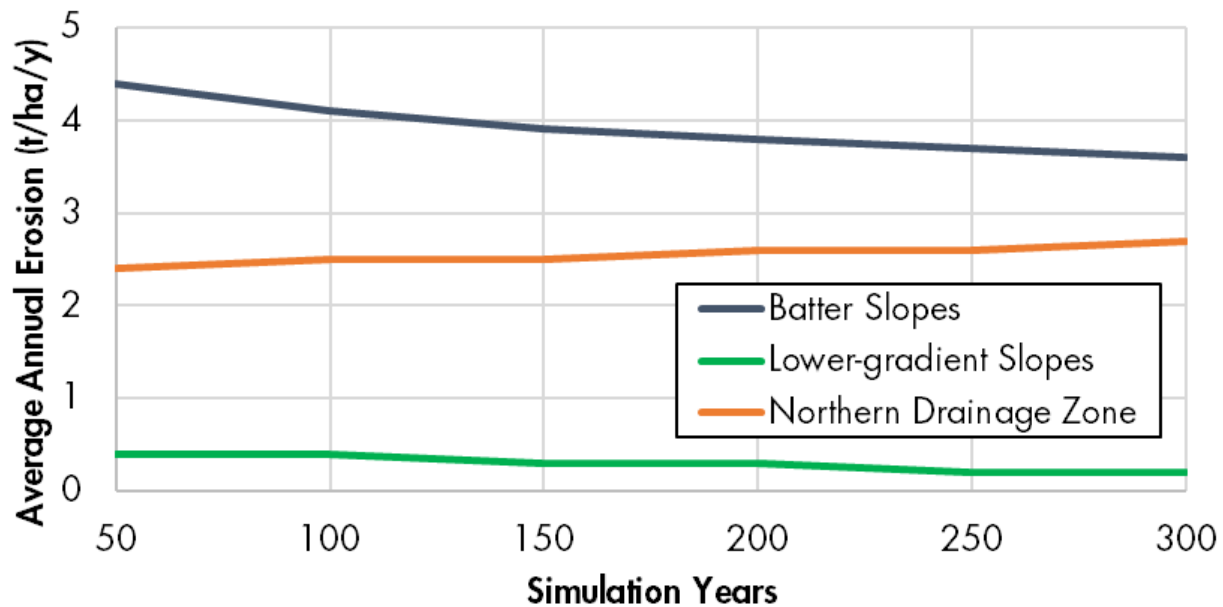
Predicted erosion statistics

Results for the SIBERIA modelling simulations with vegetated soils are presented in Table 7.5, while the change in predicted average annual erosion through time is shown in Figure 7.13. The statistics are broken into three different zones:

- 12° gradient batters
- lower-gradient slopes
- drainage zone on the northern end of the In-pit MRA

Table 7.5 Summary of SIBERIA simulations of the rehabilitation landform design

Simulation year	Maximum gully depth (m)	Average erosion (t/ha/y)	Cumulative erosion (mm)
Batter Slopes			
50	-	4.4	17
100	-	4.1	33
150	-	3.9	48
200	-	3.8	63
250	-	3.7	77
300	-	3.6	91
Lower-gradient Slopes			
50	-	0.4	2
100	-	0.4	3
150	-	0.3	4
200	-	0.3	5
250	-	0.2	6
300	-	0.2	7
Northern drainage zone			
50	-	2.4	9
100	-	2.5	19
150	-	2.5	29
200	0.3	2.6	39
250	0.4	2.6	49
300	0.4	2.7	59



Source: Landloch (2024b).

Figure 7.13 Change in predicted average annual erosion rates through time for the rehabilitation landform design covered in vegetated soil

Erosion characteristics – batter slopes and low-gradient surfaces

The SIBERIA landform evolution modelling results indicate that all batter slopes and low-gradient surfaces of the landform design erode at acceptable rates. The rates are consistent with erosion rates commonly found in the vicinity of the Project. Erosion rates are predicted to be 3.6 t/ha/y after 300 years for the batter slopes, and 0.2 t/ha/y after 300 years for the low-gradient surfaces. For these surfaces gully erosion (i.e. features deeper than 0.3 m) is not predicted to occur within 300 years of simulation.

Therefore, the potential for exposure of the underlying overburdens and interburdens in these areas is low. Erosion rates trend lower over time (Figure 7.13) for these surfaces, indicating that the model is predicting increasing stability of these surfaces through time. This suggests that the landform is quite stable.

Erosion characteristics – northern drainage zone

The northern drainage zone is the area of highest erosion risk on the landform design; however, average erosion rates predicted to be low (2.7 t/ha/y after 300 years), with erosion concentrated in discrete rills. After 200 years, these rills are predicted to reach depths >0.3 m and become gullies. Exposure of the underlying overburdens and interburdens in this zone is therefore possible in the long-term. That said, it is important to note that the overall erosion of this zone is low.

Mitigation of the risk for gully erosion will be achieved through:

- Ensuring a thicker minimum topsoil thickness of 0.5 m is adopted in the northern drainage zone.
- Augmentation of rock cover/ armour into the surface of the northern drainage zone to achieve 30% rock cover. This would be sufficient to halve the long-term erosion potential, based on model predictions using the RUSLE, and result in halving the predicted long-term erosion potential and significantly reduce the risk of rill and gully initiation in this zone.

As a result, with consideration to the long-term erosion modelling results predicting erosion after 300 years to be 0.4 m (without the inclusion of rock cover/ armour), these mitigation measures would ensure NAF materials below topsoil is not exposed and ensure the landform is stable in the long-term.

7.1.5.5. Quality assurance (QA) and quality control (QC)

Landform

Construction of the final landform will require completion of the following QA/QC aspects:

- **Reshaping**: the constructed rehabilitation shape will achieve the design geometries ± 0.2 m vertical height measured over a maximum distance of 50 m, allowing for some greater variation in microrelief caused by the blockiness of the overburdens and interburdens (i.e. some rocks or larger particles may protrude from an otherwise suitably level surface). A description of reshaping works is provided in Section 7.6.4.
- **Crest-bunding**: discharge of concentrated flows over steeper batters is a very common cause of gullying and landform failure. For the recommended design to be stable and sustainable, it will be critical that the crest-bunding included in the landform design be constructed as described in Section 7.6.4.
- **Surface ripping**: it is critical that flow concentration on the batter slopes is minimised, concentration of runoff will be prevented by minimising the size of cross-slope rip lines (i.e. upper 0.3 m of surface cross-slope ripped using a tyned machine with tynes spaced no wider than 0.5 m), as described in Section 7.6.4.

Vegetative cover

The stability of the rehabilitation landform design is dependent on establishment of a woodland ecosystem with the following broad functional properties:

- $\geq 60\%$ surface contact cover (litter and living groundcover)
- $\geq 25\%$ canopy cover from shrubs and trees

Observations of vegetation on rehabilitated portions of the Out-of-pit MRA and in undisturbed areas indicate that this is achievable.

7.1.6. Cover design

PRCP Guideline (Section 3.6.1)

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

The cover design should include:

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

A surface treatment model has been completed as part of the Landform Cover Design completed by Landloch (2024a). The surface treatment model and assessment for the Project is contained in Appendix H and the results are summarised below.

7.1.6.1. Out-of-pit and In-pit MRAs

Wastes to be stored within the Out-of-pit and In-pit MRA will include overburden, interburden and processed shales. These material types have been assessed by Terrenus (2015, 2021, and 2023) and found to not require a dedicated cover design to manage any geochemical risks. The geochemical assessment has shown that the wastes and processed shales are not anticipated to pose a high or significant risk in terms of acidic, neutral, or alkaline discharge, or elevated metal and/or sulphate concentration in surface waters or groundwaters.

As a result, a specific cover design to address these risks is not required.

The broad strategies of managing the wastes and processed shales will include:

- co-mingling of the wastes and processed shales into both the In-pit MRA and Out-of-pit MRA, with co-disposal of any PAF material within a large proportion of NAF material to provide excess neutralising capacity
- Tw3 waste will not be present at the final landform surfaces (minimum 2 m cover)

The final aspect of the cover design involves spreading of topsoil to a minimum depth of 0.3 m, ensuring compliance with the requirements of Schedule 6, Conditions 16, 18 to 20, 25 and 26 of the EA. However, as previously noted, wastes and processed shales are not anticipated to pose a high or significant risk.

7.1.6.2. Final void

The geochemical assessment has found that the environmental risks posed by the final post-closure void likely to be present at closure are generally **Low** (Terrenus, 2023). However, in consideration of the requirements of Condition G19 of the EA, to mitigate acid generation potential (and to also reduce geotechnical risks of the final void walls), the final void will be:

- backfilled and reprofiled to a lower gradient with NAF overburden and interburden so that all PAF materials will be covered with NAF waste
- filled with water to establish a permanent wetland system

The gradient to which the pit wall exposed above the equilibrium water level will be reshaped is to be no steeper than 30%, assuming that the exposed slope length will typically be no more than 30 m (vertical height of approximately 10 m).

7.1.6.3. Cover thickness

The required thickness of cover was modelled using the desktop version of the HowLeaky model (McClymont et al., 2008).

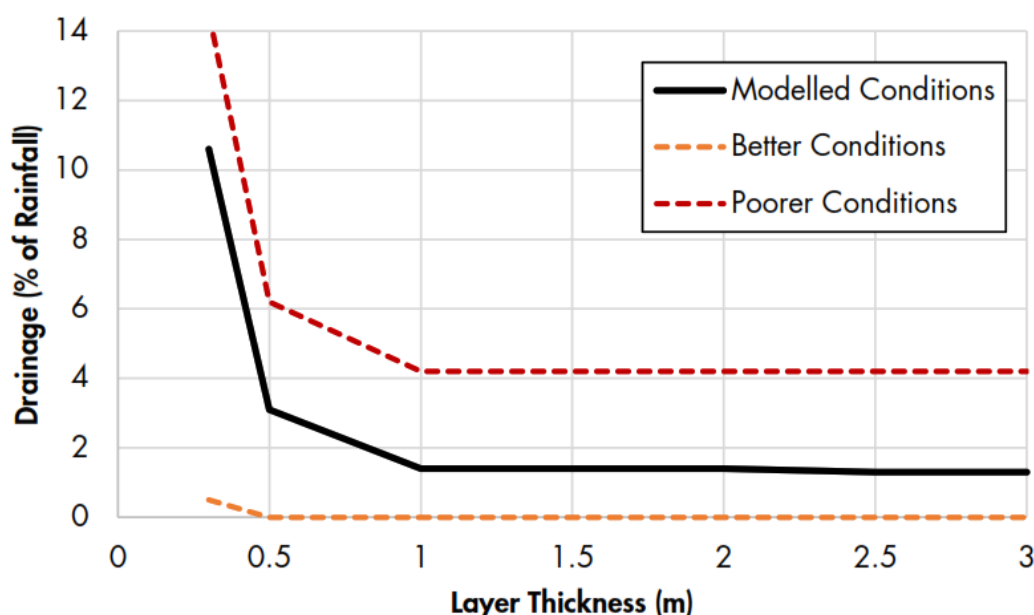
The required parameters for HowLeaky include:

- Climate data: data used was sourced for Gladstone from 1 January 1960 to 31 December 2022 from the Queensland Government's SILO patched point data sets. The average annual rainfall for the period was 889 mm and mean monthly rainfall values are shown in (Mean monthly rainfall for Gladstone for Jan 1960 to Dec 2022 [top] and annual exceedance probability of daily rainfall events in the same period [bottom]) of Appendix H. The largest daily rainfall total in the record was 254 mm, while 8 days had rainfall greater than 200 mm and 44 days had rainfall greater than 100 mm.

- **Materials data:** this relates to moisture holding capacity and runoff potential. Typical water holding capacity data for a clay loam to silty clay textured material were used (Hazelton and Murphy, 2016): field capacity 40% and wilting point 16%. Air dried moisture content was set at 9% and saturated moisture content was set at 46%, based on pedotransfer functions in the Rosetta soil hydraulic parameter estimation tool that relate material texture to hydraulic parameters (Schaap, 2001). Bulk density was set to 1.8 g/cm³, consistent with a dispersive clay-rich material. Maximum drainage of 150 mm/day in the surface 100 mm and 90 mm/day in the sublayer was set based on recommendations given in the HowLeaky model (surface layer) and values derived from the Rosetta soil hydraulic parameter estimation tool (sublayer), respectively. The runoff curve number was set to 80, consistent with soils that:
 - have slow to very slow infiltration capacity such as silty loam to clay textured materials
 - are supporting a poor-quality shrub-vegetation assemblage (<50% grass cover) (Ponce, 1989) – this grass cover level was consistent with cover levels observed on site (Landloch 2023c)
- **Vegetation:** vegetation was set to a permanent vegetative cover with 50% green cover and a rooting depth of 0.5 m. This was set assuming that the majority of vegetation will consist of grass and shrubs rather than trees. It is also consistent with cover levels observed at site.

Figure 7.14 shows the relationship between thickness of the NAF layer and the predicted drainage expressed as a percentage of rainfall (black line labelled 'Modelled Conditions'). 'Better Conditions' model results are based on a higher value for field capacity (45%), lower values for maximum drainage (70 mm/day), higher cover level (70%) and a curve number consistent with good vegetation (70) was used to consider a profile that is more conducive to plant growth. 'Poorer Conditions' model results are based on a lower value for field capacity (35%), high values for maximum drainage (110 mm/day), lower cover level (30%) and a curve number consistent with poor vegetation (85) was used to consider a profile that is less conducive to plant growth.

For all modelled scenarios, drainage reaches a minimum at a layer thickness of 1 m. Therefore, adoption of a 2 m thick cover is recommended to allow for erosion of the cover over time, and for some variation in the layer thickness actually applied by machinery during the remediation of the void walls.⁴



Source: Landloch (2024b).

Figure 7.14 Predicted drainage from the base of a layer of clay loam to silty clay wastes with thickness ranging from 0.3 m to 3 m

⁴ Bureau of Meteorology site 39123

7.1.7. Water management

PRCP Guideline (Section 3.6.1)

The rehabilitation planning part must include a description of the following:

- *a description of the contaminants that pose a risk to environmental values of the receiving environment;*
- *source, pathway, and fate of contaminants that have the potential to impact environmental values;*
- *infiltration and seepage intervention and collection controls;*
- *surface water diversions and long-term management requirements;*
- *dewatering requirements; and*
- *ongoing water management and reduction requirements (i.e. treatment).*

Technical studies into flooding and water management were undertaken as part of the Hydrology and Water Management Technical Study completed by Engeny (2024). The closure water management and flooding assessments for the Project are contained in Appendix K and the water management results are summarised below.

7.1.7.1. Potential contaminants and sources

With the exception of industrial and water storage (industrial use) PMLUs, the final landform areas not draining to the final void will be rehabilitated with established vegetation as native ecosystem (bushland) PMLU to prevent the generation of contaminants.

The final void is the key potential source for contaminants post-closure. The final void will have a localised rehabilitated catchment area draining to a pit lake. The pit lake will also receive relatively small quantities of groundwater inflows and be subject to evaporative losses. Water quality impacts related to the long-term evapo-concentration of contaminants will be mitigated by the flow through system pit lake design.

A summary of the potential contaminant sources, flow paths and destinations for the Project final landform post-closure are summarised in Table 7.6.

Table 7.6 Potential contaminant source summary

Potential Source	Potential CoCs								Potential transport mechanism	Potential destinations
	Salinity	Acidity	Sulphide	Metals ¹	Soluble organic compounds ²	Dioxins	Nitrogen compounds	Sediment		
Final void	Y	Y	Y	Y	Y	Y	Y	N	Seepage into groundwater system	Groundwater system
	Y	Y	Y	Y	Y	Y	Y	Y	Overtopping due to local hydrological inflows and outflows	Surface water system: receiving waters
	Y	Y	Y	Y	Y	Y	Y	Y	Overtopping due to flood ingress (Targinie Creek) resulting in the void filling	Surface water system: receiving waters
Rehabilitated In-pit & Out-of-pit MRAs	Y	Y	Y	Y	Y	Y	Y	N	Seepage via infiltration	Final void
									Seepage via infiltration	Groundwater system
Rehabilitated mine landforms	N	N	N	N	N	N	N	Y	Rainfall runoff	Surface water system: receiving waters

1) Potentially including Aluminium (Al), iron (Fe), barium (Ba), cobalt (Co), manganese (Mn), nickel (Ni) and zinc (Zn).

2) Potentially including PAHs & TPH.

Table 7.6 is based on the results of the *Hydrology and Water Management Technical Study* (Engeny, 2024) (Appendix K) and *Hydrogeological Report* (AGE, 2024) (Appendix L), which in turn were informed by the results of the *Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste* (Terrenus, 2023) (Appendix F). As per the results of the risk assessment *Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste* (Terrenus, 2023) (Appendix F), which considered all potential CoCs identified in Table 7.6, salinity is the key contaminant of interest for the Project final void. The risk assessment completed by Terrenus (2023) is provided in N.2(*Geochemical Source-Pathway-Risk Assessment*) of Appendix N.

Salinity was used as an overall indicator to assess the pit lake water quality due to salinity being a measure of total dissolved solids (potential contaminants), which includes the key potential CoCs listed in Table 7.6.

7.1.7.2. Potential water receptors

Wetlands

The Project is located approximately 1 km upstream of matters of state environmental significance wetlands in Port Curtis. No areas mapped as Vegetation Management Wetlands are in the proximity.

Potential surface water users

There are currently no active licences to take water downstream from the Project.

Potential groundwater receptors

The potential receptors include:

- a mapped artificial dam with potential for aquatic GDE status located southeast of the Project site
- stygofauna in the Project site;
- areas of potential springs along Humpy Creek and Targinie Creek
- area of mapped potential terrestrial GDEs northeast of ML 80003
- potential terrestrial GDEs within specific (of concern) RE types mapped on ML 80003
- groundwater bores used for irrigation and livestock watering
- water used for industrial purposes

Land use

Surrounding land use at the Project is variable, and includes the following categories:

- mining
- other minimal use
- production forestry
- residential
- irrigated perennial agriculture
- services
- manufacturing and industrial
- marsh/wetland
- estuary/coastal waters
- reservoir/dam

7.1.7.3. Potential water exposure rates

Surface water

The potential impacts of the mine on surface water environmental values are identified based on the known contaminants, their sources, and the performance of the site water management system. The potential impacts considered include:

- Release of dissolved salts through shallow seepage or overflows from the final voids with the potential for:
 - accumulation within the natural drainage gully (Gully E) between the pit lake and the marine environment (approximately 1 km reach)
 - impacts to stock, riparian, and aquatic ecosystems
- Erosion or instability of the rehabilitated final landform resulting in generation and release of sediments to receiving waters potentially impacting downstream riparian vegetation and waterway condition.
- Impact to the rate and frequency of flows of the existing ephemeral gullies and the ability to mirror natural fluctuations.
- Erosion and downstream flood impacts of the existing ephemeral gullies resulting from overflows from the final void.

Groundwater

Potential impacts of the Project final landform have been identified in Section 7.1.1.

7.1.7.4. Final void hydrology results

The Hydrology and Water Assessment completed by Engeny (2024) indicate:

- The pit lake equilibrium level is predicted to be approximately 8.1 mAHD, corresponding to 7.83 GL and, depending on rainfall, will take approximately 18 years to reach equilibrium.
- The pit lake equilibrium level is 1.9 m below the void spill level of 10 mAHD with the pit lake expected to overflow in 26% of years.
- Following the pit lake reaching equilibrium, the lake water level is expected to fluctuate by approximately 8 m (2.1 mAHD up to spill level).
- The pit lake is expected to receive sufficient volumes of clean catchment runoff that will maintain the pit lake water quality and prevent concentration of contaminants from evaporation.
- EC in the final void fluctuates between 620 and 1,540 $\mu\text{S}/\text{cm}$ following the initial filling period, with a mean lake water quality of 900 $\mu\text{S}/\text{cm}$.
- Fluctuations in void water quality are expected to occur during prolonged wet and dry periods however the EC of the pit lake during overflow events is expected to be between 623 and 1,100 uS/cm .
- Although overflow EC from the pit lake is expected to remain below 900 uS/cm in 85% of overflow occurrences, the maximum modelled overflow EC of 1,100 uS/cm is lower than water quality of the larger watercourses near the Project.
- No infiltration and seepage intervention and collection controls, surface water diversions or other long-term water management is deemed to be required at time of closure.
- In accordance with monitoring requirements (Section 9), appropriate evaluation of water quality will be undertaken to confirm that ongoing water management is not required.

7.1.7.5. Management measure summary

Summary

As discussed in Section 7.1.7.1, salinity is the key contaminant of interest for the Project final void. Due to salinity being a measure of total dissolved solids (potential contaminants), which includes the key potential CoCs listed in Table 7.6, it has been used as an overall indicator to assess the pit lake water quality.

Table 7.7 shows the key CoCs are managed as part of the landform rehabilitation based on outcomes of the surface water assessment.

Table 7.7 Potential contaminant source and management measure summary

Source	Transport mechanism	Potential destination	Management measure	Key CoC
Final void	Seepage into groundwater system.	Groundwater system	Water quality is expected to be suitable based on the assessment and not predicted to be a contaminant source to groundwater system. Therefore, not requiring active management; however, groundwater monitoring will be undertaken as described in Section 9.	Salinity
	Overtopping due to local hydrological inflows and outflows.	Surface water system: receiving waters	The flooding and water balance assessment results show management of clean catchment inflows into the pit lake maintain a suitable water quality during discharge and do not result in increased flooding downstream of the Project. Not predicted to cause environmental harm. Therefore, not requiring active management; however, surface water monitoring will be undertaken as described in Section 9	Salinity
	Overtopping due to flood ingress from regional flooding (Targinie Creek) resulting in the void filling.	Surface water system: receiving waters	Targinie Creek shows no interaction with the Pit Lake and is not expected to be a viable risk – Sections 5 and 7.3.6. Therefore, additional management is not required or proposed.	Salinity
Rehabilitated In-pit and Out-of-pit MRAs	Seepage via infiltration.	Final void, Groundwater system	Seepage contributions from the landform, post cover construction is not expected to impact the pit lake water quality as determined from the water balance assessment. Therefore, not requiring active management; however, groundwater and surface water monitoring will be undertaken as described in Section 9.	Salinity
Rehabilitation mine landforms (draining to waterways)	Rainfall runoff.	Surface water system: receiving waters	The Landform design directs runoff to the pit lake which will promote sediment deposition. The rehabilitation strategy incorporating revegetation will manage long term sediment runoff generation. Therefore, not requiring active management; however, surface water monitoring will be undertaken as described in Section 9	Sediment

Surface water quality monitoring locations and values

Surface water quality monitoring for the Project during rehabilitation and closure will be undertaken at the upstream and downstream locations shown on Figure 7.15 and identified in Table 7.8.



0 100 200 300 400 500
m

QUEENSLAND ENERGY RESOURCES



GDA2020, MGA Zone 56



Figure 7.15
Surface water and groundwater
monitoring locations

Legend

- ML 80003
- ~~~~~ Watercourse
- GW Groundwater Monitoring Location
- SW Surface Water Monitoring Location

Date: 4/06/2026

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0041_D

Requested by: John Linden

Sources:
© The State of Queensland (Department of Natural Resources and
Mines, Manufacturing and Regional and Rural Development)

Table 7.8 Surface water quality monitoring locations

Monitoring Locations	Receiving waters location description	Latitude (decimal degree, GDA2020)	Longitude (decimal degree, GDA2020)
Upstream monitoring locations			
SW1	Gully B upstream	-23.79527	151.13791
SW2	Gully D upstream	-23.79106	151.13006
SW3	Gully E upstream	-23.78444	151.12818
Downstream monitoring locations			
SW4	Gully E waterbody	-23.77917	151.13256
SW8	Gully E downstream	-23.77553	151.13888
SW5	Gully C downstream	-23.78138	151.14506
SW9	Gully B downstream	-23.79404	151.14795

Surface water quality criteria for the Project during rehabilitation and closure is provided in Table 7.9, associated with the monitoring locations provided in Table 7.8. During the R&D phase of the Project, QER will develop site-specific surface water quality values and apply to amend the values listed in Table 7.9.

Table 7.9 Surface water quality values

Quality characteristic (units)	Value	Comment on Value
pH	6.5-8.0	Lowland freshwater inside SDA WQO (Table 2F)
Electrical Conductivity (µS/cm)	700	Site-specific
Turbidity (NTU)	56	Site-specific
Sulphate (mg/L)	20	Central Calliope WQO (Table 14)
Aluminium – dissolved (µg/L)	410	Site-specific
Cobalt – dissolved (µg/L)	1.4	ANZG 2018
Iron – dissolved (µg/L)	For interpretation purposes only	
Manganese – dissolved (µg/L)	350	Site-specific
Nickel – dissolved (µg/L)	11	ANZG 2018
Zinc – dissolved (µg/L)	22	Site-specific
Nitrate (µg/L)	146	Site-specific
Total nitrogen (µg/L)	1,500	Site-specific
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	

1. All metals and metalloids must be measured as 'dissolved' (from analysis of a field filtered sample) and total (unfiltered).
2. Limits for metals and metalloids apply to dissolved results.
3. ANZG (2018) Aquatic ecosystem protection for moderately disturbed system (95% protection)
4. Lowland freshwater inside state development area (SDA) Water Quality Objective (WQO) - https://environment.desi.qld.gov.au/_data/assets/pdf_file/0034/87775/boyne-calliope-curtis-evs-wqos.pdf
5. Surface water Central Calliope ion Water Quality Objective (WQO) - https://environment.desi.qld.gov.au/_data/assets/pdf_file/0034/87775/boyne-calliope-curtis-evs-wqos.pdf

Groundwater quality monitoring locations and values

Groundwater quality monitoring for the Project during rehabilitation and closure will be undertaken at the monitoring bore locations shown on Figure 7.15 and Figure 7.16, and identified in Table 7.10.

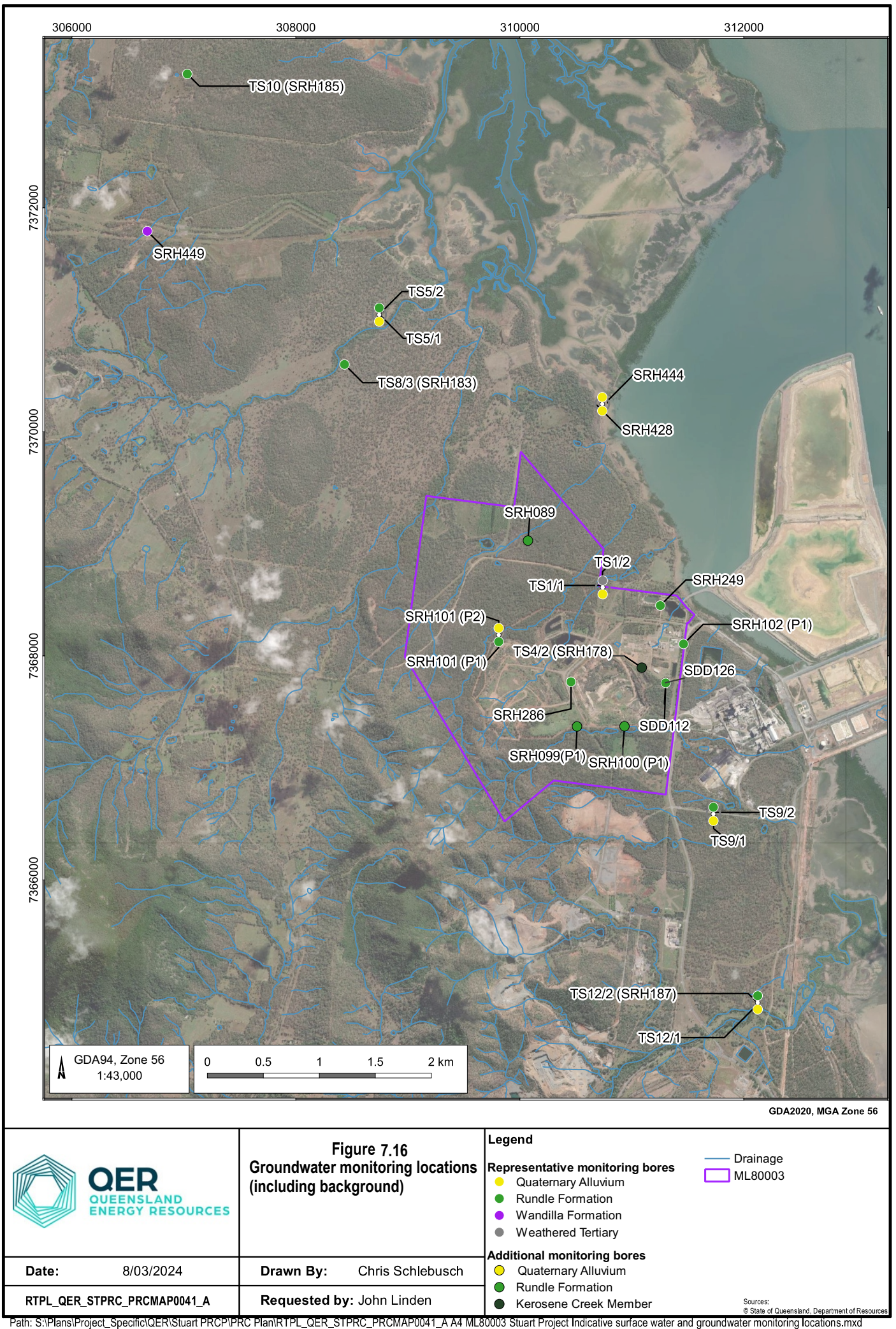


Table 7.10 Groundwater monitoring bores

Monitoring bore	Hydrogeological Unit	Location	
		Latitude (decimal degree, GDA2020)	Longitude (decimal degree, GDA2020)
MB01 (SRH101[P1])	Rundle Formation	-23.78625	151.13339
MB01 (SRH101[P2])	Alluvium	-23.78625	151.13339
MB02	Alluvium	-23.78294	151.13130
MB03	Alluvium	-23.78062	151.12847
MB04	Alluvium	-23.78033	151.14141
MB05	Rundle Formation	-23.77500	151.13554
SRH102 (P2)	Alluvium	-23.78625	151.13339
MB11	Alluvium	-23.79794	151.14727
NB01	Alluvium	-23.77553	151.13888
NB02 (TS1/1)	Alluvium	-23.78252	151.14257
NB02 (TS1/2)	Weathered Tertiary	-23.78252	151.14257
NB03	Rundle Formation	-23.87119	151.14454
SRH099(P1)	Rundle Formation	-23.79371	151.14014
SRH100(P1)	Rundle Formation	-23.79375	151.14430
SDD12	Rundle Formation	-23.79029	151.14796
SDD126	Alluvium	-23.79028	151.14795
SRH102(P1)	Rundle Formation	-23.78718	151.14958
SRH249	Rundle Formation	-23.78398	151.14739

Current groundwater quality criteria for the Project during rehabilitation and closure is provided in Table 7.11 (Groundwater quality values) and Table 7.12 (Bore-specific groundwater quality limits), associated with the monitoring locations provided in Table 7.10.

Table 7.11 Groundwater quality values

Quality characteristic (units)	Monitoring bore	Value	Comment on value
pH (pH units)	Alluvium Bores	5.25 – 7.31	Site-specific
	Rundle Formation Bores	6.06 – 8.0	Site-specific
	Weathered Tertiary Bores	6.5 – 8.5	
Electrical Conductivity (µS/cm)	Alluvium Bores, except SRH102(P2)	6,727	Site-specific
	SRH102(P2)	10,280	Site-specific
	Rundle Formation Bores, except SRH249	19,965	Site-specific
	SRH249	37,955	Site-specific
	Weathered Tertiary Bores	10,720	Site specific
Sulphate (mg/L)	Alluvium Bores	637	Site-specific
	Rundle Formation Bores, except SRH249	1,327	Site-specific
	SRH249	1,525	Site-specific
	Weathered Tertiary Bores	232	Site specific

Quality characteristic (units)	Monitoring bore	Value	Comment on value
Aluminium – dissolved (µg/L)	Alluvium Bores	80	Site-specific
	Rundle Formation Bores	41	Site-specific
	Weathered Tertiary Bores	55	ANZG 2018
Cobalt – dissolved (µg/L)	All bores	1.4	ANZG 2018
Iron – dissolved (µg/L)	All bores	For interpretation purposes only	
Manganese – dissolved (µg/L)	Alluvium Bores	1,900	ANZG 2018
	Rundle Formation Bores, except SRH249	1,340	Site-specific
	SRH249	2,226	Site-specific
	Weathered Tertiary Bores	1,045	Site specific
Nickel – dissolved (µg/L)	All bores	11	ANZG 2018
Zinc – dissolved (µg/L)	Alluvium Bores	105	Site-specific
	Rundle Formation Bores, except SRH249	89	Site-specific
	SRH249	171	Site-specific
	Weathered Tertiary Bores	109	Site-specific
Major ions (mg/L) calcium, chloride, potassium, magnesium, sodium, bicarbonate, carbonate	All bores	For interpretation purposes only	
Hardness (mg/L)	All bores	For interpretation purposes only	

- 3) All metals and metalloids must be measured as 'dissolved' (from analysis of a field filtered sample) and total (unfiltered).
- 4) Electrical conductivity and pH limits are based on insitu or field-based test results.
- 5) Limits for metals and metalloids apply to dissolved results.
- 6) ANZG (2018) Aquatic ecosystem protection for moderately disturbed system (95% protection).
- 7) Groundwater chemistry zone 14 Bondoola Depth Shallow (5-20m) WQO –
https://environment.desi.qld.gov.au/data/assets/pdf_file/0030/87564/wq1273-cccgroundwater.pdf and
https://environment.desi.qld.gov.au/data/assets/pdf_file/0034/87775/boyne-calliope-curtis-evs-wqos.pdf.
- 8) Unless bore-specific values are provided in Table 7.12.

Table 7.12 Bore-specific groundwater quality limits

	Alluvium			Weathered tertiary	Rundle			
	TS1/1	SDD126	SRH102(P2)	TS1/2	SDD112	SRH101(P1)	SRH102(P1)	SRH249
pH	5.0-6.4	5.3-6.5	5.7-8					5.6-7
Electrical Conductivity (µS/cm)	817	2,802	9,956	10,700	4,740	19,950	10,120	37,825
Sulfate (mg/L)	13			232	135	1,405		1,525
Aluminium – dissolved (µg/L)	60							
Cobalt – dissolved (µg/L)		2						
Manganese - dissolved (µg/L)	51	78	300	1,045	1,343	1,269	345	2,226
Zinc - dissolved (µg/L)	93	61	66	109	75	99	82	171

- 1) Electrical conductivity and pH limits are based on insitu or field-based test results.

7.1.8. Revegetation

PRCP Guideline (Section 3.6.1)

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

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

A revegetation model has been completed as part of the Revegetation Plan completed by Landloch (2024c). The revegetation model, monitoring program, and milestones for the Project are contained in Appendix J and the results are summarised below.

7.1.8.1. Revegetation objectives

The strategy is aimed at establishing a safe, stable, and non-polluting landform, with a self-sustaining vegetation cover consistent with the proposed PMLUs. The revegetation strategy seeks to re-establish vegetation and fauna habitats to a similar condition to adjacent undisturbed areas and associated REs.

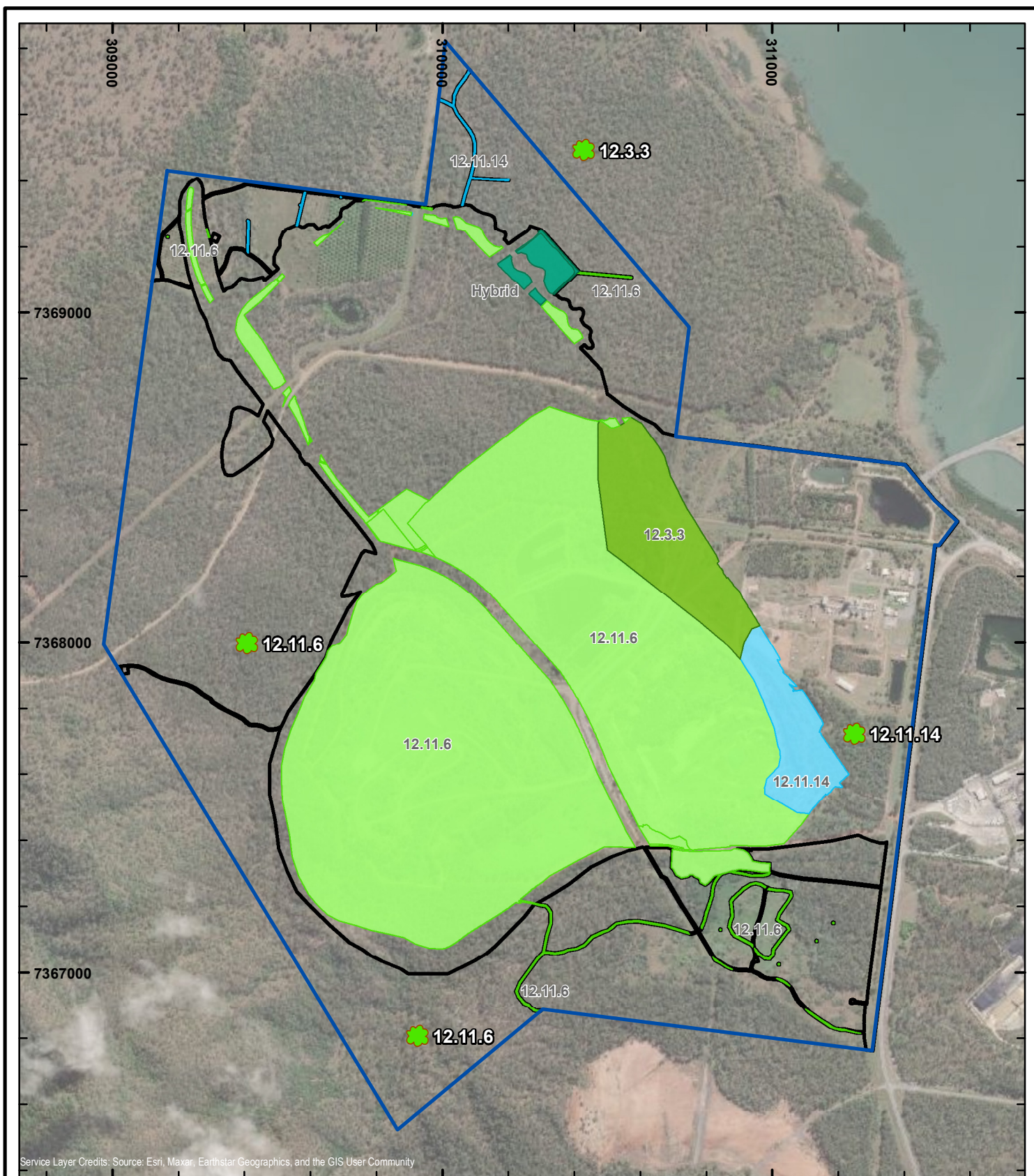
Initial revegetation activities for the PMLUs (native ecosystem [bushland] and water storage [freshwater wetland]) will focus on the establishment of groundcover to facilitate stability and topsoil retention and shrub and tree cover to enable the return of fauna habitat. Native seed mixtures will contain a variety of perennial grass, shrub, and tree species introduced by direct seeding to establish a self-sustaining woodland ecosystem.

7.1.8.2. Native ecosystems (bushland) revegetation species and seed mixes

Plant Species

Planting palettes have been described based on known RE composition on site. The species for the native ecosystem (bushland) PMLU listed in Table 7.13 are all known to occur in their respective REs.

The recommended distribution of these REs in the area to be rehabilitated is shown in Figure 7.17.



0 100 200 300 400 500
m

QUEENSLAND ENERGY RESOURCES

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S
GDA2020, MGA Zone 56

Figure 7.17
Target Regional Ecosystems
for rehabilitation of
native bushland PMLU
(Essence, 2024)

Legend

- ML 80003
- EA Approved Disturbance Area
- ✿ Reference site
- Target terrestrial REs**
 - ✿ 12.11.14
 - ✿ 12.11.6
 - ✿ 12.3.3
 - ✿ Hybrid

Date: 11/03/2024

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0027_C

Requested by: John Linden

Sources:
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Table 7.13 Native Ecosystem PMLU Seed Mix⁵

PMLU	Species	Common Name	Proportions of each species in the EA approved disturbance area (%/Cover type)	Cover Type
RE 12.11.14	<i>Eucalyptus crebra</i>	Narrow Leaved Ironbark	30	Upper Canopy
	<i>Eucalyptus tereticornis</i>	Forest Red Gum	30	
	<i>Corymbia intermedia</i>	Pink Bloodwood	20	
	<i>Corymbia tessellaris</i>	Moreton Bay Ash	20	
	<i>Lophostemon suaveolens</i>	Swamp Mahogany	35	Lower Canopy
	<i>Angophora subvelutina</i>	Broad-leaved Apple	35	
	<i>Allocasuarina torulosa</i>	Forest Oak	20	
	<i>Lophostemon confertus</i>	Brush Box	10	
	<i>Planchonia careya</i>	Cocky Apple	50	Tall Shrubs
	<i>Acacia disparrima</i>	Southern Salwood	50	
	<i>Breynia oblongifolia</i>	Coffee Bush	100	Small Shrubs
	<i>Themeda triandra</i>	Kangaroo Grass	60	Ground
	<i>Imperata cylindrica</i>	Cogongrass	20	
	<i>Cymbopogon refractus</i>	Barbed Wire Grass	10	
	<i>Panicum effusum</i>	Hairy Picnic	10	
Minimum total sowing rate			10 kg/ha	
RE 12.3.3	<i>Eucalyptus tereticornis</i>	Forest Red Gum	65	Upper Canopy
	<i>Eucalyptus moluccana</i>	Grey Box	5	
	<i>Eucalyptus crebra</i>	Narrow Leaved Ironbark	15	
	<i>Angophora leiocarpa</i>	Rusty Gum	5	
	<i>Corymbia clarksoniana</i>	Clarkson's Bloodwood	10	
	<i>Acacia disparrima</i>	Southern Salwood	15	Lower Canopy
	<i>Lophostemon suaveolens</i>	Swamp Mahogany	40	
	<i>Melaleuca nervosa</i>	Fibre bark	35	
	<i>Acacia leiocalyx</i>	Black Wattle	10	
	<i>Acacia leiocalyx</i>	Black Wattle	33	Tall Shrubs
	<i>Jacksonia scoparia</i>	Dogwood	33	
	<i>Alphitonia excelsa</i>	Red Ash	33	
	<i>Themeda triandra</i>	Kangaroo Grass	20	Ground
	<i>Cymbopogon refractus</i>	Barbed Wire Grass	10	
	<i>Heteropogon contortus</i>	Black Speargrass	30	
	<i>Panicum effusum</i>	Hairy Panic	5	
	<i>Imperata cylindrica</i>	Cogongrass	30	
	<i>Bothriochloa decipiens</i>	Pitted Bluegrass	5	
Minimum total sowing rate			10 kg/ha	

⁵ This Appendix articulates the list of species which are permitted to be included in the seed mix for Rehabilitation Areas (RAs). For Rehabilitation Areas (RAs), the list of species is further specific to the PMLU to be achieved. Listed species are known to occur on site in their respective Regional Ecosystem. Seed mixes may be supplemented with native species from the Technical Descriptions of each Regional Ecosystem, if confirmed to be present on site or within approved analogue sites, prior to the commencement of rehabilitation activities.

PMLU	Species	Common Name	Proportions of each species in the EA approved disturbance area (%/Cover type)	Cover Type
RE 12.11.6	<i>Corymbia citriodora subsp. Variegata</i>	Spotted Gum	40	Upper Canopy
	<i>Eucalyptus crebra</i>	Narrow Leaved Ironbark	20	
	<i>Angophora leiocarpa</i>	Rusty Gum	15	
	<i>Corymbia erythrophloia</i>	Red Bloodwood	10	
	<i>Corymbia intermedia</i>	Pink Bloodwood	15	
	<i>Acacia disparrima</i>	Southern Salwood	50	Lower Canopy
	<i>Allocasuarina littoralis</i>	Black Sheoak	50	
	<i>Coelospermum reticulatum</i>	Medicine Bush	20	Tall Shrubs
	<i>Planchonia careya</i>	Cocky Apple	20	
	<i>Acacia leiocalyx</i>	Black Wattle	30	
	<i>Acacia decora</i>	Western Silver Wattle	30	
	<i>Grewia latifolia</i>	Dogs Balls or Emu Berry	100	Small Shrubs
	<i>Heteropogon contortus</i>	Black Speargrass	40	Ground
	<i>Themeda triandra</i>	Kangaroo Grass	30	
	<i>Bothriochloa bladhii</i>	Australian Bluewren	20	
	<i>Cymbopogon refractus</i>	Barbed Wire Grass	10	
Minimum total sowing rate			10 kg/ha	

Planting rates and timing

The sowing rate for seeded terrestrial plant species will be based on the rates recommended by the seed supplier; however, total application rates will be in the order of 10 kg/ha, with a contingency of +20% to be adopted to account for mortality.

The composition of the different seeds will be guided by the planting palettes provided in Table 7.13; however, it is noted not all species listed in Table 7.13 are required to be used in revegetation. Rather, a combination of species can be chosen from the list based on availability at the rehabilitation stage.

Planting rates for tube stock (e.g. supplemental tree and shrub planting) will seek to establish a final tree/shrub density of 600 to 800 trees per hectare. This is consistent with tree densities assessed for analogue sites for the Project (Landloch, 2012) (Section 9.1.2).

Timing for seeding will typically be targeted for late summer or early autumn when soil moisture is high, and temperatures are milder. Planting of tube stock will generally be carried out once the seed-planted species have established. Pre-plant spot spraying may be required to reduced groundcover competition within the immediate vicinity of the planted tubestock.

Seed collection and procurement

If required, and where possible, native seed will be collected from populations on or near the Project to maintain regional tolerances. Seed collection will occur in the years prior to recommencement of full production in 2043 (e.g. in 2040 to 2043), and then on an ongoing basis as rehabilitation occurs progressively through to and after 2060 in accordance with Condition E10 of the EA.

In the case where seed collection cannot supply sufficient seed (e.g. future dry periods that reduce seed set). Species planted from seed may need to be purchased from local suppliers up to six-months in advance, in quantities sufficient to undertake direct seeding operations.

Given the significant period between the drafting of this plan and the point at which implementation will occur, suitable seed suppliers will be identified prior to recommencement of full production in 2043 (e.g. in 2042).

An appropriate temporary storage will be set up on site in advance of receiving the collected seed.

Planting stock procurement

Planting stock (e.g. tube stock for some tree species) will need to be ordered at least twelve months ahead of the planting date to allow sufficient time to propagate plants and have them sun-harden in preparation for planting.

Given the significant period between the drafting of this plan and the point at which implementation will occur, suitable propagation nurseries will be identified prior to recommencement of full production in 2043 (e.g. 2023 to 2042).

Throughout the term of the propagation phase, the chosen nursery will be requested to provide regular updates on their progress in order for planting operations to proceed as planned. Plants will only be accepted where adherence to the following quality characteristics is achieved:

- healthy and displaying signs of active growth
- characteristics of the species at the current growth stage
- sturdy stems and being free-standing
- fresh actively growing roots and a well-developed root system that is coherent when removed from the pot, but not tightly pot bound
- no signs of nutrient deficiencies
- sun hardened

All plants will need to be water-saturated prior to dispatch from the nursery. An appropriate temporary storage will be set up on site in advance of receiving the plants. Watering will be conducted for the duration of time the plants are held in temporary storage.

7.1.8.3. Water storage (freshwater wetlands) revegetation species and seed mixes

Fish and macro crustacean stocking

Macroinvertebrates can be expected to naturally colonise the final void wetland and adjacent fringing palustrine wetland, with diversity and abundance likely to increase with the stabilisation of water quality and development of habitat complexity.

Once natural colonisation by macroinvertebrates occurs, native freshwater fish and macro-crustaceans can be stocked in the wetland. This will be undertaken in accordance with guidelines and approvals required by the Queensland Department of Agriculture and Fisheries (DAF).

Fish species chosen for stocking will depend on those available from hatcheries with the correct genetic stock and/or the approval requirements of DAF, in relation to translocation from adjacent waterways.

As food webs within the wetland will need to be established, consideration will be given to the types of fish to be stocked and their sequence of introduction. Therefore, stocking will be staged, with smaller fish species and macro-crustaceans introduced initially. This will include species which are able to breed within wetland systems, and prey upon a range of invertebrates that will establish in the wetland over time.

Once populations of small fish have been established, larger fish species which prey on the smaller fish will be introduced to the final void wetland.

The introduction of very large predatory fish (e.g. barramundi), will be carefully considered, and specifically avoided for the first few years, as such species have the potential to significantly disrupt the establishment of smaller fish populations, and reduce ecological diversity. Furthermore, barramundi require access to marine waters for breeding, so individuals stocked in the wetland would not build up through natural recruitment.

Stocking of large or long-lived fish species to the ephemeral fringing palustrine wetland will be avoided, as these habitats may intermittently dry out during prolonged periods of dry weather. However, some low-lying fringing palustrine wetland to the north-east of the final void may be colonised by fish during periods of high rainfall (i.e. when the final void is spilling). In addition, many species of macroinvertebrates, and some fish (e.g. long-finned eel) can be expected to move between the pit lake wetland and the fringing palustrine wetland.

Fish species recommended for stocking of the wetland are provided in Table 7.14.

Table 7.14 Fish and macro-crustacean species potentially suitable for establishment in freshwater wetland areas (RA12 and RA14)

Common name	Species	Comments
Lacustrine wetlands		
eastern rainbowfish ¹	<i>Melanotaenia splendida splendida</i>	Omnivorous and breeds in lakes. Tolerant of a wide range of conditions.
Agassiz's glassfish ^{1,2}	<i>Ambassis agassizii</i>	Schooling fish to 8 cm. Will breed in lakes.
Empire gudgeon ¹	<i>Hypseleotris compressa</i>	Omnivorous to 12 cm. Larvae generally develop in estuaries, so may not breed well in lakes.
Firetail gudgeon ^{1,2}	<i>Hypseleotris galii</i>	Carnivorous fish to 7 cm. Will breed in lakes.
Midgley's gudgeon ¹	<i>Hypseleotris sp.</i>	Carnivorous fish to 4 cm.
Purple-spotted gudgeon ^{1,2}	<i>Mogurnda adspersa</i>	Mid-sized fish to 15 cm. Will breed in lakes.
Spangled perch ^{1,2}	<i>Leiopotherapon unicolor</i>	Very hardy mid-sized fish to 25 cm. Will breed in lakes.
Long-finned eel ¹	<i>Anguilla reinhardtii</i>	Carnivorous to 1.6 m. Requires access to sea for breeding and may travel across land.
Pacific blue-eye ²	<i>Pseudomugil signifer</i>	Carnivorous to 6 cm. Will breed in lakes.
Hyrtl's catfish	<i>Neosilurus hyrtlui</i>	Mostly carnivorous to 4 cm.
Fly-speckled hardyhead	<i>Craterocephalus stercusmuscarum</i>	Omnivorous to 8 cm.
Orange-fingered yabby ¹	<i>Cherax depressus</i>	Feeds on organic matter and grows to 9 cm.
Freshwater shrimp ^{1,2}	Family Atyidae and Palaemonidae	Generally herbivorous to 8 cm. Will breed in lakes.
Palustrine wetlands		
Eastern rainbowfish ¹	<i>Melanotaenia splendida splendida</i>	Omnivorous and breeds in lakes. Tolerant of a wide range of conditions.
Agassiz's glassfish ^{1,2}	<i>Ambassis agassizii</i>	Schooling fish to 8 cm. Will breed in lakes.
Purple-spotted gudgeon ^{1,2}	<i>Mogurnda adspersa</i>	Mid-sized fish to 15 cm. Will breed in lakes.
Pacific blue-eye ²	<i>Pseudomugil signifer</i>	Carnivorous to 6 cm. Will breed in lakes.
Orange-fingered yabby ¹	<i>Cherax depressus</i>	Feeds on organic matter and grows to 9 cm.
Freshwater shrimp ^{1,2}	Family Atyidae and Palaemonidae	Generally herbivorous to 8 cm. Will breed in lakes.

- 2) Recorded by Ecosure (2014c) in ML 80003 or surrounding areas.
- 3) Readily available from commercial hatcheries.

Plant species

Recommended species for the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs are summarised in Table 7.15, listing species that could be used to revegetate the margins of the mine void, once shaped, and the zones the species may occupy in the final void (A to D).

Table 7.15 Freshwater wetland PMLU seed mix

PMLU	Species	Common Name	Planting Density / m ² (tubestock)	Approximate Depth relative to stable water level (mAHD)	Zone
Final void and lacustrine wetland (RA12) and Fringing palustrine wetland (RA14)	<i>Juncus spp.</i> , including <i>Juncus kraussii</i> and <i>Juncus polyanthemus</i>	N/A – Several rush species	8-10	-0.2 to 0	A
	<i>Cyperus spp.</i>	N/A – Several sedge species	8-10		
	<i>Fimbristylis spp.</i> , including <i>Fimbristylis ferruginea</i> and <i>Fimbristylis polytrichoides</i>	N/A – Several sedge species	8-10		
	<i>Lomandra longifolia</i>	Basket grass	4-6		
	<i>Lomandra hystrix</i>	Green mat-rush	4-6		
	<i>Pseudoraphis spinescens</i>	Spiny mudgrass	8-10		
	<i>Sporobolus virginicus</i>		turf		
	<i>Typha orientalis</i>		3-5	0.1 to 0.6	B
	<i>Typha domingensis</i>		3-5		
	<i>Phragmites australis</i>		3-5		
	<i>Baumea spp.</i>		6-8		
	<i>Lepironia spp.</i>		6-8		
	<i>Bolboschoenus spp.</i>		4-6		
	<i>Cyperus spp.</i>	N/A – several sedge species	6-8		
	<i>Eleocharis spp.</i>		4-6		
	<i>Juncus spp.</i> Including <i>Juncus polyanthemus</i> and <i>J. usitatus</i>	N/A – several rush species	6-8		
	<i>Philydrum lanuginosum</i>		6-8		
	<i>Isolepis mucronate</i>		6-8		
	<i>Sacciolepis indica</i>		10-12		
	<i>Ludwigia octovalvis</i>		2-4		
	<i>Triglochin procerum</i>		4-6		
	<i>Persicaria decipiens</i>		4-6		
	<i>Ceratopteris thalictroides</i>		2-4		
	<i>Nymphaea violacea</i>		2-3	0.1 to 4	C
	<i>Nymphoides crenata</i>		2-3		
	<i>Nymphoides indica</i>		2-3		
	<i>Ottelia alismoides</i>		2-3		
	<i>Ottelia ovalifolia</i>		2-3		
	<i>Potamogeton spp.</i>		1		
	<i>Marsilea mutica</i>		4-6		
	<i>Monochoria cyanea</i>		2-3		
	<i>Ceratophyllum demersum</i>		6-8		
	<i>Myriophyllum spp.</i>		6-8	0.5 to 2	D
	<i>Hydrilla spp.</i>		6-8		
	<i>Najas tenuifolia</i>		6-8		

The location of the zones in the freshwater wetland (lacustrine) is shown diagrammatically in Figure 7.18.

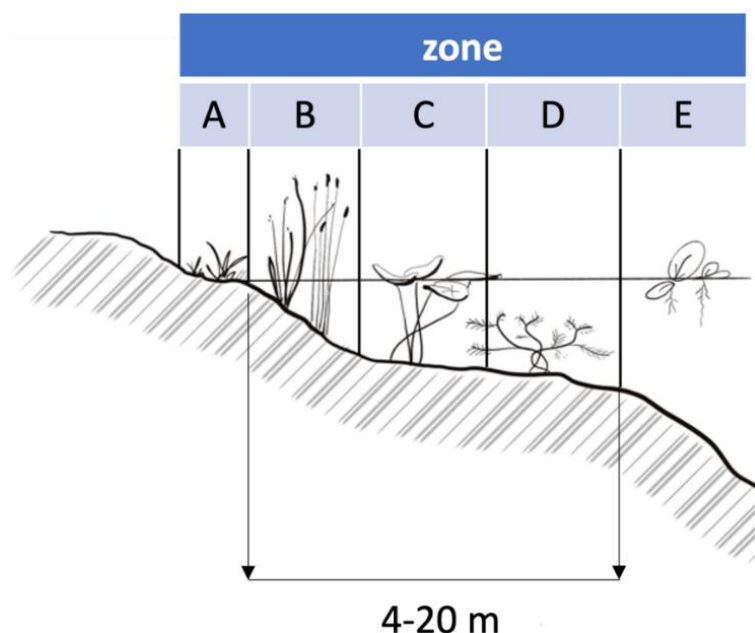


Figure 7.18 Conceptual diagram showing relationship of aquatic habitat zones around the final void lacustrine wetlands (RA12)

While subject to further detailed design, the fringing palustrine wetlands around the perimeter of the final void are expected to be shallow (< 5 m), ephemeral, with gentle slopes and fed mainly by overland flow from rainfall within their catchment. Deep water habitats will not be present within the fringing palustrine wetlands, so rehabilitation will be confined to the establishment and maintenance of Zones A to C with an expected maximum total width of approximately 10 m (Figure 7.19).

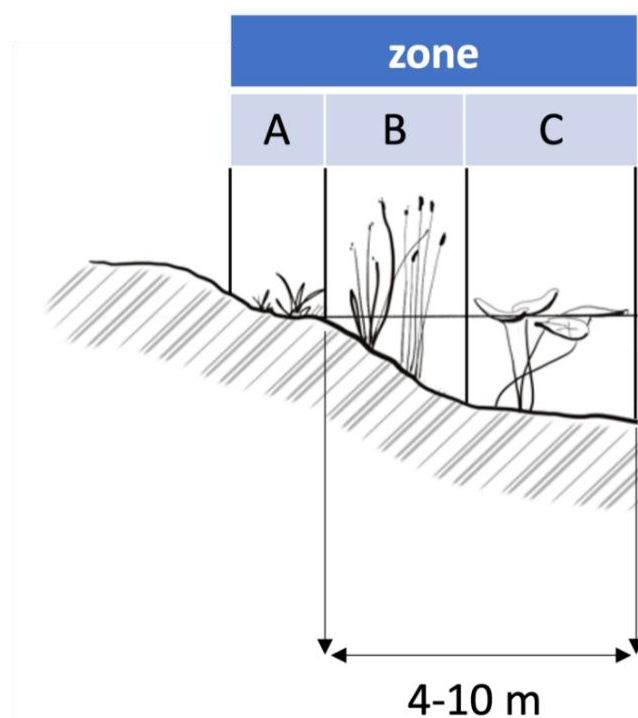


Figure 7.19 Conceptual diagram showing relationship of aquatic habitat zones around the fringing palustrine wetlands

Where only a genus is noted, care will be taken to use only species that are found in central Queensland. An ecologist will be consulted on the final planting list, recognising the period of several decades prior the commencement of rehabilitation. Aquatic plant will be collected only once the Final Void has filled with freshwater and has reached its equilibrium water level (18 to 19 years after mining ceases based on average annual rainfall).

Planting rates

The planting rates for aquatic species will seek to establish a dense cover in Zones A and B (Figure 7.18 and Figure 7.19). Planting densities will seek to establish a similar density to that found in existing aquatic wetland areas in the vicinity of Project (Section 9.1.2).

A survey of these analogue wetlands will be completed prior to the end of mine life (e.g. Year 19 to 20, 2059 to 2060) to establish an appropriate density.

Planting stock procurement

Aquatic plants will be collected from aquatic wetland areas in the vicinity of Project. While minor extraction will occur during the R&D period, these aquatic wetland areas will be identified closer to recommencement at full production in 2043 (e.g. in 2042).

Aquatic plants will be collected only once the final void has filled with freshwater and has reached its equilibrium water level. Completing planting prior to this may cause death of some of the plants, particularly those found in Zones A to D (Figure 7.18 and Figure 7.19).

Plants will be directly translocated from the adjacent aquatic wetland areas to the final void, minimising the need for propagation and temporary storage of these plants.

7.1.8.4. Establishing and managing revegetation

Establishment methods

Direct seeding will be preferred to achieve an even, continuous cover of vegetation. Seeding may be undertaken using conventional broadacre seeding equipment (e.g. combine seeder, spread with harrows or spinner).

Tube stock (where used) will be planted by hand. Aquatic plants will also be hand-planted, as these plants are likely to be sourced as tube stock rather than seed.

Weed control

Establishment of a self-sustaining ecosystem with comparable management requirements to similarly regional ecosystem will require weed management. As such:

- weed density and diversity will not exceed 110% of baseline survey results
- no declared weeds are to be present in rehabilitation

Weed management operations will typical use controlled and targeted herbicide applications to prevent damaging desirable vegetation. Broadscale herbicide applications will only be used as a last resort to avoid the likelihood of exposing large areas of soil and increasing erosion risks.

Planting success

Monitoring of newly planted tube stock will commence immediately after planting and continue until plants have established. Plant health and mortality will be recorded, and any damaged or distressed plants will be attended to (e.g. watered, fertilised). If the mortality rate exceeds 30% of total plants, supplementary planting will be undertaken.

Fauna control

Over grazing activity from native animals (e.g. kangaroos and wallabies), livestock (e.g. cattle, sheep, etc.), and feral pests (e.g. pigs, goats, and mice) have the potential to impact rehabilitation success.

Grazing activity that impacts rehabilitation will be recorded during annual rehabilitation monitoring assessments. Where damage exceeds acceptable levels, grazing reduction treatments are to be engaged. Feral pest controls (e.g. trapping and shooting) will be instigated if they are found to be damaging revegetated areas. Damage from other animals may need to be managed through the establishment of exclusion areas (e.g. fencing) until rehabilitation has recovered.

7.2. Tailings storage facilities

PRCP Guideline (Section 3.6.2)

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

The design for a TSF must include relevant elements:

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

There will be no tailings storage on the Project site.

7.3. Voids

PRCP Guideline (Section 3.6.3)

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

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

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

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

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

7.3.1. Final void designs

Once the final void is backfilled and reshaped (which could occur within months of completion of mining) and filled with water (with current hydrological predictions indicating equilibrium level will be reached in approximately 18.7 years post closure with a minimum and maximum time of 5 years and 36 years respectively), acid generation is assessed to be highly unlikely and with low to moderate consequences (Terrenus, 2023).

The gradient to which the pit wall will be reshaped is to be no steeper than 16.7°, assuming that the exposed slope length will be no more than 30 m (vertical height of approximately 10 m). This was calculated using the RUSLE using methods described in Landloch (2024b). The average is 11.3° or less for all sides.

The predicted erosion rate for this final void wall configuration is 14 t/ha/y, slightly higher than the higher natural erosion rates present in the vicinity of the Project (i.e. >10 t/ha/y [Landloch, 2024b]). A slightly higher erosion rate was considered acceptable given that the large majority of the generated sediment will be contained within the final void and not report to the surrounding environment.

7.3.2. Geotechnical and geochemical stability

7.3.2.1. Geotechnical stability

At the end of mining a single void will remain at the northern end of the mined area. The walls of the final void will be reshaped soon after completion of mining to ensure geotechnical stability. This is described in Section 7.1.6.2.

7.3.2.2. Geochemical stability

Based on the area of exposure in the final void, the statistical distribution of final void wall and floor materials is shown in Figure 7.20a for four scenarios represented at the final void following the end of mining, these being:

- end of mining: all mined units are exposed in the walls/floor of the void (Figure 7.20a)
- spill level: 10 mAHD. The 'full level' elevation of the final void where water will flow out into the freshwater wetland lagoons (Figure 7.20b). The final void is predicted to spill in approximately 26% of the years over an approximate 300-year modelled period (i.e. about one year in every four on average, noting the void would not spill for the duration of that year)
- average water level: approximately 8.1 mAHD (Figure 7.20c). The long-term average water level of the final void, taking into account wet and dry periods modelled for approximately 300 years. At this level, the final void will be approximately 91% full
- lowest level: approximately 2 mAHD (Figure 7.20d). The long-term lowest water level for the modelled period

The data shows that once the 8.1 mAHD equilibrium level is reached, very little unweathered rock (i.e. CF and KCK) will be exposed. The dominant exposure material is highly to extremely weathered Qa and Tw1 material.

Terrenus (2023) completed a geochemical source hazard assessment for the materials expected to be exposed on the final void walls and floor, with the AMD source hazard results summarised in Section 7.1.3.5.

When combined, and considering the proportion of PAF material of each type relative to the total proportion of all materials in the final void, the AMD hazard score void walls/floor at closure has been determined for two scenarios, these being:

- end of mining assumed worst-case (i.e. dry void)
- post-closure normal water level (i.e. equilibrium level of approximately 8.1 mAHD)

For the end of mining assumed worst-case scenario, prior to any wall/floor rock being covered/capped (which is proposed to occur soon after completion of mining), Terrenus (2023) found that approximately 47% of the final void walls/floor (combined) is estimated to be PAF, which includes material classified as UC(PAF), PAF-LC and NAF-S. AMD generation from the completely exposed walls/floor is **Moderate** and AMD generation from the completely exposed walls/floors is **Likely** until such time that the walls/floor are covered with waste (pre-closure remediation) and/or become submerged by water reporting to the final void (post-closure). During this period, QER will actively manage water quality in the pit in a manner consistent with the approach applied for the existing mine pit.

For the post-closure normal water level scenario, after wall/floor rock has been covered/capped and the final void has filled with water to 'normal' post-closure water level (approximately 8.1 mAHD), approximately 12.5% of the exposed void walls/floor (combined) is estimated to be PAF, which includes material classified as UC(PAF), PAF-LC, and NAF-S. As such, the assessment has found that AMD generation from the partially exposed final void walls/floor (exposed above water level) is **Low to Moderate** and AMD generation from the partially exposed walls/floors is **Highly Unlikely**.

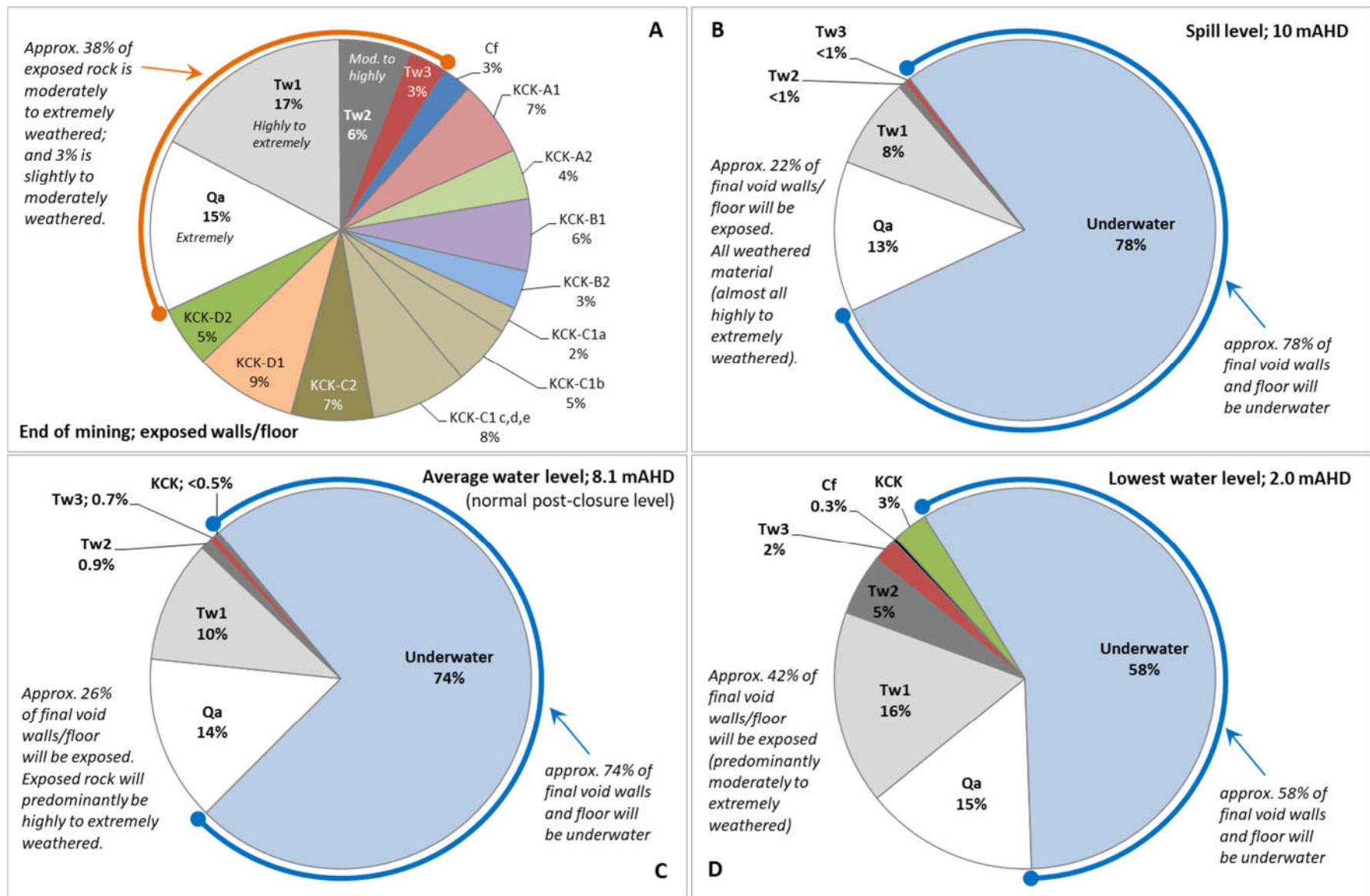
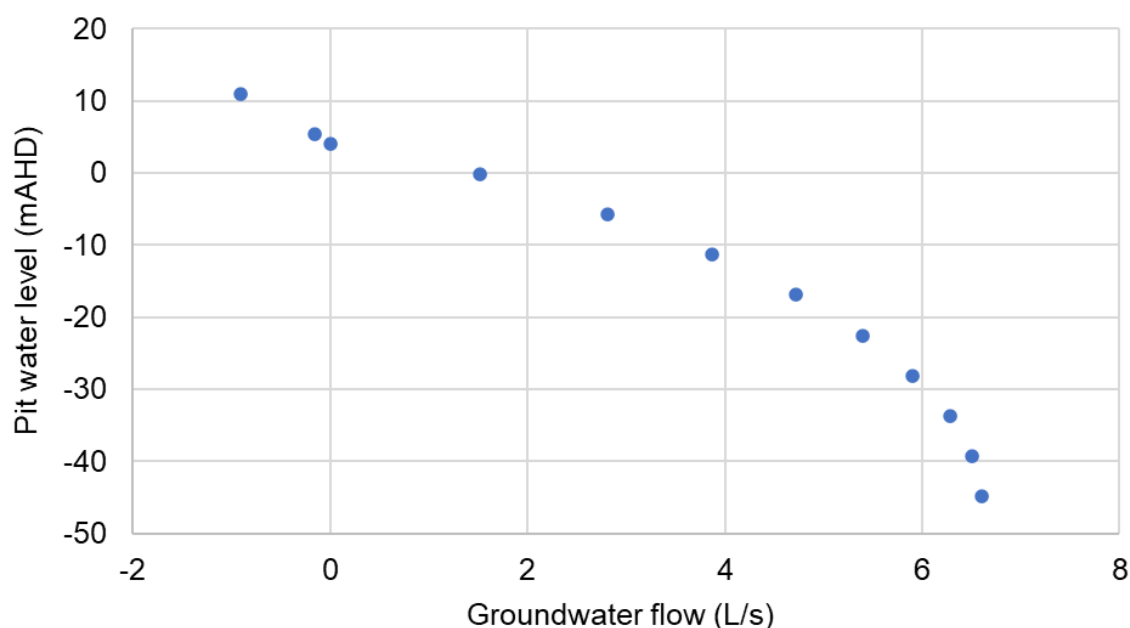


Figure 7.20 Estimated final void wall/floor exposure (surface area exposure) by material type at selected void water level scenarios

7.3.3. Groundwater modelling

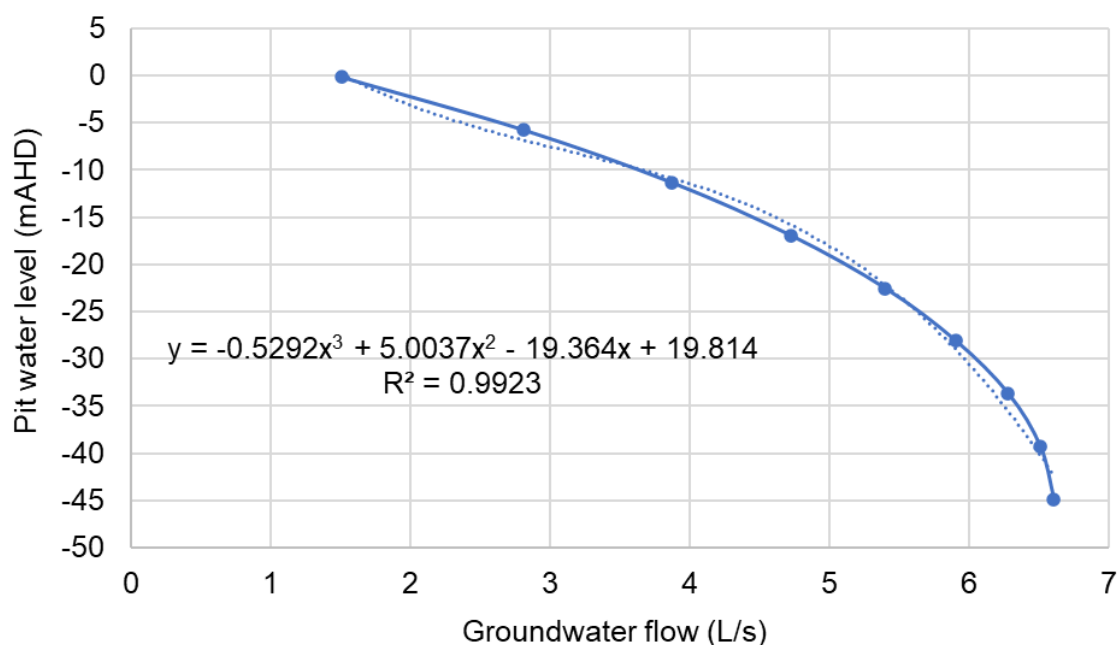
A Hydrogeological Report (AGE, 2024) was prepared for the Project, which incorporated water balance modelling completed in conjunction with Engeny (2024), in order to determine whether the final void would act as a sink or a source to groundwater. A copy of groundwater modelling is provided in Appendix L.

The modelled inflow and outflow as a function of elevation is shown in Figure 7.21 and the derivation of the height dependant inflow and outflow relationships is shown on Figure 7.22 and Figure 7.23, respectively.



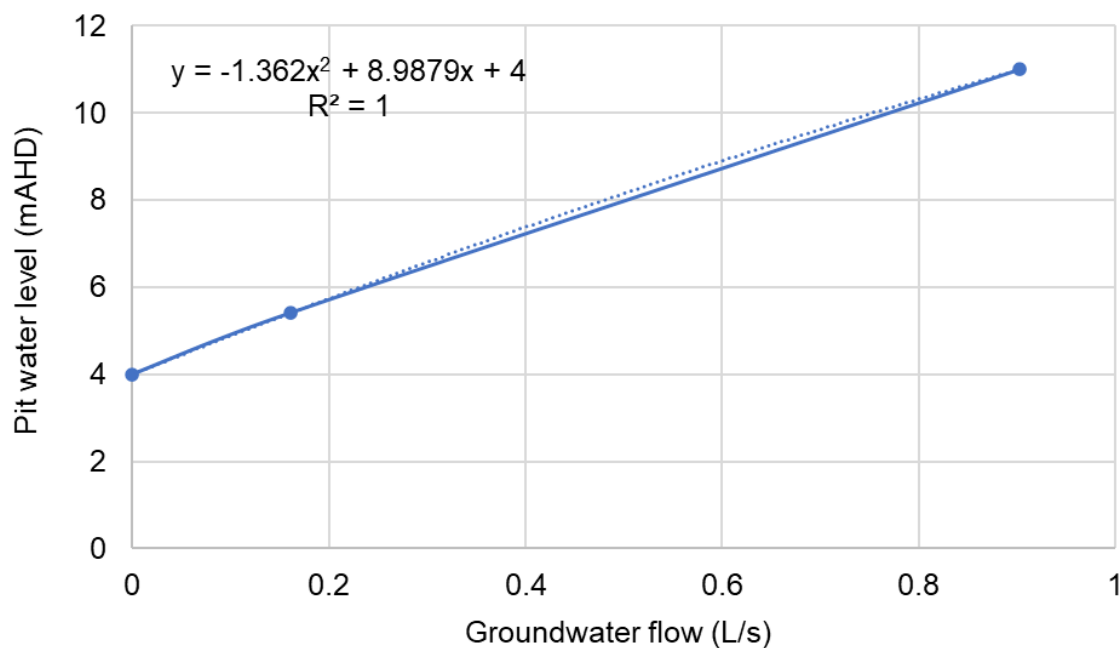
Source: AGE (2024).

Figure 7.21 Groundwater model results



Source: AGE (2024).

Figure 7.22 Groundwater model results and equation for the relationship between inflow and elevation



Source: AGE (2024).

Figure 7.23 Groundwater model results and equation for the relationship between outflow and elevation

The results outlined in Figure 7.21, Figure 7.22 and Figure 7.23 were provided to Engeny and the final void status was determined via a water balance (Engeny, 2024), with the main conclusions being:

- The long-term equilibrium water level of the final void is predicted to be approximately 8.1 mAHD.
- Relative to assumed regional groundwater levels of 4 mAHD, this classifies the predicted final void conditions as a source to groundwater.
- Water levels in the final void are predicted to vary between 2 mAHD and overflow (approximately 10 mAHD);
 - at the lower elevations, the water level in the pit will be below the regional groundwater level; therefore, the pit may temporarily become a sink during drought conditions
 - seasonal overflow is predicted to occur approximately 26% of all years
- The time required to reach equilibrium pit lake levels is predicted to be approximately 18 years, ranging between 5 and 36 years depending on rainfall.
- The estimated EC of the final pit water void ranges between 620 and 1,540 mS/cm (Engeny, 202).

7.3.4. Water balance modelling

A GoldSim water balance model was developed to assess the final void hydrology at the Project, as per the final landform developed by Landloch (2024b). This model was simulated to assess variability in the final void lake level and water quality post closure. The simulation involved running the entire historic climate sequence (133 years) until the final void reached an equilibrium state. Equilibrium conditions and forecast void lake levels are presented in Figure 7.24, while Table 7.16 summarises the final void water balance results.

Table 7.16 Final void lake results summary

Name	Bottom of Pit (mAHD)	Void Spill Elevation (mAHD)	Void Equilibrium Water Level (mAHD)	Void Equilibrium Lake Area (ha)	Equilibrium Volume (GL, % of total volume)	Estimated Spill Frequency (% of years)
Final Void	- 45.0	10.0	8.1	40.6	7.83 (91% full)	26



Source: Engeny (2024).

Figure 7.24 Final void water level time series results

The outcomes of water balance model indicate:

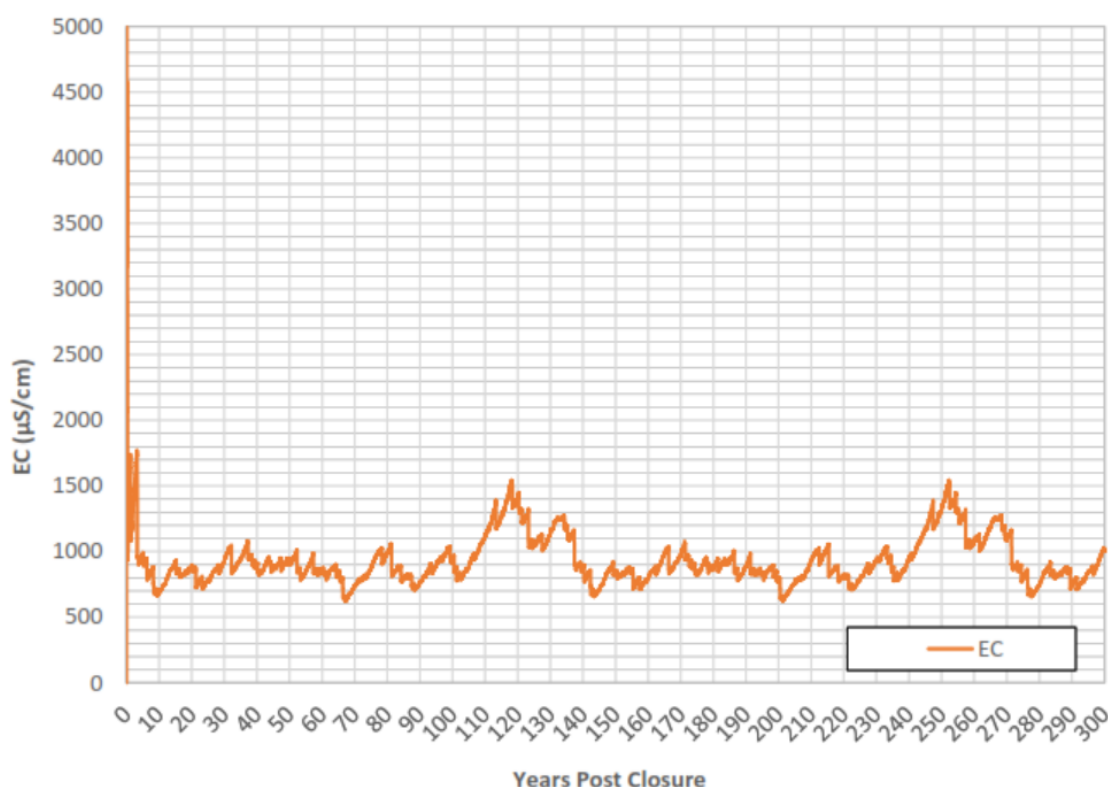
- The pit lake equilibrium level is predicted to be approximately 8.1 mAHD, corresponding to 7.83 GL and will take approximately 18 years to reach equilibrium.
- the pit lake equilibrium level is 1.9 m below the void spill level of 10 mAHD with the pit lake expected to overflow in 26% of years.
- Following the pit lake reaching equilibrium, the lake water level is expected to fluctuate by approximately 8 m (2.1 mAHD up to spill level).
- The pit lake is expected to receive sufficient volumes of clean catchment runoff that will maintain the pit lake water quality and prevent concentration of contaminants from evaporation.
- EC in the final void fluctuates between 620 and 1,540 $\mu\text{S}/\text{cm}$ following the initial filling period, with a mean lake water quality of 900 $\mu\text{S}/\text{cm}$.
- Fluctuations in void water quality are expected to occur during prolonged wet and dry periods however the EC of the pit lake during overflow events is expected to be between 623 and 1,100 $\mu\text{S}/\text{cm}$.
- Although overflow EC from the pit lake is expected to remain below 900 $\mu\text{S}/\text{cm}$ in 85% of overflow occurrences, the maximum modelled overflow EC of 1,100 $\mu\text{S}/\text{cm}$ is lower than water quality of the larger watercourses near the Project.
- No infiltration and seepage intervention and collection controls, surface water diversions or other long-term water management is deemed to be required at time of closure.
- In accordance with monitoring requirements (Section 9), appropriate evaluation of water quality will be undertaken to confirm that ongoing water management is not required.

7.3.5. Predicted water quality

7.3.5.1. Pit lake water quality

Final void EC results are shown in Figure 7.25 and indicate the following:

- During extended dry periods, for example between modelled years 105 and 120 post closure, EC increases in the final void as a result of evapo-concentration.
- EC in the final void fluctuates between 620 and 1540 $\mu\text{S}/\text{cm}$ following the initial filling period, with the EC in the final void remaining relatively stable at approximately 900 $\mu\text{S}/\text{cm}$ when the void lake level is around the equilibrium level (e.g. between 20 and 60 years post closure).
- As the final void is predicted to spill in 26% of years, no longer term evapo-concentration is observed.

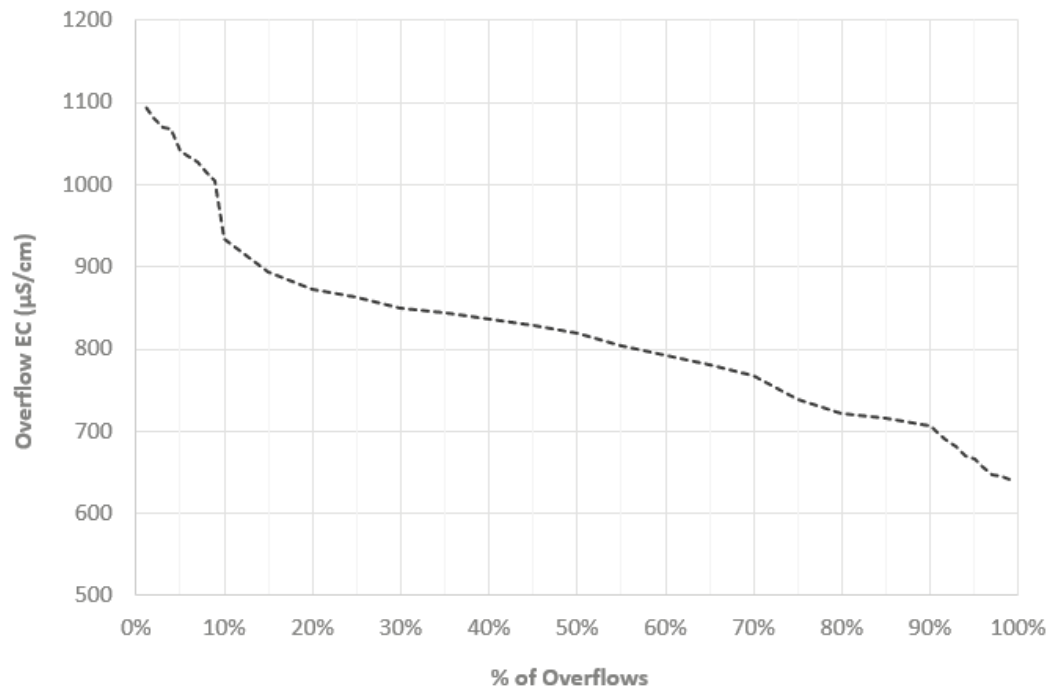


Source: Engeny (2024).

Figure 7.25 Final void EC levels post-closure

7.3.5.2. Pit lake overflow water quality

Fluctuations of void water quality are expected to occur during prolonged wet and dry periods, with the EC of the pit lake during overflow events expected to be between 623 $\mu\text{S}/\text{cm}$ and a maximum of approximately 1,100 $\mu\text{S}/\text{cm}$; however, 80% of overflows are below 720 $\mu\text{S}/\text{cm}$. The maximum level of 1,100 $\mu\text{S}/\text{cm}$ is below values recorded from monitoring in the existing gullies. Water quality monitoring of the existing Gully E show background EC is generally below the modelled ranges in the pit lake; however, Gully E is highly ephemeral and sampled in response to rainfall runoff events with large dilution. The percentage of total overflows plotted against the corresponding overflow EC is shown in Figure 7.26.



Source: Engeny (2024).

Figure 7.26 Percentage of total overflows vs overflows EC

7.3.6. Flood risk

The results of flood modelling completed by Engeny (2024) show:

- The final void is not inundated from flooding in Targinie Creek up to and including the PMF event. Therefore, Targinie Creek is unaffected by the final landform and does not pose a flood risk to the final void pit lake.
- Flooding in Gully B and Gully D around the rehabilitated Out-of-pit MRA do not interact with the landform up to and including the PMF event.
- Peak flood velocity in the natural gullies is generally between 1 m/s and 2 m/s with isolated locations reaching 2.8 m/s in the 1% AEP flood event. The natural drainage paths around the landform are not expected to receive excessive flows resulting in erosion or scour.
- Flooding in the concept layout of the lagoon systems shows the peak flood wave is highly attenuated and does not result in excessive flood velocity. The lagoon system will manage catchment runoff entering the pit lake; however, detailed design and implementation is required during the operational phase of the mine to confirm the arrangement and performance.
- Peak flow out of the final void lake is 18.5 m³/s in the 0.1% AEP while the pre-mining Gully E 0.1% AEP peak flow at the void overflow location is 22.8 m³/s which shows the additional catchment reporting to Gully E via the pit lake overflow location is highly attenuated. Overflows from the pit lake are highly attenuated and are not expected to result in increased flow rates in Gully E causing erosion or downstream flood impacts.
- The final void water balance assessment shows the pit lake is expected to overflow in 26% of years, while Gully E is expected to flow more frequently in response to high rainfall events. Flow in Gully E downstream of the pit lake are expected to be less frequent and of lower magnitude in extreme events, reducing the risk of scour to the natural drainage line. The reduced pit lake overflow frequency and peak flow rate during extreme events means peak flood velocities in Gully E will not be increased and not impact the condition of the downstream drainage line (Gully E).

7.3.7. Stratification

Stratification of a waterbody is separation of the vertical water profile based on water density, which occurs due to variations in salinity and temperature in the water column. Water density increases with salinity and reducing temperature, and a stratified waterbody typically has higher salinity in the deeper stratified layers and lower salinity in the surface layers. The deeper stratified layers can become deoxygenated if the waterbody remains stratified for extended periods of time.

The final void pit lake is likely to become stratified due to the depth and geometry of the void, as well as the contributing saline groundwater inflows at the bottom of the pit lake and fresh rainfall runoff inflows at the pit lake surface. The stratified profile of the pit lake is likely to resemble the groundwater quality profile for the deeper layers and have lower salinity at the lake surface.

As salinity modelling of the pit lake assumes a fully mixed waterbody, the pit lake salinity results presented in Section 7.3.5 are considered conservative, due to a stratified lake likely having lower salinity at the surface compared to being fully mixed. Under stratified conditions the pit lake is likely to have:

- lower salinity at the lake surface compared to the predicted salinity Section 7.3.5.1
- higher salinity at the base of the lake compared to the predicted salinity in Section 7.3.5.1, and is expected resemble the surrounding groundwater quality.
- lower overflow salinity compared to the predicted results in Section 7.3.5.2.

7.3.7.1. Disassembly risk

Disassembly results in mixing and overturning of the stratified layers (all or part), which can result in a fully mixed waterbody or the lower stratified layers rising to the lake surface. Disassembly of the stratified layers can occur during the winter months if the surface layer cools faster than the lower layers, and overcomes the chemical or temperature density stratification. The presence of vertical stratification can be influenced by factors such as water depth, the degree of water column mixing from wind and waves, salinity, and climatic factors including temperature.

However, disassembly is temporary, with the waterbody typically returning to a stratified state once conditions stabilise (i.e. based on water quality and climatic conditions).

The fully mixed conditions adopted for the salinity modelling resembles a disassembled stratified pit lake which fully mixes as part of the disassembly process. However, stratification disassembly that results in a rapid overturn of the stratified layers may result in poorer surface water quality due to poor mixing during disassembly.

Disassembly of the pit lake, that would result in poor water quality at the lake surface, is considered unlikely to occur due to several physical features of the pit lake that would reduce the likelihood or frequency of disassembly events. These include:

- The subtropical climate of the Gladstone region, which has low seasonal variation in temperature and reduces the likelihood of the surface layer cooling faster than the lower layers and overcoming the chemical density stratification.
- Groundwater inflows at the bottom of the pit having a much higher salinity than the surface inflows, which will maintain chemical stratification.
- Diffuse inflows of fresh water from catchment runoff being directed to the surface layer of the pit lake, which will maintain salinity-related stratification.
- The void geometry having a small surface area relative to the lake depth.

7.3.7.2. Potential impact on RA12 (Final void and wetlands)

Final void (pit lake)

The influence of deoxygenated water from a disassembly event can be expected to be short-term, as oxygenation of surface water layers would occur rapidly, due to photosynthesis from macrophytes and wind-based mixing of the pit lake surface. However, a disassembly event may negatively affect biota, such as stocked native fish, due to low dissolved oxygen concentrations. Monitoring of fish during such an event will be important to understand the extent of water quality changes and the tolerance of relevant species (Section 9).

While macroinvertebrates are also likely to be affected by low dissolved oxygen concentrations, they can be expected to rapidly recolonise the affected wetlands through natural recruitment processes once water quality in the pit lake has stabilised.

Fringing palustrine wetland

Several small fringing palustrine wetland will be established on the margins of the final void. These shallow wetlands (<5 m in depth) will generally be disconnected from the final void wetland from a hydrological perspective, due to their elevation above the level of the final void by a height of approximately 1-5 m.

Due to their shallow depth and disconnection from the pit lake by elevation above the final void, fringing palustrine wetland on the periphery of the pit lake are unlikely to be affected by stratification.

Generally, during heavy rainfall, the network of fringing palustrine wetland will overflow into the final void, which overflows to Port Curtis via a surface drainage gully to the east of the final void wetland. Therefore, fringing palustrine wetland are likely to be a refuge for aquatic fauna to recolonise any sections of the pit lake significantly impaired by poor water quality caused by a disassembly event. However, during heavy rainfall events resulting in final void spilling, there may be temporary hydrological connection between some areas of the fringing palustrine wetland to the north-east of the final void.

Furthermore, in the event disassembly occurs during a large rainfall event, spilled surface water from the pit lake can be expected to become oxygenated by mixing with air during overland flow through the surface drainage system, prior to reaching Port Curtis.

7.4. Underground mining

PRCP Guideline (Section 3.6.4)

For underground mining operations, the rehabilitation planning part must include:

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

No underground mining occurs at the Project site.

7.5. Built infrastructure

PRCP Guideline (Section 3.6.5)

The administering authority's expectation of rehabilitation relating to built infrastructure is that it will be decommissioned, demolished,

salvaged and/or disposed of unless it is being formally retained by the landholder to achieve an appropriate PMLU.

The rehabilitation planning part must include:

- *identification of infrastructure that will be decommissioned and the methods for decommissioning;*
- *a description of infrastructure that will remain post rehabilitation and the identification of ongoing maintenance requirements; and*
- *evidence of agreement for any infrastructure that will have ownership transferred.*

In accordance with Condition E16 of the EA, at the end of Project life, PMLUs that have RAs with infrastructure to be retained post-mining include:

- The estimated EC of the final pit water void ranges between 620 and 1,540 mS/cm (Engeny, 202).
- Industrial PMLUs:
 - RA04 – CWHPs, sediment dams, and infrastructure to be removed from site will be undertaken prior to surrender of the EA, except where agreed in writing by the post-mining landowner/holder.
 - RA06 – infrastructure, plant site, and haul roads required for operational activities until completion of rehabilitation activities, after which infrastructure will be removed from site, except where retention is agreed in writing by the post-mining landowner/holder.
 - RA09 – exploration pads and tracks, and ore stockpile area (i.e. ROM pad), with infrastructure to be removed from site to be undertaken prior to surrender of the EA, except where agreed in writing by the post-mining landowner/holder.
 - RA10 – sewage disposal area, fuel, and storage areas, with some built infrastructure required for operational activities until completion of rehabilitation activities, after which infrastructure will be removed from site, except where retention is agreed in writing by the post-mining landowner/holder.
- Permanent infrastructure: RA07 – Realignment of Forest Road, which will be under the control of Gladstone Regional Council.
- Water storage (stock use) PMLU: RA05 – detention ponds, required to meet the conditions of the signed agreement with the landowner/s, as applicable.
- Water storage areas (industrial use) PMLU: RA03, including MWSP, CWHPs and sediment dams, which are required to meet the conditions of the signed agreement with the landowner/s, as applicable.

Infrastructure decommissioning and removal has been nominated as a rehabilitation milestone and will be completed for each RA (as relevant) in accordance with the PRCP schedule.

7.6. Summary of key rehabilitation and management practices

7.6.1. Key rehabilitation activities and rehabilitation milestones

Rehabilitation activities drive achievement of the Project RMs and inform the associated PRCP schedule. For each RA at the Project site, Table 7.17 details the:

- key rehabilitation activities to drive achievement of the RMs
- indicative timing of rehabilitation activities, with rehabilitation to occur progressive where practicable (i.e. at the In-pit MRA as mining progresses northward) in accordance with Condition E10 of the EA associated RMs

A summary of the Project RMs, and their associated milestone criteria and reporting requirements is provided in Table 7.18.

Table 7.17 Key rehabilitation activities identified to drive achievement of the Projects RMs, per relevant activity

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
RA01	Out-of-pit MRA	80	Native ecosystem (bushland)	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a Suitably Qualified Person (SQP) confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an appropriately qualified person (AQP). 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a Factor of Safety (FOS) ≥ 1.5. 3.4 Reshaping and reprofiling works completed to achieve: (a) Maximum slope angles of 12 degrees. (b) PAF material does not report to the surface of the landform. (c) The landform is capped with ≥ 2 m of NAF overburden and interburden (waste). (d) design geometries are achieved to ± 0.2 m vertical height measured over a maximum distance of 50 m. (e) no weathered tertiary sediment waste rock less than moderately to highly weathered is present on the final landform surfaces. (f) An AQP confirms the achievement of items (a) to (e) including testing of the top 2m of cover for items (b), (c) and (e). 3.5 Completion of bunding works, including construction of the crest-bunding included in the landform design. 3.6 Maximum 0.3 m of surface cross-slope ripping of batter slopes using a tynd machine with tynes spaced no wider than 0.5 m. 3.7 Completion of a geotechnical assessment to be carried out by an AQP to ensure slopes and void overflow points are stable. RM4: 4.1 Soil health and suitability is assessed and documented by an AQP to confirm growth media is suitable for the PMLU and target vegetation establishment specified in RM5. 4.2 An assessment of the need for soil amelioration undertaken and applied at rates determined by an AQP to achieve the properties outlined in point 4.6 below and suitable for the PMLU. 4.3 Completion of surface ripping to a minimum of 0.3 m. 4.4 Topsoil is applied to a minimum depth of 0.3 m. 4.5 Growth media is scarified to incorporate soil ameliorants but not to a depth that will bring waste material to the surface (i.e. less than 0.3 m, the minimum depth of growth media). 4.6 Soil depth (0 to 0.3m) demonstrates properties to support the PMLU including: (a) cation exchange capacity of $>20\text{cmol}/\text{kg}$. (b) major macronutrient concentrations: i. Nitrogen: Total $>0.2\%$. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K $>200\text{mg K}/\text{kg soil}$. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) ≤ 0.5 dS/m. (e) Exchangeable sodium percentage (ESP)(%) < 6. (f) Emerson aggregate class: >3. 4.7 The surface and groundwater monitoring network is installed and monitoring commenced.	Waste placement within the Out-of-pit MRA will be ongoing during the R&D phase, albeit at a reduced rate in comparison to full extraction between 2043 to 2060. Therefore, interim revegetation will be conducted during the R&D phase in areas not required for emplacement and without existing groundcover. Waste emplacement within the Out-of-Pit MRA will be completed in the early stages of full extraction between Years 3 and 5 (2043 to 2045). Revegetation of the Out-of-Pit MRA can occur at this time.	RM1 RM2 RM3 RM4 RM5 RM8 RM12

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				RM5: 5.1 Seeding (or planting of tubestock) of all topsoiled surfaces completed using a species mix and seeding rate stated in Table 7.13 for RE 12.11.6. 5.2 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 5.3 Tilling on the contour with tyne spacing no greater than 0.5 m. RM8: 8.1 A BioCondition assessment is completed by an AQP using the methodology outlined in the latest version of the Queensland Herbarium's 'BioCondition Assessment Manual'. 8.2 The BioCondition assessment completed under (RM8.1) complies with the >20/60 PRCP Benchmark for the PMLU, as per Table 9.6. 8.3 Where RM8.2 is not achieved, an AQP has confirmed that the ecosystem is on a trajectory to achieving the biocondition benchmarks 10-15 years of Table 9.6. 8.4 Species used in revegetation remain present and showing evidence of natural recruitment. Evidence of flora recruitment from rehabilitation monitoring data. 8.5 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 8.6 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 8.7 Weed presence is a maximum of 10% of total vegetative groundcover. 8.8 AQP confirms through annual monitoring that the ground cover achieves item (RM8.6). 8.9 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 8.10 No evidence of salt accumulation at soil surface, prolonged water ponding, or bare areas greater than 10m². 8.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity of >20cmol+/kg. (b) major macronutrient concentrations: i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) is less than 0.5 dS/m. (e) Exchangeable sodium percentage (ESP) (%) < 6. (f) Fencing has been assembled around RAs, as applicable. (g) Emerson aggregate class: >3. 8.12 Fencing has been assembled around RAs, as applicable. 8.13 Surface water runoff from rehabilitated areas is non-polluting to receiving waters and complies with Table 7.9. RM12: 12.1 Completion of a Hazard and Safety Assessment by an AQP to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 12.2 Water quality results monitored monthly at, but not limited to, downstream locations specified in Table 7.8, must achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. 12.3 Where the surface water quality exceeds criteria (RM12.2), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM12.2. 12.4 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12. 12.5 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results. 12.6 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 12.7 An assessment of BioCondition benchmarks for Native Ecosystem (Bushland) complies with the >40/60 PRCP Benchmark for the PMLU as per Table 9.6.		
RA02 ¹	In-pit MRA	88.5	Native ecosystem (bushland)	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2:	Revegetation activities will occur progressively and follow the advancing open pit. As a result, revegetation of the In-Pit MRA will be completed in a progressive manner over the life of the mine, between Years 3 and 20 (i.e. 2043 to 2060).	RM1 RM2 RM3 RM4 RM5 RM8 RM12

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5. 3.4 Reshaping and reprofiling works completed to achieve: (a) Maximum slope angles of 12 degrees. (b) PAF material does not report to the surface of the landform. (c) The landform is capped with ≥ 2 m of NAF overburden and interburden (waste). (d) design geometries are achieved to ± 0.2 m vertical height measured over a maximum distance of 50 m. (e) no weathered tertiary sediment waste rock less than moderately to highly weathered is present on the final landform surfaces. (f) An AQP confirms the achievement of items (a) to (e) including testing of the top 2m of cover for items (b), (c) and (e). 3.5 Completion of bunding works, including construction of the crest-bunding included in the landform design. 3.6 Maximum 0.3 m of surface cross-slope ripping of batter slopes using a tyned machine with tynes spaced no wider than 0.5 m. 3.7 Completion of a geotechnical assessment to be carried out by an AQP to ensure slopes and void overflow points are stable. RM4: <u>RA02 (excluding northern drainage zone)</u> 4.1 Soil health and suitability is assessed and documented by an AQP to confirm growth media is suitable for the PMLU and target vegetation establishment specified in RM5. 4.2 An assessment of the need for soil amelioration undertaken and applied at rates determined by an AQP to achieve the properties outlined in point 4.6 below and suitable for the PMLU. 4.3 Completion of surface ripping to a minimum of 0.3 m. 4.4 Topsoil is applied to a minimum depth of 0.3 m. 4.5 Growth media is scarified to incorporate soil ameliorants but not to a depth that will bring waste material to the surface (i.e. less than 0.3 m, the minimum depth of growth media). 4.6 Soil depth (0 to 0.3m) demonstrates properties to support the PMLU including: (a) cation exchange capacity of $>20\text{cmol}^+/\text{kg}$. (b) major macronutrient concentrations: i. Nitrogen: Total $>0.2\%$. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K$>200\text{mg K/kg}$ soil. iv. Organic C: at the recommendation of an AQP. (c) pH_w range is between 6.0 to 7.5. (d) salinity (EC1:5) ≤ 0.5 dS/m. (e) Exchangeable sodium percentage (ESP)(%) < 6. (f) Emerson aggregate class: >3. 4.7 The surface and groundwater monitoring network is installed and monitoring commenced. <u>Northern drainage zone (RA02)</u> 4.8 Topsoil is spread to a minimum depth of 0.5 m. 4.9 Placement of rock cover/armour has been completed to achieve 30% rock cover. 4.10 Rock used for rock cover/armour must be NAF and have minimum slake durability of 85% after two cycles and resistant to chemical and mechanical breakdown in-situ) and must not contribute to any increase in salinity or sodicity of the soil. RM5: 5.1 Seeding (or planting of tubestock) of all topsoiled surfaces completed using a species mix and seeding rate stated in Table 7.13 for RE 12.11.6, RE 12.3.3, and RE 12.11.14. 5.2 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 5.3 Tilling on the contour with tyne spacing no greater than 0.5 m. RM8: 8.1 A BioCondition assessment is completed by an AQP using the methodology outlined in the latest version of the Queensland Herbarium's 'BioCondition Assessment Manual'. 8.2 The BioCondition assessment completed under (RM8.1) complies with the $>20/60$ PRCP Benchmark for the PMLU, as per Table 9.6. 8.3 Where RM8.2 is not achieved, an AQP has confirmed that the ecosystem is on a trajectory to achieving the biocondition benchmarks 10-15 years of Table 9.6. 8.4 Species used in revegetation remain present and showing evidence of natural recruitment. Evidence of flora recruitment from rehabilitation monitoring data.		

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				8.5 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 8.6 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 8.7 Weed presence is a maximum of 10% of total vegetative groundcover. 8.8 AQP confirms through annual monitoring that the ground cover achieves item (RM8.6). 8.9 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 8.10 No evidence of salt accumulation at soil surface, prolonged water ponding, or bare areas greater than 10 m². 8.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity of >20cmol+/kg. (b) major macronutrient concentrations: i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) is less than 0.5 dS/m. (e) Exchangeable sodium percentage (ESP) (%) < 6. (f) Fencing has been assembled around RAs, as applicable. (g) Emerson aggregate class: >3. 8.12 Fencing has been assembled around RAs, as applicable. 8.13 Surface water runoff from rehabilitated areas is non-polluting to receiving waters and complies with Table 7.9. RM12: 12.1 Completion of a Hazard and Safety Assessment by an AQP to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 12.2 Water quality results monitored monthly at, but not limited to, downstream locations specified in Table 7.8, must achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. 12.3 Where the surface water quality exceeds criteria (RM12.2), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM12.2. 12.4 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12. 12.5 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results. 12.6 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 12.7 An assessment of BioCondition benchmarks for Native Ecosystem (Bushland) complies with the >40/60 PRCP Benchmark for the PMLU as per Table 9.6.		
RA03	Settling ponds, Sediment dams, and CWHPs	9.3	Water storage (industrial use)	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5. RM4: 4.15 Apply a groundcover over all bare ground through revegetation with grass species listed in Table 7.13 for RE 12.11.14 and/or RE 12.3.3.	Required for water management until end of mining in 2060, after which rehabilitation activities will be completed.	RM1 RM2 RM3 RM11

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				RM11: 11.1 Minimum 70% groundcover is achieved through revegetation with grass species. 11.2 Weed presence is a maximum of 10% of total vegetative groundcover in annual monitoring. 11.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 11.4 A Hazard and Safety Assessment is completed by an AQP that demonstrates: a. Hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. b. All retained water storages (banks and spillways) are safe and stable. 11.5 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 11.6 An AQP certifies that the as constructed landform achieves design criteria and is geotechnically stable. 11.7 An AQP certifies that retained infrastructure is stable and non-polluting. 11.8 All retained water storages to be assessed and approved as safe and stable by an AQP. 11.9 Surface water runoff is non-polluting to receiving waters and complies with the values in Table 7.9. 11.10 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 11.11 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 11.12 If the surface water quality exceeds criteria (RM11.11), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM11.11. 11.13 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, bores specified Alluvium in Table 7.10, identified in Figure 7.15 and Figure 7.16, for all quality characteristics listed in Table 7.11 and Table 7.12. 11.14 Groundwater quality results at Alluvium sites in Figure 7.15 must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.		
RA04	Sediment dams and CWHPs	6.3	Industrial	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS $\geq$ 1.5. RM4: 4.15: Apply a groundcover over all bare ground through revegetation with grass species listed in Table 7.13 for RE 12.11.14 and/or RE 12.3.3. RM11: 11.1 Minimum 70% groundcover is achieved through revegetation with grass species. 11.2 Weed presence is a maximum of 10% of total vegetative groundcover in annual monitoring. 11.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 11.4 A Hazard and Safety Assessment is completed by an AQP that demonstrates: a. Hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. b. All retained water storages (banks and spillways) are safe and stable. 11.5 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 11.6 An AQP certifies that the as constructed landform achieves design criteria and is geotechnically stable. 11.7 An AQP certifies that retained infrastructure is stable and non-polluting. 11.8 All retained water storages to be assessed and approved as safe and stable by an AQP. 11.9 Surface water runoff is non-polluting to receiving waters and complies with the values in Table 7.9.	Required for water management until end of mining in 2060, after which rehabilitation activities will be completed.	RM1 RM2 RM3 RM4 RM11

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				11.10 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 11.11 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 11.12 If the surface water quality exceeds criteria (RM11.11), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM11.11. 11.13 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, bores specified Alluvium in Table 7.10, identified in Figure 7.15 and Figure 7.16, for all quality characteristics listed in Table 7.11 and Table 7.12. 11.14 Groundwater quality results at Alluvium sites in Figure 7.15 must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.		
RA05	Detention ponds	3.3	Water storage (stock use)	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS $\geq$ 1.5. RM4 4.15 Apply a groundcover over all bare ground through revegetation with grass species listed in Table 7.13 for RE 12.11.14 and/or RE 12.3.3. RM6 6.1 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 6.2 Tilling on the contour with tyne spacing no greater than 0.5 m. 6.3 Seeding of all topsoiled surfaces completed using the seed mix and seeding rate stated in Table 7.13 for RE 12.11.6. 6.4 Aquatic plant species tube stock have been planted, in the relevant zones, as detailed in Table 7.15. RM10: 10.1 All retained water storages assessed and confirmed as safe for humans, wildlife and stock and stable by an AQP. 10.2 Dams are safe for stock access and have vegetated banks. 10.3 Surface water quality results monitored quarterly must not exceed the values in Table 7.9. RM14: 14.1 Hazard and Safety Assessment completed by an AQP demonstrates: (a) hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. (b) retained water storages (banks and spillways) are safe and stable. 14.2 Dams are safe for stock access and have vegetated banks. 14.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 14.4 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 14.5 Surface water runoff is non-polluting to receiving waters and complies with Table 7.9. 14.6 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 14.7 If the surface water quality exceeds criteria (RM14.6), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM14.6. 14.8 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, alluvium bores specified in Table 7.10 and Figure 7.15, for all quality characteristics listed in Table 7.11 and Table 7.12. 14.9 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.	Required for water management until end of mining in 2060, after which rehabilitation activities will be completed.	RM1 RM2 RM3 RM10 RM14

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
RA06	Plant site, haul road, and infrastructure	39.5	Industrial	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5. RM4 4.15 Apply a groundcover over all bare ground through revegetation with grass species listed in Table 7.13 for RE 12.11.14 and/or RE 12.3.3. RM11: 11.1 Minimum 70% groundcover is achieved through revegetation with grass species. 11.2 Weed presence is a maximum of 10% of total vegetative groundcover in annual monitoring. 11.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 11.4 A Hazard and Safety Assessment is completed by an AQP that demonstrates: a. Hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. b. All retained water storages (banks and spillways) are safe and stable. 11.5 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 11.6 An AQP certifies that the as constructed landform achieves design criteria and is geotechnically stable. 11.7 An AQP certifies that retained infrastructure is stable and non-polluting. 11.8 All retained water storages to be assessed and approved as safe and stable by an AQP. 11.9 Surface water runoff is non-polluting to receiving waters and complies with the values in Table 7.9. 11.10 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 11.11 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 11.12 If the surface water quality exceeds criteria (RM11.11), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM11.11. 11.13 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, bores specified Alluvium in Table 7.10, identified in Figure 7.15 and Figure 7.16, for all quality characteristics listed in Table 7.11 and Table 7.12. 11.14 Groundwater quality results at Alluvium sites in Figure 7.15 must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.	Required for access and operational activities until end of mining (i.e. in 2060) and until completion of rehabilitation activities.	RM1 RM2 RM3 RM4 RM11
RA07	Forest Road realignment	11	Road reserve	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site.	Realignment of Forest Road will be undertaken between Year 8 to 13 of the mine plan (i.e. between 2048 to 2053).	RM1 RM2 RM3 RM7

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				(j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS $\geq$ 1.5. RM4 4.15 Apply a groundcover over all bare ground through revegetation with grass species listed in Table 7.13 for RE 12.11.14 and/or RE 12.3.3. RM7: 7.1 The realignment of Forest Road is gazetted as a State Road and accepted by the relevant QLD Government Department (i.e. Gladstone Regional Council and/or Department of Transport and Main Roads [TMR]).		
RA08	Infrastructure, and Final void perimeter	6.4	Native ecosystem (bushland)	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS $\geq$ 1.5. RM4 4.1 Soil health and suitability is assessed and documented by an AQP to confirm growth media is suitable for the PMLU and target vegetation establishment specified in RM5. 4.2 An assessment of the need for soil amelioration undertaken and applied at rates determined by an AQP to achieve the properties outlined in point 4.6 below and suitable for the PMLU. 4.3 Completion of surface ripping to a minimum of 0.3 m. 4.4 Topsoil is applied to a minimum depth of 0.3 m. 4.5 Growth media is scarified to incorporate soil ameliorants but not to a depth that will bring waste material to the surface (i.e. less than 0.3 m, the minimum depth of growth media). 4.6 Soil depth (0 to 0.3m) demonstrates properties to support the PMLU including: (a) cation exchange capacity of $>20\text{cmol}^+/\text{kg}$. (b) major macronutrient concentrations: i. Nitrogen: Total $>0.2\%$. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K$>200\text{mg K/kg}$ soil. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) ≤ 0.5 dS/m. (e) Exchangeable sodium percentage (ESP)(%) < 6. (f) Emerson aggregate class: >3. 4.7 The surface and groundwater monitoring network is installed and monitoring commenced. RM5:	Required for operational activities until end of mining (i.e. in 2060) and until completion of rehabilitation activities.	RM1 RM2 RM3 RM4 RM5 RM8 RM12

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				5.1 Seeding (or planting of tubestock) of all topsoiled surfaces completed using a species mix and seeding rate stated in Table 7.13 for 12.11.6, RE 12.11.14, and RE 12.3.3. 5.2 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 5.3 Tilling on the contour with tyne spacing no greater than 0.5 m. RM8: 8.1 A BioCondition assessment is completed by an AQP using the methodology outlined in the latest version of the Queensland Herbarium's 'BioCondition Assessment Manual'. 8.2 The BioCondition assessment completed under (RM8.1) complies with the >20/60 PRCP Benchmark for the PMLU, as per Table 9.6. 8.3 Where RM8.2 is not achieved, an AQP has confirmed that the ecosystem is on a trajectory to achieving the biocondition benchmarks 10-15 years of Table 9.6. 8.4 Species used in revegetation remain present and showing evidence of natural recruitment. Evidence of flora recruitment from rehabilitation monitoring data. 8.5 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 8.6 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 8.7 Weed presence is a maximum of 10% of total vegetative groundcover. 8.8 AQP confirms through annual monitoring that the ground cover achieves item RM8.6. 8.9 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 8.10 No evidence of salt accumulation at soil surface, prolonged water ponding, or bare areas greater than 10m². 8.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity of >20cmol+/kg. (b) major macronutrient concentrations: i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) is less than 0.5 dS/m. (e) Exchangeable sodium percentage (ESP) (%) < 6. (f) Fencing has been assembled around RAs, as applicable. (g) Emerson aggregate class: >3. 8.12 Fencing has been assembled around RAs, as applicable. 8.13 Surface water runoff from rehabilitated areas is non-polluting to receiving waters and complies with Table 7.9. RM12: 12.1 Completion of a Hazard and Safety Assessment by an AQP to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 12.2 Water quality results monitored monthly at, but not limited to, downstream locations specified in Table 7.8, must achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. 12.3 Where the surface water quality exceeds criteria (RM12.2), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM12.2. 12.4 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12. 12.5 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results. 12.6 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 12.7 An assessment of BioCondition benchmarks for Native Ecosystem (Bushland) complies with the >40/60 PRCP Benchmark for the PMLU as per Table 9.6.		
RA09	Exploration tracks and pads, and Ore stockpile area	2.62	Industrial	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan.	Available once all mining activities are complete in 2060, after which rehabilitation activities will be completed. Areas to be rehabilitated after the full extraction mining phase re-commences (i.e. 2043 to 2060) when pad and tracks are no longer required.	RM1 RM2 RM3 RM4 RM11

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS $\geq$ 1.5. RM4: 4.15 Apply a groundcover over all bare ground through revegetation with grass species listed in Table 7.13 for RE 12.11.14 and/or RE 12.3.3. RM11: 11.1 Minimum 70% groundcover is achieved through revegetation with grass species. 11.2 Weed presence is a maximum of 10% of total vegetative groundcover in annual monitoring. 11.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 11.4 A Hazard and Safety Assessment is completed by an AQP that demonstrates: a. Hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. b. All retained water storages (banks and spillways) are safe and stable. 11.5 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 11.6 An AQP certifies that the as constructed landform achieves design criteria and is geotechnically stable. 11.7 An AQP certifies that retained infrastructure is stable and non-polluting. 11.8 All retained water storages to be assessed and approved as safe and stable by an AQP. 11.9 Surface water runoff is non-polluting to receiving waters and complies with the values in Table 7.9. 11.10 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 11.11 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 11.12 If the surface water quality exceeds criteria (RM11.11), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM11.11. 11.13 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, bores specified Alluvium in Table 7.10, identified in Figure 7.15 and Figure 7.16, for all quality characteristics listed in Table 7.11 and Table 7.12. 11.14 Groundwater quality results at Alluvium sites in Figure 7.15 must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.		
RA10	Fuel and storage areas, and Sewage disposal area	6	Industrial	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS $\geq$ 1.5. RM4: 4.15 Apply a groundcover over all bare ground through revegetation with grass species listed in Table 7.13 for RE 12.11.14 and/or RE 12.3.3. RM11: 11.1 Minimum 70% groundcover is achieved through revegetation with grass species. 11.2 Weed presence is a maximum of 10% of total vegetative groundcover in annual monitoring. 11.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2.	Required for operational activities until end of mining (i.e. in 2060) and until completion of rehabilitation activities.	RM1 RM2 RM3 RM4 RM11

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				11.4 A Hazard and Safety Assessment is completed by an AQP that demonstrates: a. Hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. b. All retained water storages (banks and spillways) are safe and stable. 11.5 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 11.6 An AQP certifies that the as constructed landform achieves design criteria and is geotechnically stable. 11.7 An AQP certifies that retained infrastructure is stable and non-polluting. 11.8 All retained water storages to be assessed and approved as safe and stable by an AQP. 11.9 Surface water runoff is non-polluting to receiving waters and complies with the values in Table 7.9. 11.10 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 11.11 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 11.12 If the surface water quality exceeds criteria (RM11.11), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM11.11. 11.13 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, bores specified Alluvium in Table 7.10, identified in Figure 7.15 and Figure 7.16, for all quality characteristics listed in Table 7.11 and Table 7.12. 11.14 Groundwater quality results at Alluvium sites in Figure 7.15 must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.		
RA11	Exploration tracks and pads	0.42	Native ecosystem (bushland)	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS $\geq$ 1.5. RM4: 4.1 Soil health and suitability is assessed and documented by an AQP to confirm growth media is suitable for the PMLU and target vegetation establishment specified in RM5. 4.2 An assessment of the need for soil amelioration undertaken and applied at rates determined by an AQP to achieve the properties outlined in point 4.6 below and suitable for the PMLU. 4.3 Completion of surface ripping to a minimum of 0.3 m. 4.4 Topsoil is applied to a minimum depth of 0.3 m. 4.5 Growth media is scarified to incorporate soil ameliorants but not to a depth that will bring waste material to the surface (i.e. less than 0.3 m, the minimum depth of growth media). 4.6 Soil depth (0 to 0.3m) demonstrates properties to support the PMLU including: (a) cation exchange capacity of $>20\text{cmol}^+/\text{kg}$. (b) major macronutrient concentrations: i. Nitrogen: Total $>0.2\%$. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K$>200\text{mg K/kg}$ soil. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) $\leq 0.5\text{ dS/m}$. (e) Exchangeable sodium percentage (ESP)(%) < 6. (f) Emerson aggregate class: >3. 4.7 The surface and groundwater monitoring network is installed and monitoring commenced.	Exploration tracks and pads not required for ongoing operational activities, available for rehabilitation from 10/12/2026.	RM1 RM2 RM3 RM4 RM5 RM8 RM12

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				RM5: 5.1 Seeding (or planting of tubestock) of all topsoiled surfaces completed using a species mix and seeding rate stated in in Table 7.13 for RE 12.11.16. 5.2 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 5.3 Tilling on the contour with tyne spacing no greater than 0.5 m. RM8: 8.1 A BioCondition assessment is completed by an AQP using the methodology outlined in the latest version of the Queensland Herbarium's 'BioCondition Assessment Manual'. 8.2 The BioCondition assessment completed under (RM8.1) complies with the >20/60 PRCP Benchmark for the PMLU, as per Table 9.6. 8.3 Where RM8.2 is not achieved, an AQP has confirmed that the ecosystem is on a trajectory to achieving the biocondition benchmarks 10-15 years of Table 9.6. 8.4 Species used in revegetation remain present and showing evidence of natural recruitment. Evidence of flora recruitment from rehabilitation monitoring data. 8.5 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 8.6 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 8.7 Weed presence is a maximum of 10% of total vegetative groundcover. 8.8 AQP confirms through annual monitoring that the ground cover achieves item (RM8.6). 8.9 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 8.10 No evidence of salt accumulation at soil surface, prolonged water ponding, or bare areas greater than 10m². 8.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity of >20cmol+/kg. (b) major macronutrient concentrations: i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) is less than 0.5 dS/m. (e) Exchangeable sodium percentage (ESP) (%) < 6. (f) Fencing has been assembled around RAs, as applicable. (g) Emerson aggregate class: >3. 8.12 Fencing has been assembled around RAs, as applicable. 8.13 Surface water runoff from rehabilitated areas is non-polluting to receiving waters and complies with Table 7.9. RM12: 12.1 Completion of a Hazard and Safety Assessment by an AQP to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 12.2 Water quality results monitored monthly at, but not limited to, downstream locations specified in Table 7.8, must achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. 12.3 Where the surface water quality exceeds criteria (RM12.2), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM12.2. 12.4 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12. 12.5 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results. 12.6 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 12.7 An assessment of BioCondition benchmarks for Native Ecosystem (Bushland) complies with the >40/60 PRCP Benchmark for the PMLU as per Table 9.6.		
RA12	Final void	68.6	Freshwater wetland (lacustrine)	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2:	The final void will remain at the completion of mining in 2060, after which rehabilitation activities can commence.	RM1 RM2 RM3 RM4 RM6 RM9 RM13

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5. 3.8 Reshaping and reprofiling works completed to achieve: (a) Maximum slope angles of 16.7 degrees. (b) Average slope of ≤ 11.3 degrees across the void slopes. (c) slope length ≤ 30 m with a vertical height of maximum 10 m. (d) Landform is capped with ≥ 2 m of NAF overburden and interburden. (e) Tw3 waste and PAF material is not present at the final landform surfaces. (f) Littoral zone/s established as per Figure 7.18 for all void slopes reporting to the final void wetland. 3.9 Completion of a geotechnical assessment to be carried out by a suitably qualified person to ensure slopes and overflow points are stable. 3.10 Surface water runoff to the mining void do not exceed the parameters of Table 7.9. 3.11 To minimise the potential for algae blooms and aquatic weeds development in the void, structures have been established in the landform to manage surface water runoff from disturbed land e.g. the establishment of interception or drainage structures to meet the objectives of 'Treatment wetlands' of administering agency's Wetland Info Treatment wetlands — Planning and design (Department of the Environment, Tourism, Science and Innovation). RM4: 4.11 The pit has filled with water to an equilibrium level of 8.1 mAHD (expected to take approximately 18 years post closure). 4.12 Results of an external groundwater review completed at closure (2060) confirming the relevant compliance bores, water quality criteria, and monitoring schedule. RM6: 6.1 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 6.2 Tilling on the contour with tyne spacing no greater than 0.5 m. 6.5 Seeding of all topsoiled surfaces completed using the seed mix and seeding rate stated Table 7.13 for RE 12.11.6. 6.6 Aquatic plant species tube stock, in the relevant zones, as detailed in Table 7.15. 6.7 Native fish and macro-crustacean species introduced (once food webs develop), as detailed in Table 7.14. RM9: 9.1 Absence of blooms of algae or macrophytes which are sufficiently large, or prolonged in duration, to compromise the ecological functioning of the wetland. 9.2 AQP confirms that any algal or macrophyte blooms present is not of an extent that would compromise the ecological function of the wetland. 9.3 Macroinvertebrate diversity indices are similar to those of analogue sites (Figure 9.2) and have reached a stable trajectory. 9.4 Freshwater native fish have formed self-sustaining populations and do not require supplementary stocking. Species diversity comparable to analogue sites, taking into consideration differences in habitat. 9.5 AQP confirms the species presence and colonisation of Macroinvertebrates and species required to support the trajectory for the wetlands to be self-sustaining. 9.6 Native fauna species identified are comparable to those at analogue sites and of a presence that supports the wetlands to be self-sustaining i.e. frogs and fish at various lifecycles and insignificant to no populations of cane toads. 9.7 Aquatic plant species from Table 7.15 have established a continuous fringe of dense aquatic vegetation along the littoral zone depicted in Figure 7.18. 9.8 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 9.9 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 9.10 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 9.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity and major macronutrient (N, P, K, and organic C) concentrations: i. Nitrogen: Total $>0.2\%$. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K $>200\text{mg K/kg soil}$. iv. Organic C: at the recommendation of an AQP. b. pHw range is between 6.0 to 7.5. c. primary growth media salinity (EC1:5) is less than 0.5 dS/m. d. Exchangeable sodium percentage (ESP) (%) < 6. e. Fencing has been assembled around RAs. 9.12 Water quality results at representative locations of the wetlands and locations identified in Table 7.8 monitored monthly are compliant with the values of Table 7.9 for a minimum period of 5 consecutive years. 9.13 If the surface water quality exceeds criteria (RM9.12), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site, then the water quality is deemed compliant with RM9.12.		

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				9.14 For a minimum of five consecutive years groundwater quality must be monitored quarterly at compliance bores specified as Alluvium in Table 7.10. Groundwater quality results must not exceed any value for 3 consecutive results. RM13: 13.1 For the final void: (a) highwalls and low walls are internally draining. (b) void banks, spillway, and upstream water management drainage systems to manage catchment inflows to the void are assessed as safe and stable. (c) stratification modelling conducted with analysis confirming that the effects of disassembly does not impact on the achievement of the achievement and maintenance of the freshwater (lacustrine) wetland and survivability of fauna. (d) Assessment using Queensland Government's Wetland Condition Assessment Tool confirms that the lacustrine wetland is comparable to the analogue sites (Northern embayment of Lake Awoonga). (e) AQP confirms that disassembly events do not impact on the achievement of the freshwater (lacustrine) wetland. (f) is protected from flood water ingress. (g) will not cause environmental harm outside of the relevant tenure boundary. (h) is safe to humans, wildlife and livestock. (i) certification of the final void by an AQP will be undertaken to verify criteria (a) to (h) above. 13.2 Hazard and Safety Assessment completed by a appropriately qualified person demonstrates: (a) hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. (b) retained water storages (banks and spillways) are safe and stable.		
RA13	Farm detention dam (Gully B)	4.5	Native ecosystem (bushland)	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5. RM9: 9.1 Absence of blooms of algae or macrophytes which are sufficiently large, or prolonged in duration, to compromise the ecological functioning of the wetland. 9.2 AQP confirms that any algal or macrophyte blooms present is not of an extent that would compromise the ecological function of the wetland. 9.3 Macroinvertebrate diversity indices are similar to those of analogue sites (Figure 9.2) and have reached a stable trajectory. 9.4 Freshwater native fish have formed self-sustaining populations and do not require supplementary stocking. Species diversity comparable to analogue sites, taking into consideration differences in habitat. 9.5 AQP confirms the species presence and colonisation of Macroinvertebrates and species required to support the trajectory for the wetlands to be self-sustaining. 9.6 Native fauna species identified are comparable to those at analogue sites and of a presence that supports the wetlands to be self-sustaining i.e. frogs and fish at various lifecycles and insignificant to no populations of cane toads. 9.7 Aquatic plant species from Table 7.15 have established a continuous fringe of dense aquatic vegetation along the littoral zone depicted in Figure 7.18. 9.8 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 9.9 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 9.10 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 9.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity and major macronutrient (N, P, K, and organic C) concentrations i. Nitrogen: Total $>0.2\%$.	This area has been subject to revegetation and is not required for further use. Therefore, ongoing rehabilitation activities will be conducted during the R&D phase.	RM1 RM2 RM3 RM9 RM12

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. b. pHw range is between 6.0 to 7.5. c. primary growth media salinity (EC1:5) is less than 0.5 dS/m. d. Exchangeable sodium percentage (ESP) (%) < 6. e. Fencing has been assembled around RAs. 9.12 Water quality results at representative locations of the wetlands and locations identified in Table 7.8 monitored monthly are compliant with Table 7.9 values for a minimum period of 5 consecutive years. 9.13 If the surface water quality exceeds criteria (RM9.12), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site, then the water quality is deemed compliant with RM9.12. 9.14 For a minimum of five consecutive years groundwater quality must be monitored quarterly at compliance bores specified as Alluvium in Table 7.10. Groundwater quality results must not exceed any value for 3 consecutive results. RM12: 12.1 Completion of a Hazard and Safety Assessment by an AQP to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 12.2 Water quality results monitored monthly at, but not limited to, downstream locations specified in Table 7.8, must achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. 12.3 Where the surface water quality exceeds criteria (RM12.2), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM12.2. 12.4 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, <i>but not limited to</i>, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12. 12.5 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results. 12.6 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 12.7 An assessment of BioCondition benchmarks for Native Ecosystem (Bushland) complies with the >40/60 PRCP Benchmark for the PMLU as per Table 9.6.		
RA14	Void perimeter	9.3	Freshwater wetland (palustrine)	RM1: 1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant). RM2: 2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. 2.3 Any residual ore in infrastructure or surface areas has been removed and buried. RM3: 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS $\geq$ 1.5. 3.12 Reshaping and reprofiling works completed to achieve: (a) Depressions and drainage features suitable to fringing palustrine wetlands around the perimeter of the final void that are comparable to analogue sites (Byelllee Wildlife Reserve wetland and Wilmot Lagoon). (b) A gentle slope of $\leq$12 degrees. (c) Reshaping varied around the waterbody to create both wider (shallower angle) and narrower (steeper angle) vegetation zones, increasing habitat variability around the wetland. (d) Littoral zone/s established as per Figure 7.19 along the edges of all wetland ponds. RM4: 4.13 Conducting sampling and testing to confirm Acid Sulphate Soils are not exposed in the wetland, completed by an AQP. 4.14 Fringing wetland fills with water during which time surface water quality monitoring will be undertaken by AQP. RM6:	The freshwater wetland (palustrine) will be constructed at the completion of mining in 2060 to support the freshwater wetland (lacustrine).	RM1 RM2 RM3 RM4 RM6 RM9 RM13

RA ID	Relevant activities	Area (ha)	PMLU	Rehabilitation activities (to drive achievement of RMs)	Rehabilitation timing	RMs
				6.1 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 6.2 Tilling on the contour with tyne spacing no greater than 0.5 m. 6.5 Complete seeding of all topsoil surfaces using a rehabilitation seed mix and seeding rate, comprising the species and application rates in Table 7.13 for RE 12.11.6. 6.6 Aquatic plant species tube stock planted in the relevant zones, as detailed in Table 7.15. 6.7 Native fish and macro-crustacean species introduced (once food webs develop), as detailed in Table 7.14. RM9: 9.1 Absence of blooms of algae or macrophytes which are sufficiently large, or prolonged in duration, to compromise the ecological functioning of the wetland. 9.2 AQP confirms that any algal or macrophyte blooms present is not of an extent that would compromise the ecological function of the wetland. 9.3 Macroinvertebrate diversity indices are similar to those of analogue sites (Figure 9.2) and have reached a stable trajectory. 9.4 Freshwater native fish have formed self-sustaining populations and do not require supplementary stocking. Species diversity comparable to analogue sites, taking into consideration differences in habitat. 9.5 AQP confirms the species presence and colonisation of Macroinvertebrates and species required to support the trajectory for the wetlands to be self-sustaining. 9.6 Native fauna species identified are comparable to those at analogue sites and of a presence that supports the wetlands to be self-sustaining i.e. frogs and fish at various lifecycles and insignificant to no populations of cane toads. 9.7 Aquatic plant species from Table 7.15 have established a continuous fringe of dense aquatic vegetation along the littoral zone depicted in Figure 7.19. 9.8 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 9.9 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 9.10 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 9.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity and major macronutrient (N, P, K, and organic C) concentrations: i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. b. pHw range is between 6.0 to 7.5. c. primary growth media salinity (EC1:5) is less than 0.5 dS/m. d. Exchangeable sodium percentage (ESP) (%) < 6. e. Fencing has been assembled around RAs. 9.12 Water quality results at representative locations of the wetlands and locations identified in Table 7.8 monitored monthly are compliant with Table 7.9 values for a minimum period of 5 consecutive years. 9.13 If the surface water quality exceeds criteria (RM9.12), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site, then the water quality is deemed compliant with RM9.12. 9.14 For a minimum of five consecutive years groundwater quality must be monitored quarterly at compliance bores specified as Alluvium in Table 7.10. Groundwater quality results must not exceed any value for 3 consecutive results. RM13: 13.3 The palustrine wetland: (a) is stable. (b) is protected from marine flood water ingress. (c) will not cause environmental harm outside of the relevant tenure boundary. (d) is safe to humans, wildlife and livestock. (e) Assessment using Queensland Government's Wetland Condition Assessment Tool confirms that the lacustrine wetland is comparable to the analogue sites (Byellee Wildlife Reserve wetland and Wilmot Lagoon). (f) Certification by an AQP to verify criteria (a) to (e) above. 13.4 Hazard and Safety Assessment completed by an AQP demonstrates: (a) hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. (b) retained water storages (banks and spillways) are safe and stable.		

Table 7.18 Rehabilitation milestones with relevant reporting requirements

RM reference	Rehabilitation milestone	Milestone criteria	Reporting requirements
RM1	Infrastructure decommissioning and removal	1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed.	Undertake and document visual inspections. Waste disposal records. Landowner agreement(s).

RM reference	Rehabilitation milestone	Milestone criteria	Reporting requirements
		(e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant).	
RM2	Identification, remediation and removal of contaminated land	2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. Identification, remediation and removal of contaminated land 2.3 Any residual ore in infrastructure or surface areas has been removed and buried.	Contaminated Land Investigation Documents. Site Suitability Statement.
RM3	Landform development, and reshaping/reprofiling	All rehabilitation areas 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5 . Additional for Out-of-pit MRA (RA01) and In-pit MRA (RA02) 3.4 Reshaping and reprofiling works completed to achieve: (a) Maximum slope angles of 12 degrees. (b) PAF material does not report to the surface of the landform. (c) The landform is capped with ≥ 2 m of NAF overburden and interburden (waste). (d) design geometries are achieved to ± 0.2 m vertical height measured over a maximum distance of 50 m. (e) no weathered tertiary sediment waste rock less than moderately to highly weathered is present on the final landform surfaces. (f) An AQP confirms the achievement of items (a) to (e) including testing of the top 2m of cover for items (b), (c) and (e). 3.5 Completion of bunding works, including construction of the crest-bunding included in the landform design. 3.6 maximum 0.3 m of surface cross-slope ripping of batter slopes using a tynd machine with tynes spaced no wider than 0.5 m. 3.7 Completion of a geotechnical assessment to be carried out by an AQP to ensure slopes and void overflow points are stable. Freshwater wetland (lacustrine) (RA12) 3.8 Reshaping and reprofiling works completed to achieve: (a) Maximum slope angles of 16.7 degrees. (b) Average slope of ≤ 11.3 degrees across the void slopes. (c) slope length ≤ 30 m with a vertical height of maximum 10 m. (d) Landform is capped with ≥ 2 m of NAF overburden and interburden. (e) Tw3 waste and PAF material is not present at the final landform surfaces. (f) Littoral zone/s established as per Figure 7.18 for all void slopes reporting to the final void wetland. 3.9 Completion of a geotechnical assessment to be carried out by a suitably qualified person to ensure slopes and overflow points are stable. 3.10 Surface water runoff to the mining void do not exceed the parameters of Table 7.9. 3.11 To minimise the potential for algae blooms and aquatic weeds development in the void, structures have been established in the landform to manage surface water runoff from disturbed land e.g. the establishment of interception or drainage structures to meet the objectives of 'Treatment wetlands' of administering agency's Wetland Info Treatment wetlands — Planning and design (Department of the Environment, Tourism, Science and Innovation). Fringing wetland (palustrine) (RA14) 3.12 Reshaping and reprofiling works completed to achieve: (a) Depressions and drainage features suitable to fringing palustrine wetlands around the perimeter of the final void that are comparable to analogue sites (Byellee Wildlife Reserve wetland and Wilmot Lagoon). (b) A gentle slope of ≤ 12 degrees. (c) Reshaping varied around the waterbody to create both wider (shallower angle) and narrower (steeper angle) vegetation zones, increasing habitat variability around the wetland. (d) Littoral zone/s established as per Figure 7.19 along the edges of all wetland ponds.	Survey/LiDAR of surface and extent after overburden and interburden is emplaced. Data from waste characterisation and associated reports, including sampling and testing results. Analyse final landform against design. Lagoon system detailed design report. Geotechnical assessment and certification for final landform construction quality
RM4	Surface preparation	RA01, RA02 (excluding northern drainage zone), RA08, RA11 4.1 Soil health and suitability is assessed and documented by an AQP to confirm growth media is suitable for the PMLU and target vegetation establishment specified in RM5. 4.2 An assessment of the need for soil amelioration undertaken and applied at rates determined by an AQP to achieve the properties outlined in point 4.6 below and suitable for the PMLU. 4.3 Completion of surface ripping to a minimum of 0.3 m. 4.4 Topsoil is applied to a minimum depth of 0.3 m. 4.5 Growth media is scarified to incorporate soil ameliorants but not to a depth that will bring waste material to the surface (i.e. less than 0.3 m, the minimum depth of growth media). 4.6 Soil depth (0 to 0.3m) demonstrates properties to support the PMLU including: (a) cation exchange capacity of $>20\text{cmol}^+/\text{kg}$. (b) major macronutrient concentrations. i. Nitrogen: Total $>0.2\%$. ii. Phosphorus: at the recommendation of an AQP.	Initial topsoil survey, mapping, and material balancing. Material balance reviews. Topsoil inventory. Document topsoil depth. Document soil sampling and testing results, including Acid Sulphate Soils (as relevant). Document soil ameliorants and physical treatments requirements assessment and application. Northern Drainage Zone construction records.

RM reference	Rehabilitation milestone	Milestone criteria	Reporting requirements
		iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) ≤0.5 dS/m. (e) Exchangeable sodium percentage (ESP)(%) < 6. (f) Emerson aggregate class: >3. 4.7 The surface and groundwater monitoring network is installed and monitoring commenced. Northern drainage zone (RA02) 4.8 Topsoil is spread to a minimum depth of 0.5 m. 4.9 Placement of rock cover/armour has been completed to achieve 30% rock cover. 4.10 Rock used for rock cover/armour must be NAF and have minimum slake durability of 85% after two cycles and resistant to chemical and mechanical breakdown in-situ) and must not contribute to any increase in salinity or sodicity of the soil. Freshwater wetland (lacustrine) (RA12) 4.11 The pit has filled with water to an equilibrium level of 8.1 mAHD (expected to take approximately 18 years post closure). 4.12 Results of an external groundwater review completed at closure (2060) confirming the relevant compliance bores, water quality criteria, and monitoring schedule. Fringing wetlands (palustrine) (RA14) 4.13 Conducting sampling and testing to confirm Acid Sulphate Soils are not exposed in the wetland, completed by an AQP. 4.14 Fringing wetland fills with water during which time surface water quality monitoring will be undertaken by AQP. Industrial PMLU (RA03, RA04, RA05, RA06, RA07, RA09, RA10) 4.15 Apply a groundcover over all bare ground through revegetation with grass species listed in Table 7.13 for RE 12.11.14 and/or RE 12.3.3.	Document seed mix, planting rates and timing, and areas. External groundwater review. Surface and groundwater monitoring network establishment records.
RM5	Revegetation – native ecosystem (bushland) PMLU	RA01, RA08, and RA11 5.1 Seeding (or planting of tubestock) of all topsoiled surfaces completed using a species mix and seeding rate stated in Table 7.13 for RE 12.11.6 (for RA1); RE 12.11.6, RE 12.3.3, and RE 12.11.14 (for RA2); RE 12.11.6, RE 12.11.14, and RE12.3.3 (for RA8); and RE 12.11.16 (for RA11). 5.2 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 5.3 Tilling on the contour with tyne spacing no greater than 0.5 m.	Document seed mix, planting rates and timing, and areas.
RM6	Revegetation – water storage (stock use), freshwater wetland (lacustrine), and freshwater wetland (palustrine) PMLUs	6.1 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 6.2 Tilling on the contour with tyne spacing no greater than 0.5 m. RA5 (water storage [stock use]) 6.3 Seeding of all topsoiled surfaces completed using the seed mix and seeding rate stated in Table 7.13 for RE 12.11.6. 6.4 Aquatic plant species tube stock have been planted, in the relevant zones, as detailed in Table 7.15. RA12 (freshwater wetland [lacustrine]) and RA14 (freshwater wetland [palustrine]) 6.5 Seeding of all topsoiled surfaces completed using the seed mix and seeding rate stated Table 7.13 for RE 12.11.6. 6.6 Aquatic plant species tube stock, in the relevant zones, as detailed in Table 7.15. 6.7 Native fish and macro-crustacean species introduced (once food webs develop), as detailed in Table 7.14.	Document seed mix, planting rates and timing, and areas. Document introduction of native fish and macro-crustacean.
RM7	Achievement of Forest Road Realignment	7.1 The realignment of Forest Road is gazetted as a State Road and accepted by the relevant QLD Government Department (i.e. Gladstone Regional Council and/or Department of Transport and Main Roads [TMR]).	Signed compensation agreement. Notification from Gladstone Regional Council / QLD Government.
RM8	Achievement of surface requirements – native ecosystem (bushland) PMLU	8.1 A BioCondition assessment is completed by an AQP using the methodology outlined in the latest version of the Queensland Herbarium's 'BioCondition Assessment Manual'. 8.2 The BioCondition assessment completed under (RM8.1) complies with the >20/60 PRCP Benchmark for the PMLU as per Table 9.6. 8.3 Where RM8.2 is not achieved, an AQP has confirmed that the ecosystem is on a trajectory to achieving the biocondition benchmarks 10-15 years of Table 9.6. 8.4 Species used in revegetation remain present and showing evidence of natural recruitment. Evidence of flora recruitment from rehabilitation monitoring data. 8.5 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 8.6 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 8.7 Weed presence is a maximum of 10% of total vegetative groundcover. 8.8 AQP confirms through annual monitoring that the ground cover achieves RM 8.6. 8.9 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 8.10 No evidence of salt accumulation at soil surface, prolonged water ponding, or bare areas greater than 10m². 8.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity of >20cmol+/kg. (b) major macronutrient concentrations: i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP.	AQP BioCondition Benchmark assessment. Surface water monitoring results. Groundwater monitoring results. Erosion monitoring results. BioCondition Benchmark monitoring. Aquatic ecosystem monitoring, Seeding and supplemental hand-planting records. Annual soil condition monitoring.

RM reference	Rehabilitation milestone	Milestone criteria	Reporting requirements
		(c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) is less than 0.5 dS/m. (e) Exchangeable sodium percentage (ESP) (%) <6. (f) Fencing has been assembled around RAs, as applicable. (g) Emerson aggregate class: >3. 8.12 Fencing has been assembled around RAs, as applicable. 8.13 Surface water runoff from rehabilitated areas is non-polluting to receiving waters and complies with Table 7.9.	
RM9	Achievement of surface and water quality requirements – freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs	9.1 Absence of blooms of algae or macrophytes which are sufficiently large, or prolonged in duration, to compromise the ecological functioning of the wetland. 9.2 AQP confirms that any algal or macrophyte blooms present is not of an extent that would compromise the ecological function of the wetland. 9.3 Macroinvertebrate diversity indices are similar to those of analogue sites (Figure 9.2) and have reached a stable trajectory. 9.4 Freshwater native fish have formed self-sustaining populations and do not require supplementary stocking. Species diversity comparable to analogue sites, taking into consideration differences in habitat. 9.5 AQP confirms the species presence and colonisation of Macroinvertebrates and species required to support the trajectory for the wetlands to be self-sustaining. 9.6 Native fauna species identified are comparable to those at analogue sites and of a presence that supports the wetlands to be self-sustaining i.e. frogs and fish at various lifecycles and insignificant to no populations of cane toads. 9.7 Aquatic plant species from Table 7.15 have established a continuous fringe of dense aquatic vegetation along the littoral zone depicted in Figure 7.18. 9.8 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 9.9 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 9.10 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 9.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity and major macronutrient (N, P, K, and organic C) concentrations: i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. b. pHw range is between 6.0 to 7.5. c. primary growth media salinity (EC1:5) is less than 0.5 dS/m. d. Exchangeable sodium percentage (ESP) (%) < 6. e. Fencing has been assembled around RAs. 9.12 Water quality results at representative locations of the wetlands and locations identified in Table 7.8 monitored monthly are compliant with Table 7.9 values for a minimum period of 5 consecutive years. 9.13 If the surface water quality exceeds criteria (RM9.12), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site, then the water quality is deemed compliant with RM9.12. 9.14 For a minimum of five consecutive years groundwater quality must be monitored quarterly at compliance bores specified as Alluvium in Table 7.10. Groundwater quality results must not exceed any value for 3 consecutive results.	AQP assessment of aquatic ecosystem functionality. Surface water monitoring results. Groundwater monitoring results. Erosion monitoring results. BioCondition Benchmark monitoring. Aquatic ecosystem monitoring, Seeding and supplemental hand-planting records. Annual soil condition monitoring.
RM10	Achievement of water quality requirements – water storage (stock use) PMLU	10.1 All retained water storages assessed and confirmed as safe for humans, wildlife and stock and stable by an AQP. 10.2 Dams are safe for stock access and have vegetated banks. 10.3 Surface water quality results monitored quarterly must not exceed the values in Table 7.9.	AQP certification report. Surface water monitoring results.
RM11	Achievement of PMLU to stable condition - Industrial PMLU and Permanent Infrastructure PMLU	11.1 Minimum 70% groundcover is achieved through revegetation with grass species. 11.2 Weed presence is a maximum of 10% of total vegetative groundcover in annual monitoring. 11.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 11.4 A Hazard and Safety Assessment is completed by an AQP that demonstrates: a. Hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. b. All retained water storages (banks and spillways) are safe and stable. 11.5 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 11.6 An AQP certifies that the as constructed landform achieves design criteria and is geotechnically stable. 11.7 An AQP certifies that retained infrastructure is stable and non-polluting. 11.8 All retained water storages to be assessed and approved as safe and stable by an AQP. 11.9 Surface water runoff is non-polluting to receiving waters and complies with the values in Table 7.9. 11.10 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 11.11 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 11.12 If the surface water quality exceeds criteria (RM11.11), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM11.11. 11.13 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, bores specified Alluvium in Table 7.10, identified in Figure 7.15 and Figure 7.16, for all quality characteristics listed in Table 7.11 and Table 7.12. 11.14 Groundwater quality results at Alluvium sites in Figure 7.15 must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.	AQP certification report. Hazard and Safety Assessment. Surface water monitoring results. Groundwater monitoring results. Erosion monitoring results. BioCondition Benchmark monitoring.

RM reference	Rehabilitation milestone	Milestone criteria	Reporting requirements
RM12	Achievement of PMLU to stable condition – native ecosystem (bushland) PMLU	12.1 Completion of a Hazard and Safety Assessment by an AQP to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 12.2 Water quality results monitored monthly at, but not limited to, downstream locations specified in Table 7.8, must achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. 12.3 Where the surface water quality exceeds criteria (RM12.2), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM12.2. 12.4 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12. 12.5 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results. 12.6 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 12.7 An assessment of BioCondition benchmarks for Native Ecosystem (Bushland) complies with the >40/60 PRCP Benchmark for the PMLU as per Table 9.6.	Hazard and Safety Assessment. Surface water monitoring results. Groundwater monitoring results. Erosion monitoring results. BioCondition Benchmark Assessment.
RM13	Achievement of PMLU to a stable condition – Freshwater wetland (lacustrine) and freshwater wetland (palustrine)	RA12 (freshwater wetland [lacustrine]) 13.1 For the final void: (a) highwalls and low walls are internally draining. (b) void banks, spillway, and upstream water management drainage systems to manage catchment inflows to the void are assessed as safe and stable. (c) stratification modelling conducted with analysis confirming that the effects of disassembly does not impact on the achievement of the achievement and maintenance of the freshwater (lacustrine) wetland and survivability of fauna. (d) Assessment using Queensland Government's Wetland Condition Assessment Tool confirms that the lacustrine wetland is comparable to the analogue sites (Northern embayment of Lake Awoonga). (e) AQP confirms that disassembly events do not impact on the achievement of the freshwater (lacustrine) wetland. (f) is protected from flood water ingress. (g) will not cause environmental harm outside of the relevant tenure boundary. (h) is safe to humans, wildlife and livestock. (i) certification of the final void by an AQP will be undertaken to verify criteria (a) to (h) above. 13.2 Hazard and Safety Assessment completed by a appropriately qualified person demonstrates: (a) hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. (b) retained water storages (banks and spillways) are safe and stable. RA14 (freshwater wetland [palustrine]) 13.3 The palustrine wetland: (a) is stable. (b) is protected from marine flood water ingress. (c) will not cause environmental harm outside of the relevant tenure boundary. (d) is safe to humans, wildlife and livestock. (e) Assessment using Queensland Government's Wetland Condition Assessment Tool confirms that the lacustrine wetland is comparable to the analogue sites (Byellee Wildlife Reserve wetland and Wilmot Lagoon). (f) Certification by an AQP to verify criteria (a) to (e) above. 13.4 Hazard and Safety Assessment completed by an AQP demonstrates: (a) hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. (b) retained water storages (banks and spillways) are safe and stable.	Hazard and Safety Assessment. Certification of final void. Wetland Condition Assessment.
RM14	Achievement of PMLU to stable condition – water storage (stock use) PMLU	14.1 Hazard and Safety Assessment completed by an AQP demonstrates: (a) hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. (b) retained water storages (banks and spillways) are safe and stable. 14.2 Dams are safe for stock access and have vegetated banks. 14.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 14.4 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 14.5 Surface water runoff is non-polluting to receiving waters and complies with Table 7.9. 14.6 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 14.7 If the surface water quality exceeds criteria (RM14.6), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM14.6. 14.8 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, alluvium bores specified in Table 7.10 and Figure 7.15, for all quality characteristics listed in Table 7.11 and Table 7.12. 14.9 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.	Hazard and Safety Assessment. Surface water monitoring results. Groundwater monitoring results. Erosion monitoring results.

7.6.2. Infrastructure decommissioning and removal (RM1)

With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete:

- all services disconnected, terminated and removed
- all buildings and associated infrastructure dismantled and removed offsite
- all hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed
- all fencing that is not part of PMLU requirements removed
- all pipelines drained and removed
- all waste removed
- all surface water drainage infrastructure removed
- all drillholes, bores, sediment ponds and sumps decommissioned
- all machinery and equipment removed from site
- all water storages dewatered, desilted and liners removed (as relevant)

7.6.3. Contaminated land assessment (RM2)

In accordance with the EA conditions C16, F1, F2, and F3, spillage of any wastes, contaminants, or other materials must be cleaned up as quickly as practicable, stored in accordance with relevant standards and handled in a way that prevents environmental harm. Although contamination at the Project site is unlikely, the following will be completed in RAs (as relevant):

- Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report and, where required, a Validation Report and/or a draft Site Management Plan
- a site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site
- any residual ore in infrastructure or surface areas has been removed and buried

7.6.4. Final landform and cover development (RM3)

For the landform design described in Section 7.1.5 to be stable and sustainable the following aspects will be completed:

- Reshaping works described in Section 7.6.4.1.
- Crest-bunding included in the design and described in Section 7.6.4.2.

7.6.4.1. Reshaping and reprofiling (RM3)

Overview

At all RAs, the following reshaping and reprofiling works will be completed:

- all major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform
- erosion and sediment control systems are installed as per the construction design and verified by an AQP.
- AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5 .

Reshaping works at the Out-of-pit and In-pit MRAs (RA01 and RA02) and the final void (RA12) are described further below. The broad strategies of managing the wastes and processed shales will include reshaping works to ensure:

- Co-mingling of the wastes and processed shales into both the In-pit MRA and Out-of-pit MRA, with co-disposal of any PAF material within a large proportion of NAF material to provide excess neutralising capacity, to ensure PAF material does not report to the surface of the landform.
- Tw3 waste will not be present at the final landform surfaces (≥ 2 m cover), with no weathered tertiary sediment waste rock less than moderately to highly weathered to be present on the final landform surfaces.

Finally, at the end of mining in 2060, the ROM pad (RA10) will require removal of remnant kerogen shale (ore) and disposal within the In-pit MRA. Following this the ROM pad will be reshaped, covered with soil, ripped, and seeded.

Out-of-pit MRA, including road access area

Prior to further placement of overburden or interburden materials, the existing built shape will be reshaped to construct the lower three lifts (including the road access area) that gradually slope from the south to the north. This will enable these sloping sections to be constructed prior to finalisation of the two uppermost lifts.

Once the lower three sloping lifts are reshaped to the final rehabilitation design the remaining waste will be placed into the two uppermost lifts. To avoid construction of an unnecessarily high landform, if mining ceases prior to the entire volume of waste being extracted, reshaping works to the second uppermost lift will be completed before commencement of the uppermost lift.

Following completion of reshaping works, all lifts will have crest-bunding constructed (Section 7.6.4.2), and surface ripping and soil application completed (Section 7.6.5). After this work is completed, revegetation works will commence (Section 7.6.6), with discharge points on the upper two lifts not created until vegetation is sufficiently established (e.g. approximately two to three years).

Road access to the lifts during operation will occur on the northern side of the landform where the lifts heights are lowest. These road access points will be removed once rehabilitation of the uppermost lift has been completed (i.e. no ramps will be left on the final rehabilitation design).

The constructed rehabilitation shape of the Out-of-pit final landform will achieve the design geometries ± 0.2 m vertical height measured over a maximum distance of 50 m, allowing for some greater variation in microrelief caused by the 'blockiness' of the overburdens and interburdens (i.e. some rocks or larger particles may protrude from an otherwise suitably level surface). It is critical that flow concentration on the batter slopes is minimised, concentration of runoff will be prevented by minimising the size of cross-slope rip lines (i.e. upper 0.3 m of surface cross-slope ripped using a tyned machine with tynes spaced no wider than 0.5 m).

An AQP will confirm the achievement of the reshaping and reprofiling works, including testing of the top 2 m of cover for items (2), (3), and (5), have been completed to achieve:

1. maximum slope angles of 12°
2. PAF material does not report to the surface of the landform
3. The landform is capped with ≥ 2 m of NAF overburden and interburden (waste)
4. design geometries are achieved to ± 0.2 m vertical height measured over a maximum distance of 50 m
5. no weathered tertiary sediment waste rock less than moderately to highly weathered is present on the final landform surfaces

In-pit MRA

Following completion of emplacement at the Out-of-pit MRA, waste will be progressively placed into the In-pit MRA as mining continues in a northerly direction. However, waste will preferentially be placed into the pit rather than the Out-of-pit MRA if the volume of wastes is ultimately lower than currently proposed.

The pit will be filled with overburden, interburden and processed shale, with rehabilitation activities to occur in relevant sections (shown in Figure 7.9) once the pit has been completely filled. Once filled, the upper surface and side slopes will be reshaped to the design angles, soil will be applied, and vegetation established.

In addition, modification of the surface material will be required within the northern drainage zone to reduce detachment potential through placement of rock cover/armour in zones of higher erosion risk.

The constructed rehabilitation shape of the In-pit final landform will achieve the design geometries ± 0.2 m vertical height measured over a maximum distance of 50 m, allowing for some greater variation in microrelief caused by the blockiness of the overburdens and interburdens (i.e. some rocks or larger particles may protrude from an otherwise suitably level surface). It is critical that flow concentration on the batter slopes is minimised, concentration of runoff will be prevented by minimising the size of cross-slope rip lines (i.e. upper 0.3 m of surface cross-slope ripped using a tyned machine with tynes spaced no wider than 0.5 m).

An AQP will confirm the achievement of the reshaping and reprofiling works, including testing of the top 2 m of cover for items (2), (3), and (5), have been completed to achieve:

1. maximum slope angles of 12°
2. PAF material does not report to the surface of the landform
3. The landform is capped with ≥ 2 m of NAF overburden and interburden (waste)
4. design geometries are achieved to ± 0.2 m vertical height measured over a maximum distance of 50 m
5. no weathered tertiary sediment waste rock less than moderately to highly weathered is present on the final landform surfaces

Freshwater wetland (lacustrine) (RA12)

To mitigate the potential for acid generation (and to also reduce geotechnical risks of the final void walls), the final void will require reshaping and cover/capping works to the wall and floor to lower the slope angles. This will be undertaken with NAF overburden and interburden so that all PAF materials are covered with NAF waste.

The gradient to which the pit wall exposed above the equilibrium water level will be reshaped is to be no steeper than 16.7° or 30%, with an average slope of $\leq 11.3^\circ$ across the void slopes, and slope lengths ≤ 30 m with a vertical height of maximum 10 m. This will include establishment of littoral zone/s as per Figure 7.18 for all void slopes reporting to the final void wetland.

A geotechnical assessment will be carried out by a SQP to ensure slopes and overflow points are stable.

Following completion of reshaping and cover works, the final void will be allowed to fill with water (predominantly surface water inflow, supplemented by groundwater inflow) to become part of a freshwater wetland (lacustrine) system.

Routine water quality monitoring of surface water runoff to the mining void to ensure it does not exceed the parameters in Table 7.9. In addition, to minimise the potential for algae blooms and aquatic weeds development in the void, structures will be established in the landform to manage surface water runoff from disturbed land e.g. the establishment of interception or drainage structures to meet the objectives of 'Treatment wetlands' of administering agency's Wetland Info Treatment wetlands — Planning and design (Department of the Environment, Tourism, Science and Innovation).

Fringing wetland (palustrine) (RA14)

Reshaping and reprofiling works at the fringing wetland (palustrine (RA14) will be completed to achieve:

- depressions and drainage features suitable to fringing palustrine wetlands around the perimeter of the final void that are comparable to analogue sites (i.e. Byellee Wildlife Reserve wetland and Wilmot Lagoon)
- a gentle slope of ≤ 12 degrees
- reshaping varied around the waterbody to create both wider (shallower angle) and narrower (steeper angle) vegetation zones, increasing habitat variability around the wetland
- littoral zone/s established as per Figure 7.19 along the edges of all wetland ponds

7.6.4.2. Bunding (RM3)

Crest-bunding is included in the final landform design for the Out-of-pit and In-pit MRAs. The crest bunds will be designed to be high enough to contain extreme rainfall events while allowing some freeboard, with a height of 1 m adopted for the purpose of the modelling.

Construction of the crest-bunds will require they:

- are thoroughly compacted and constructed of stable (non-dispersive) material
- have their outer faces continuous with the outer batter profile and have the same surface treatments applied to it (e.g. soils)
- have a width across the top of the bund of at least 2 m
- have their inner face sloping gradually inwards at a gradient of 1V:10H, with a gentle inward gradient ensuring any water that temporarily ponds will do so well away from the outer batter slope, thereby minimising the potential for any sinkhole that may form to reach the outer batter slope and create rills or gullies

7.6.4.3. Relevant reporting and monitoring requirements

Reporting and monitoring requirements relevant to the final landform and cover development include:

- completion of survey/LiDAR of landform
- collection of data from waste characterisation and associated reports, including sampling and testing results
- AQP certifies that as constructed landform achieves design criteria for geotechnical stability, and other specific requirements for the Out-of-pit MRA (RA01) and In-pit MRA (RA02)
- completion of a lagoon system detailed design report
- completion of a geotechnical assessment to be carried out by a SQP to ensure slopes and overflow points are stable at the freshwater wetland (lacustrine) (RA12)
- completion of a geotechnical assessment to be carried out by an AQP to ensure slopes and void overflow points are stable at the Out-of-pit MRA (RA01), In-pit MRA (RA02), and freshwater wetland (lacustrine) (RA12)

7.6.5. Surface preparation (RM4)

7.6.5.1. Overview of the soil profile

The proposed soil profile for surface preparation prior to rehabilitation is as follows:

- Primary growth media: establishment of an at least 0.3 m thick profile over the secondary growth media is recommended in all areas except for the northern drainage zone in the In-pit MRA, where topsoil will be spread to a minimum thickness of 0.5 m. The soil will be fertilised with a slow-release source of nitrogen at the time of seeding to support the rapid establishment and growth of vegetation.
- Secondary growth media: overburden and interburden (other than Tw3 which will be placed at least 2 m below the landform surface) was assessed as being suitable for use as a secondary growth media layer that underlies the primary growth media layer. The underlying overburden and interburden will be required to provide additional water storage and structural support for use by deeper rooted vegetation. Overburden and interburden will not be placed within 0.3 m of the rehabilitated landform surface.
- Processed shale: processed shale will not be placed within 2 m of the rehabilitated landform surface.

7.6.5.2. Topsoil suitability criteria: sampling and testing

In preparation for surface ripping, sampling, and testing will be undertaken for:

- the surface 2 m of waste following reshaping works to confirm the material is overburden and/or interburden and NAF
- topsoil to confirm amelioration requirements, with topsoil properties to support the target PMLU required to have:
 - cation exchange capacity and major macronutrient (N, P, K, and organic C) concentrations in root zone (0 to 0.3 m) at least 80% of those measured at comparable reference sites (which may coincide with vegetation analogue sites) and indicate the soil is capable of sustaining required groundcover levels
 - pH_w range of soil is between 5.0 to 7.0 to at least 0.3 m
 - primary growth media (0 to 0.3 m) salinity (EC_{1:5}) is less than 0.5 dS/m

7.6.5.3. Surface ripping

Out-of-pit and In-pit MRAs

Rip lines will be no deeper than 300 mm from peak to trough of the rip line once settlement has occurred. To achieve this, an unconsolidated rip line approximately 500 mm deep is recommended. Ripping will be desirable to:

- reduce machinery compaction
- remove track marks that are not on contour
- incorporate amelioration to encourage rapid vegetation growth

It is noted that rehabilitation earthworks are significantly different to earthworks typically conducted by mining staff and requires great precision and adherence to the specified designs if successful rehabilitation is to be achieved. Therefore, equipment used for rehabilitation works will have precision guidance systems installed and operators will be suitably skilled and experienced.

Following completion of ripping works, topsoil will be spread to a depth of at least 0.3 m except for the northern drainage zone in the In-pit MRA, where topsoil will be spread to a minimum thickness of 0.5 m.

Final void

Following the filling of the final void to equilibrium levels (i.e. 8.1 mAHD), ripping works to a minimum of 0.3 m will be undertaken above the equilibrium level to reduce compaction and allow adequate water and root penetration. Following this, topsoil will be spread to the surface above the equilibrium water level to a depth of at least 0.3 m.

7.6.5.4. Topsoil application

Topsoil will be replaced as areas become available for rehabilitation to achieve the PMLU of native ecosystem (bushland) and freshwater wetland (lacustrine). All the stockpiled topsoil will be used as part of the rehabilitation activities and spread to a minimum depth of 0.3 m except for the northern drainage zone in the In-pit MRA, where topsoil will be spread to a minimum thickness of 0.5 m.

7.6.5.5. Amelioration

Accurate application rates and amelioration requirements will be determined by a suitably qualified person prior to use in rehabilitation, with fertiliser and mulch/compost (if required) to be applied at seeding. It can be broadcast with a spreader or applied hydraulically or pneumatically. Spreaders are typically suitable for slopes with gradients <35%, and hydraulic or pneumatic applications will be required for 12° slopes.

Scarification of the topsoil to incorporate soil ameliorants will be undertaken in a manner to ensure waste material is not brought to the surface.

7.6.5.6. Northern drainage zone rock cover application

Following application of ameliorants (as relevant), to reduce detachment potential, modification of the surface material within the northern drainage zone will be undertaken through placement of rock cover/ armour to achieve 30% rock cover.

7.6.5.7. Relevant reporting and monitoring requirements

Reporting and monitoring requirements relevant to the final landform and cover development include:

- initial topsoil survey, mapping, and material balancing
- material balance reviews
- topsoil inventory
- survey/LiDAR of surface and extent after
 - overburden and interburden is emplaced
 - topsoil is placed
- document topsoil depth
- document soil sampling and testing results, including Acid Sulphate Soils (as relevant)
- Northern Drainage Zone construction records
- soil ameliorants and physical treatments requirements assessment and application
- document seed mix, planting rates and timing, and areas.
- external groundwater review
- Surface and groundwater monitoring network establishment records
- undertake rehabilitation monitoring as per Sections 9.1 and 9.2

7.6.6. Revegetation (RM5 and RM6)

Revegetation works will be undertaken as detailed in Section 7.1.8, specifically:

- Section 7.1.8.2 for native ecosystems (bushland) PMLUs (i.e. RA01, RA02, RA08, and RA11)
- Section 7.1.8.3 for freshwater wetland PMLUs (i.e. RA12 and RA14)

It is noted establishment of a vegetative cover with the following broad functional properties will be required on the final landform:

- ≥60% surface contact cover (litter and living groundcover)
- ≥25% canopy cover from shrubs and trees (Section 7.1.5.5)
- Reporting and monitoring requirements relevant to the final landform and cover development include:
- survey of analogue wetlands completed prior to the end of mine life (e.g. Year 19 to 20, 2059 to 2060) to establish an appropriate density for the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs
- documenting seed mix, planting rates and timing, and areas, based on the requirements for native ecosystems (bushland), water storage (freshwater lacustrine wetlands), and freshwater wetland (palustrine) PMLUs detailed in Sections 7.1.8.2 and 7.1.8.3 respectively
- documenting introduction of native fish and macro-crustacean, based on the fish species recommended for stocking of water storage (freshwater wetlands) PMLU provided in Table 7.14 of Section 7.1.8.3
- fire management plan (Section 7.6.7.1)
- undertake rehabilitation management activities as per Sections 7.6.7, and 7.6.8.
- assessment of impact of climate change on vegetation growth and erosion potential (Section 7.6.7.1)
- complete comparison of monitoring results to analogue sites as per Section 9.1.2
- undertake rehabilitation monitoring as per Sections 7.6.7, 9.1, and 9.2

7.6.7. Terrestrial and aquatic ecology management (RM8)

7.6.7.1. Management considerations and activities

Management of rehabilitated areas will be tailored to the requirements of the relevant REs being established within the native ecosystem (bushland) PMLUs and within the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs.

Erosion monitoring

Erosion monitoring will be undertaken to ensure no erosion is occurring that compromises vegetation communities (Section 9.1.1). This would include annual visual assessment to verify erosion is acceptable (until relinquishment), with transect monitoring to be completed every five years until Year 20. Thereafter, transects will be undertaken if annual visual assessment indicates accelerated erosion (e.g. gully formation).

The focus of visual assessment and transect erosion monitoring will be to ensure erosion is consistent with, and not exceeding, the erosion predictions in Table 7.5 of Section 7.1.5.4.

Ecological burning

Ecological burning guidelines for each RE are provided in Section 9.2.2.8 and will be followed once vegetation communities have been established. This includes guidance on the timing, intensity, and interval of fires, to best suit the ecological characteristics and requirements of each community.

A fire management plan will be prepared and updated as rehabilitation progresses, to guide the use of fire as a tool to achieve rehabilitation objectives. This will include the requirement for:

- annual assessment of fuel loads and fuel characteristics
- preparation of post-burn monitoring reports

Weeds and pests – the native ecosystem (bushland) PMLUs

Weeds and pests have the potential to impact the success of rehabilitation activities. In early years, weeds and pests may outcompete plantings and delay the successful establishment of vegetation communities. Therefore, a weeds and pest management plan will be developed for the Project, which will include the requirement for:

- annual programs for weed and pest management
- regular monitoring of the distribution and abundance of weeds and pest activity

The rehabilitation contractor will generally be responsible for implementing a planned program of weed and pest management, along with monitoring the distribution and abundance of weeds and pest activity.

Weeds and pests – freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs

A range of pest species are likely to eventually access the wetland, including:

- Cane Toad: occurs throughout the Gladstone region and may colonise the wetland within the first-year. However, the establishment of sedges on the fringe of the wetland is likely to deter the species and reduce the area of favourable breeding habitat.
- The Mosquito Fish: found within local streams and dams, is likely to be introduced to the wetland at some point through natural processes (e.g. by waterbirds or during periods of overflow). Delaying the introduction of mosquito fish to the wetland will assist in facilitating the development of populations of native fish species and increase resilience of the freshwater ecosystem.

In addition, during early stages of establishment, the wetland may experience blooms of algae, phytoplankton or floating macrophytes such as the native *Azolla*. Rapidly achieving a stable water quality within minimal nutrient inputs, along with a diverse community of aquatic plants and biota will be the best strategy to reduce the risk of blooms.

In the event that blooms arise, to avoid reductions in DO concentrations and associated impacts on biota, some management interventions (e.g. adjustments to water quality or harvesting of macrophytes) may be considered. However, such approaches are generally only effective for short periods of time and in localised areas. This will be documented in a weeds and pest management plan developed for the Project, which will include the requirement for:

- annual programs for weed and pest management
- regular monitoring of the distribution and abundance of weeds and pest activity

Habitat within the native ecosystem (bushland) PMLUs

There will be some delay to the establishment of functional fauna habitat within rehabilitated areas, due to the time scales over which vegetation communities establish. However, incremental improvements can be expected over time, particularly in areas that adjoin undisturbed vegetation communities. In addition, the early establishment of microhabitat features (i.e. such as leaf litter, logs, and hollows [including use of nest boxes]) will enhance use of developing vegetation communities by fauna. Such features will be established in accordance with the revegetation plan and advice of ecologists implementing the program.

Habitat within the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs

Once water levels and quality within the wetland stabilises (i.e. expected to take approximately 18 years post-closure), the establishment of macrophytes and fringing vegetation will be encouraged, to support food webs and provide habitat for the diversity of aquatic species.

Water quality

As the final void is expected to spill approximately once in every four years on average over an approximately 300 year modelled period, the maintenance of water quality is important to demonstrate that the wetland is self-sustaining and will not impact on ecological values of Port Curtis.

Implementation and review

Monitoring the success of rehabilitation activities will be conducted by the rehabilitation contractor and/or ecological consultants, incorporating any refinements of ecologists at that time.

Revisions to the approach and methods used for ecological monitoring may be made over time, as scientific methods for ecological monitoring evolve and will be documented in a restoration plan. This will include assessment of the impact of climate conditions on vegetation growth and erosion potential.

Amendments to proposed monitoring methods and associated PRC plan documentation will involve consultation and approval of DESI.

7.6.7.2. Monitoring program and objectives

The monitoring program has been designed to allow for assessment of ecological values through time. Comparisons of ecological indicators will be made with those at analogue sites and with respect to published benchmarks for relevant ecosystem indicators (e.g. RE benchmarks and water quality guidelines). Demonstration of the self-sustainability of ecosystems will be achieved through evidence of natural recruitment of ecological values, resilience to disturbance (e.g. fires and algal blooms) and the recycling of natural resources within ecosystems.

Monitoring methods have been selected to align with well-established approaches for the assessment of vegetation communities, fauna habitats and aquatic ecosystems, as follows:

- Native ecosystem (bushland) PMLUs: methods include a combination of the BioCondition method (Eyre et al., 2015) and the Queensland Biodiversity and Ecology Information System (QBEIS) (Neldner et al. 2023, Queensland Herbarium 2022). Adoption of these methods (which are very similar) aligns with the recommendations of Spain et al. (2023), while providing for the collection of data on indicators that are limited to one method only (e.g. coarse woody debris in the BioCondition method). Methods and indicators adopted for terrestrial ecosystems also generally align with those that emerged from a comprehensive analysis of suitable variables by Umwelt (2021) based on research by Oliver and Dorrough (2019).
- Freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs: monitoring approaches are based on the national and State guidelines of ANZG (2018) and QWQG (DEHP 2013) for water quality, DNRM (2001) for selected aquatic ecology values and the Whole-of-System Values-based Framework for Wetlands in Queensland (DESI 2024). For targeted fauna surveys, the Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland will be applied (Eyre et al. 2022).

Monitoring for terrestrial and aquatic ecology is described in Sections 9.1.1 and 9.2.2.

7.6.8. Achievement of surface and groundwater quality requirements (RM9) at freshwater wetland PMLUs

Achievement of surface and groundwater quality requirements at the freshwater wetland PMLUs will be achieved by:

- Confirmation by an AQP:
 - that any algal or macrophyte blooms present is not of an extent that would compromise the ecological function of the wetland.
 - the species presence and colonisation of Macroinvertebrates and species required to support the trajectory for the wetlands to be self-sustaining.
- Native fauna species identified are comparable to those at analogue sites and of a presence that supports the wetlands to be self-sustaining (i.e. frogs and fish at various lifecycles and insignificant to no populations of cane toads).
- Aquatic plant species from Table 7.15 have established a continuous fringe of dense aquatic vegetation along the littoral zone depicted in Figure 7.18.
- Any supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed.
- Final tree/shrub density of 600 to 800 trees per hectare has been achieved.
- No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2.
- Annual soil condition monitoring confirms growth media depth (0-0.3 m) meets the following suitability criteria:
 - cation exchange capacity and major macronutrient (N, P, K, and organic C) concentrations:
 - Nitrogen: Total >0.2%
 - Phosphorus: at the recommendation of an AQP
 - Potassium: available K>200mg K/kg soil
 - Organic C: at the recommendation of an AQP
 - pHw range is between 6.0 to 7.5
 - primary growth media salinity (EC1:5) is less than 0.5 dS/m
 - Exchangeable sodium percentage (ESP) (%) < 6
 - Fencing has been assembled around RAs
- Water quality results at representative locations of the wetlands and locations identified in Table 7.8 monitored monthly are compliant with Table 7.9 values for a minimum period of five consecutive years. However, if the surface water quality exceeds criteria, the applicable upstream site is compared to the downstream site result and if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site, then the water quality is deemed compliant.
- For a minimum of five consecutive years groundwater quality must be monitored quarterly at compliance bores specified as Alluvium in Table 7.10, and groundwater quality results do exceed any value for three consecutive results.

7.6.9. Achieving relevant target PMLU (RM7, RM10 to RM14)

7.6.9.1. RM7: Achievement of Forest Road Realignment

Subject to obtaining all relevant approvals and completion of realignment of Forest Road, Gladstone Regional Council / QLD Government has notified QER that the new Forest Road alignment (RA07) is accepted “off maintenance”, in accordance with processes prescribed future agreement with, or approvals from, Gladstone Regional Council and/or the QLD Government.

7.6.9.2. RM10 and RM14: Achievement of surface requirements and PMLU to a stable condition for water storage (stock use) PMLU

Achievement of the PMLU to stable condition for water storage (stock use) PMLU will be achieved by:

- Assessment and confirmation by an AQP that it is safe for humans, wildlife and stock and stable
- Confirmation the dams are safe for stock access and have vegetated banks.
- Surface water quality results monitored quarterly do not exceed the values in Table 7.9, for a minimum of 5 consecutive years.
- Completion of a Hazard and Safety Assessment completed by an AQP demonstrates:
 - hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use
 - retained water storages (banks and spillways) are safe and stable
- No evidence of erosion classified as ‘moderate’ or ‘severe’ as defined by Table 9.2..
- Surface water:
 - Runoff is non-polluting to receiving waters and complies with the values in Table 7.9, with results monitored quarterly not exceeding the values in Table 7.9, for a minimum of 5 consecutive years.
 - Monitoring results within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. However, if the surface water quality exceeds criteria, the applicable upstream site is compared to the downstream site result and if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant.
- For a minimum of five consecutive years groundwater quality has been monitored quarterly at, but not limited to, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12, and groundwater quality results have not exceeded the values in Table 7.11 and Table 7.12, for 3 consecutive results.

7.6.9.3. RM11: Achievement of PMLU to stable condition – Industrial PMLU and Permanent Infrastructure PMLU

Achievement of the PMLU to stable condition for Industrial PMLU and Permanent Infrastructure PMLU will be achieved by:

- Monitoring confirming:
 - minimum 70% groundcover is achieved through revegetation with grass species
 - weed presence is a maximum of 10% of total vegetative groundcover in annual monitoring
 - no evidence of erosion classified as ‘moderate’ or ‘severe’ as defined by Table 9.2.

- Completion of a Hazard and Safety Assessment is completed by an AQP that demonstrates:
 - hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use
 - all retained water storages (banks and spillways) are safe and stable.
- Erosion and sediment control systems are installed as per the construction design and verified by an AQP.
- AQP certifies that:
 - as constructed landform achieves design criteria and are geotechnical stability
 - retained infrastructure is stable and non-polluting.
- All retained water storages to be assessed and approved as safe and stable by an AQP.
- Surface water:
 - Runoff is non-polluting to receiving waters and complies with the values in Table 7.9, with results monitored quarterly not exceeding the values in Table 7.9, for a minimum of 5 consecutive years.
 - Monitoring results within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. However, if the surface water quality exceeds criteria, the applicable upstream site is compared to the downstream site result and if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant.
- For a minimum of five consecutive years groundwater quality has been monitored quarterly at, but not limited to, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12, and groundwater quality results have not exceeded the values in Table 7.11 and Table 7.12, for 3 consecutive results.

7.6.9.4. RM12: Achievement of PMLU to stable condition – native ecosystem (bushland) PMLUs

Achievement of the PMLU to stable condition for native ecosystem (bushland) PMLUs will be achieved by:

- Completion Hazard and Safety Assessment by an AQP confirming safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use.
- Water quality results monitored monthly at, but not limited to, downstream locations specified in Table 7.8, achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. However, where the surface water quality exceeds criteria, the applicable upstream site is compared to the downstream site result and if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site, then the water quality is deemed compliant.
- For a minimum of five consecutive years groundwater quality has been monitored quarterly at, but not limited to, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12, and groundwater quality results have not exceeded the values in Table 7.11 and Table 7.12, for 3 consecutive results.
- No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2.
- An assessment of BioCondition benchmarks for Native Ecosystem (Bushland) complies with the >40/60 PRCP Benchmark for the PMLU as per Table 9.6.

7.6.9.5. RM13: Achievement of PMLU to a stable condition – RA12 (Freshwater wetland [lacustrine] PMLU, and RA14 (freshwater wetland [palustrine] PMLU)

RA12 (freshwater wetland [lacustrine])

Certification of the final void by an AQP will be undertaken to verify:

- highwalls and low walls are internally draining
- void banks, spillway, and upstream water management drainage systems to manage catchment inflows to the void are assessed as safe and stable
- stratification modelling conducted with analysis confirming that the effects of disassembly does not impact on the achievement of the achievement and maintenance of the freshwater (lacustrine) wetland and survivability of fauna
- assessment using Queensland Government's Wetland Condition Assessment Tool confirms that the lacustrine wetland is comparable to the analogue sites (Northern embayment of Lake Awoonga)
- disassembly events do not impact on the achievement of the freshwater (lacustrine) wetland
- the freshwater (lacustrine) wetland:
 - is protected from flood water ingress.
 - will not cause environmental harm outside of the relevant tenure boundary.
 - is safe to humans, wildlife and livestock.

In addition, a Hazard and Safety Assessment will be completed by an AQP that demonstrates:

- hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use
- retained water storages (banks and spillways) are safe and stable

RA14 (freshwater wetland [palustrine])

Certification of the final void by an AQP will be undertaken to verify:

- is stable
- is protected from marine flood water ingress
- will not cause environmental harm outside of the relevant tenure boundary
- is safe to humans, wildlife and livestock
- assessment using Queensland Government's Wetland Condition Assessment Tool confirms that the lacustrine wetland is comparable to the analogue sites (Byellee Wildlife Reserve wetland and Wilmot Lagoon)

In addition, a Hazard and Safety Assessment will be completed by an AQP that demonstrates:

- hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use
- retained water storages (banks and spillways) are safe and stable

8. Risk Assessment

Legislative requirement

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

PRCP Guideline (Section 3.7)

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

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

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

8.1. Identifying, assessing, and treating risks

8.1.1. Risk methodology

The key steps to the risk assessment process were:

- Establish the context: consideration should be given to both the internal and external environment, the limits within the risk assessment are valid, the activity being assessed and the cross section of people contributing to the risk management process.
- Identification of hazards: risk identification refers to the process of identifying risks against a pre-defined set of business objectives, taking into account the context, the previous risk assessments, incidents, and the findings of audits performed onsite.
- Risk analysis: each potential consequence should be analysed separately, and existing or current controls should be identified, and their effectiveness and efficiency taken into account.
- Risk evaluation: to assist in making decisions, and to define which risks need treatment and the priority for treatment implementation.
- Risk treatment: selecting control options for modifying risks and implementing those controls to reduce residual risk factors to a level as low as is reasonably achievable (ALARA). Costs and efforts of the controls versus the benefits derived should be reviewed. Reduction of the risks should be according to the hierarchy of controls:
 - Level 1: eliminate the hazard/s
 - Level 2: substitute the hazard/s with something safer, isolate the hazard/s from people via physical separation, or reduce the risk/s through engineering controls
 - Level 3: reduce exposure to the hazard using administrative controls

8.1.2. Risk matrix

The likelihood and consequence categories have been developed based on the criteria in the *Integrated Mine Closure Good Practice Guide, 2nd Edition*, which was designed in consideration of AS ISO 31000:2018 *Risk management – guidelines*, and with the addition of a consequence category for PRCP schedule impacts. The consequence and likelihood are shown in Table 8.1 and Table 8.2 respectively. The risk matrix is shown in Table 8.3.

Table 8.1 Consequence categories

Consequence rating						
Consequence	Schedule	Financial	Safety	Environmental	Legal and regulatory	Social / reputation
1 – Insignificant	Less than 1% impact on overall Project timeline.	Less than 1% impact on the overall budget of the Project.	First-aid case.	Lasting days or less; affecting small area (metres); receiving environment altered with no sensitive habitats and no biodiversity value (e.g. urban/industrial areas).	Technical non-compliance. No warning received; no regulatory reporting required.	Minor disturbance of culture/social structures. Minor impact; awareness/concern from specific individuals.
2 – Minor	May result in overall Project timeline overrun of equal to or more than 1% and less than 3%.	May result in overall Project budget overrun of equal to or more than 1% and less than 3%.	Medical-treatment case.	Lasting weeks; affecting limited area (hundreds of metres); receiving environment altered with little natural habitat and low biodiversity value.	Breach of regulatory requirements; report/involvement of authority. Attracts administrative fine.	Some impacts on local population, mostly repairable. Single stakeholder complaint in reporting period. Limited impact; concern/complaints from certain groups/organisations (e.g. NGOs).
3 – Moderate	May result in overall Project timeline overrun of equal to or more than 3% and less than 10%.	May result in overall Project budget overrun of equal to or more than 3% and less than 10%.	Lost-time injury.	Lasting months; affecting extended area (kilometres); receiving environment comprising largely natural habitat and moderate biodiversity value.	Minor breach of the law; report/investigation by authority. Attracts compensation/penalties/enforcement action.	Ongoing social issues. Isolated complaints from community members/stakeholders. Local impact; public concern/adverse publicity localised within neighbouring communities.
4 – High	May result in overall Project timeline overrun of equal to or more than 10% and less than 30%.	May result in overall Project budget overrun of equal to or more than 10% and less than 30%.	Permanent disability or single fatality.	Lasting years; affecting area on sub-basin scale; receiving environment classified as having sensitive natural habitat with high biodiversity value.	Breach of the law. May attract criminal prosecution, penalties/enforcement action; individual licence temporarily revoked.	Significant social impacts. Organised community protests threatening continuity of operations. Suspected reputational damage; local/regional public concern and reactions.
5 – Major	May result in overall Project timeline overrun of 30% or more.	May result in overall Project budget overrun of 30% or more.	Numerous permanent disabilities or multiple fatalities.	Permanent impact; affecting area on a whole basin or regional scale; receiving environment classified as highly sensitive natural habitat with very high biodiversity value.	Significant breach of the law. Individual or company lawsuits; permit to operate substantially modified or withdrawn.	Major widespread social impacts. Community reaction affecting business continuity. Licence to operate in jeopardy. Noticeable reputational damage; national/international public attention and repercussions.

Table 8.2 Likelihood categories

Likelihood	
5 – Almost certain (>90%)	Greater than 90% likelihood of occurring. Has happened, will probably happen during the mine life and there is no reason to suspect it won't happen.
4 – Likely (30%-90%)	Likelihood of occurring is equal to or more than 30% and less than 90%. This consequence is not uncommon in the mining and metals industry/area.
3 – Possible (10%-30%)	Likelihood of occurring is equal to or more than 10% and less than 30%. There is a possibility of this risk occurring as it has occurred before (albeit infrequently) in the mining and metals industry/area.
2 – Unlikely (3%-10%)	Likelihood of occurring is more than or equal to 3% and less than 10%. There are no specific circumstances to suggest this could happen.
1 – Improbable (<3%)	Likelihood of occurring is less than 3%. It would require a substantial change in circumstances to create an environment for this to occur, and even then, this is a rare occurrence.
0 – Highly improbably (0%)	Additional category added for this assessment to denote impacts where no source-fate-pathway connection exists.

Table 8.3 Risk Matrix

		Consequence				
		1 – Insignificant	2 – Minor	3 – Moderate	4 – High	5 – Major
Likelihood	5 – Almost certain	Medium	Significant	Significant	High	High
	4 – Likely	Medium	Medium	Significant	High	High
	3 – Possible	Low	Medium	Significant	Significant	High
	2 – Unlikely	Low	Low	Medium	Significant	Significant
	1 – Improbable	Low	Low	Medium	Medium	Significant
	0 – Not possible	Highly improbable	Highly improbable	Highly improbable	Highly improbable	Highly improbable

8.1.3. Risk identification

The risk event 'a stable condition for land described as a post-mining land use not being achieved', was assessed per ISO 31000 methodology described in Section 8.1.1 above (the full risk assessment is included in Appendix N), where stable condition is defined as per Section 111A of the EP Act:

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

As discussed in Section 4, no NUMAs are proposed for the Project.

A number of scenarios were identified in the risk identification process related to a stable condition for the relevant PLMUs not being achieved:

- final landform/final void failure
- alteration of hydrogeological conditions
- alteration of surface water hydrology
- alteration of flood hydrology
- impact on rehabilitation of terrestrial ecological values
- impact on rehabilitation of aquatic ecological values
- insufficient, inadequate, or inappropriate soil and capping material required for rehabilitation activities;
- insufficient identification and management of waste characterisation
- inadequate and/or inappropriate revegetation
- deterioration of built infrastructure conditions

Necessary risk treatments identified to achieve a stable condition for the relevant PMLUs are summarised in Table 8.4.

8.1.4. Risk analysis, evaluation, and relevant treatments

Worst case outcomes were assessed for each scenario, with preventative and mitigating controls identified (as required) and the residual risk rating calculated. Full details of the risk analysis, risk evaluation and risk treatment for these scenarios is presented in Appendix N.

Table 8.4 Necessary risk treatments identified to achieve a stable condition for the relevant PMLUs

Aspect	Risk treatment
Risk scenario – Landform/final void failure	
Reason for selected treatment option	to ensure the final landform/final void is stable and sustainable
Proposed action/s	- Reshaping the final landform shape to achieve the design geometries ± 0.2 m vertical height measured over a maximum distance of 50 m (Sections 7.1.5.5 and 7.6.4.1). - Construction of the crest-bunding included in the landform design (Sections 7.1.5.5 and 7.6.4.2). - Minimising the size of cross-slope rip-lines to minimise flow concentration on the batter slopes (Sections 7.1.5.5 and 7.6.5). - Establishment of a vegetative cover with the following broad functional properties: $\geq 60\%$ surface contact cover (litter and living groundcover) $\geq 25\%$ canopy cover from shrubs and trees (Sections 7.1.5.5 and 7.6.6) - Modification of the surface material to reduce detachment potential within the northern drainage zone through placement of rock cover/armour in zones of higher erosion risk (Sections 7.1.5.4 and Section 7.6.4.1). - Within the final void, the gradient to which the pit wall exposed above the equilibrium water level will be reshaped is to be no steeper than 30%, assuming that the exposed slope length will typically be no more than 30 m (vertical height of ~ 10 m) (Section 7.6.4.1). - Geotechnical assessment to be carried out by a suitable qualified person to ensure slopes achieve EA requirement, where relevant. - Certifying engineers to be involved in construction quality assurance and review monitoring data during rehabilitation establishment.
Reporting and monitoring requirements	- analysis of final landform against design - available material inventory - survey/LiDAR - rehabilitation monitoring data - geotechnical assessment - engineer's certification for final landform construction quality
Risk scenario – Alteration of hydrogeological conditions	
Reason for selected treatment option	- Minimise the potential for groundwater impacting achievement of the relevant PMLUs for the site and a stable landform post closure not being achieved. - Minimise the potential for impact on groundwater resources.
Proposed action/s	- groundwater monitoring network review (Section 7.1.7.5) - continued quarterly groundwater monitoring and annual review for all parameters listed in EPML00658213 (Section 9.1.1 and 9.2.3) - monitoring will be undertaken as outlined in Section 9.1.1 and 9.2. - certifying engineers to be involved in construction quality assurance and review monitoring data during rehabilitation establishment

Aspect	Risk treatment
Reporting and monitoring requirements	- reporting under existing EA requirements - groundwater monitoring network review report - engineer's certification for final landform construction quality
Risk scenario – Alteration of surface water hydrology	
Reason for selected treatment option	- Minimise the potential for surface water impacting achieving the relevant PMLUs for the site and a stable landform post closure not being achieved. - Minimise the potential for impact on surface water resources.
Proposed action/s	- Review of baseline surface water compliance criteria (Section 7.1.7.5). - Water quality monitoring of the final void pit lake and drainage gullies during the pit lake filling period (Sections 9.1.1 and 9.2.4). - Water level and volume monitoring of the pit lake during the filling period to validate water balance model assumptions and predicted pit lake behaviour (Sections 9.1.1 and 9.2.4). - Certifying engineers to be involved in construction quality assurance and review monitoring data during rehabilitation establishment (Section 7.6.4).
Reporting and monitoring requirements	- rehabilitation monitoring data - engineer's certification for final landform construction quality
Risk scenario – Alteration of flood hydrology	
Reason for selected treatment option	Risks without treatment were generally rated as Low and no additional treatment is proposed; however confirmation of the arrangement and performance of the lagoon system is required as its risk was rated as Medium.
Proposed action/s	- Detailed design of the lagoon system is required during the operational phase of the mine to confirm the arrangement and performance of the lagoon system. - Certifying engineers to be involved in construction quality assurance and review monitoring data during rehabilitation establishment.
Reporting and monitoring requirements	- lagoon system detailed design report - engineer's certification for final landform construction quality
Risk scenario – impact on rehabilitation of terrestrial ecological values	
Reason for selected treatment option	Proposed revegetation plan will minimise potential impacts on rehabilitation on terrestrial ecological values.
Proposed action/s	- Develop and implement a detailed restoration plan. - Develop and implement a weed and pest management plan for rehabilitated areas (Section 7.6.7). - Develop and implement a fire management plan for rehabilitated areas (Section 7.6.7). - Implement the monitoring program (Sections 7.6.7, 9.1, and 9.2). - Complete an assessment of the impact of climate on vegetation growth and erosion potential. - Certifying engineers to be involved in construction quality assurance and review monitoring data during rehabilitation establishment.

Aspect	Risk treatment
Reporting and monitoring requirements	- restoration plan - weed and pest management plan for rehabilitated areas - fire management plan for rehabilitated areas - rehabilitation monitoring data - engineer's certification for final landform construction quality - assessment of the impact of climate on vegetation growth and erosion potential
Risk scenario – impact on rehabilitation of aquatic ecological values	
Reason for selected treatment option	Proposed revegetation plan will minimise potential impacts on rehabilitation on aquatic ecological values.
Proposed action/s	- Develop and implement a weed and pest management plan for rehabilitated areas (Section 7.6.7). - Implement the monitoring program (Section 7.6.7, 9.1, and 9.2). - Within the final void, the gradient to which the pit wall exposed above the equilibrium water level will be reshaped is to be no steeper than 30%, assuming that the exposed slope length will typically be no more than 30 m (vertical height of ~10 m) (Section 7.6.4.1). - Groundwater monitoring network review (Section 7.1.7.5). - Continued quarterly groundwater monitoring and annual review for all parameters listed in EPML00658213 (Sections 7.6.8, 9.1, and 9.2). - Review of baseline surface water compliance criteria (Section 7.1.7.5). - Water quality monitoring of the final void pit lake and drainage gullies during the pit lake filling period (Sections 9.1.1 and 9.2.4). - Water level and volume monitoring of the pit lake during the filling period to validate water balance model assumptions and predicted pit lake behaviour (Sections 9.1.1 and 9.2.4). - Certifying engineers to be involved in construction quality assurance and review monitoring data during rehabilitation establishment.
Reporting and monitoring requirements	- analysis of final landform against design - available material inventory - survey/LiDAR - rehabilitation monitoring data - reporting under existing EA requirements - groundwater monitoring network review (Section 7.1.7.5) - engineer's certification for final landform construction quality
Risk scenario – Insufficient, inadequate, or inappropriate soil and capping material required for rehabilitation activities	
Reason for selected treatment option	enables utilisation of site resources for greatest chance of stable condition being achieved
Proposed action/s	- Initial topsoil survey, mapping, and material balancing. - Review the topsoil material balance periodically during operations to ensure sufficient volumes for the rehabilitation needs.

Aspect	Risk treatment
	• Undertake rehabilitation planning and preparation in accordance with the specific requirements for soil, seed, and management for the relevant PMLUs. • Management of topsoil stripping (Section 7.6.5). • Management of topsoil storage (Section 7.6.5). • Topsoil sampling and testing an suitably qualified person to determine ameliorant and fertiliser requirements for planned seed mix (Section 7.6.5). • Surface ripping in advance of topsoil application (Section 7.6.5). • Management of topsoil application during rehabilitation (Section 7.6.5). • Ameliorants and fertilisers applied (Section 7.6.5). • Management planting rates and timing, seed collection/selection and procurement, and planting stock procurement (Sections 7.1.8.2 and 7.1.8.3). • Complete an assessment of the suitability of the soils as a primary growth medium and overburdens/interburdens as a secondary growth medium.
Reporting and monitoring requirements	• topsoil survey results • survey/LiDAR • topsoil inventory • topsoil sampling and testing results • rehabilitation monitoring data
Risk scenario – Insufficient identification and management of waste characterisation	
Reason for selecting treatment option	The SPR risk assessment undertaken as part of the Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste (Terrenus, 2023) identified SPR risk ratings as follows: • Final landforms: Low potential to generate AMD, OD, and non-oxidative salinity. • Final void (end of mining): Medium and Medium to High potential to generate AMD prior to capping and filling with water, and Low and Low to Medium potential AMD following capping and while the void is filling with water. • Final void (post-closure) Low potential to generate AMD.
Proposed action/s	• Ongoing waste characterisation during operations. • The broad strategies of managing the wastes and processed shales in the final landforms include reshaping works to ensure: • Co-mingling of the wastes and processed shales into both the In-pit MRA and Out-of-pit MRA, with co-disposal of any PAF material within a large proportion of NAF material to provide excess neutralising capacity. • Tw3 waste will not be present at the final landform surfaces (minimum 2 m cover) (Section 7.6.4). • To mitigate the potential for acid generation potential (and to also reduce geotechnical risks of the final void walls), the final void will require reshaping and cover/capping works to the wall and floor (with NAF overburden and interburden so that all PAF materials are covered with NAF waste) to lower the slope angles (Section 7.6.4). • Sampling and testing the surface 2 m of waste following reshaping works to confirm the material is overburden and/or interburden and NAF (Section 7.6.5). • Certifying engineers to be involved in construction quality assurance and review monitoring data during rehabilitation establishment.
Reporting and monitoring requirements	• data from waste characterisation and associated reports • sampling and test results • rehabilitation monitoring • engineer's certification for final landform construction quality

Aspect	Risk treatment
Risk scenario – Inadequate and/or inappropriate revegetation	
Reason for selecting treatment option	to ensure the successful revegetation of RAs to support their relevant PMLU
Proposed action/s	- Management of topsoil stripping (Section 7.6.5). - Management of topsoil storage (Section 7.6.5). - Topsoil sampling and testing an suitably qualified person to determine ameliorant and fertiliser requirements for planned seed mix (Section 7.6.5). - Surface ripping in advance of topsoil application (Section 7.6.5). - Management of topsoil application during rehabilitation (Section 7.6.5). - Ameliorants and fertilisers applied (Section 7.6.5). - Management planting rates and timing, seed collection/selection and procurement, and planting stock procurement (Sections 7.1.8.2 and 7.1.8.3). - Certifying engineers to be involved in review of monitoring data during rehabilitation establishment.
Reporting and monitoring requirements	- topsoil inventory - topsoil sampling and testing results - rehabilitation monitoring data - complete an assessment of predicted erosion potential of the vegetated soils - engineer's certification for final landform construction quality
Risk scenario – Deterioration of built infrastructure conditions	
Reason for selected treatment option	minimise or prevent contamination
Proposed action/s	- undertake PSI contaminated land assessment post-mining to identify any areas requiring further DSI - remediate any contamination - a contaminated land survey is carried out by a suitably qualified person confirming no contamination (Section 7.6.3)
Reporting and monitoring requirements	- PSI contaminated land assessment - final contaminated land survey - rehabilitation monitoring data
Risk scenario – a PMLU (other than a continuation of an existing lawful use) is not approved under the Gladstone SDA Development Scheme or is conditioned so as to impact on methodology under this PRC plan	
Reason for selected treatment option	to seek approval for PMLUs (other than existing lawful uses under Section 85 of the SDPWO Act)

Aspect	Risk treatment
Proposed action/s	• After land for an area has become available for rehabilitation and before undertaking work that is dependent on the nominated PMLU under this PRC Plan, if the Development Scheme is still in effect at that time, apply for development approval under the Development Scheme for the PMLU. • If the PMLU is approved by the Coordinator-General, incorporate any conditions into the design and planning for the PMLU. • If the PMLU is rejected, apply to amend this PRC plan to replace the PMLU.
Reporting and monitoring requirements	• provide the administering authority with a copy of the Coordinator-General's decision
Risk scenario – a third party landholder or easement holder undertakes development that constrains a PMLU	
Reason for selected treatment option	• inconsistent development by third parties beyond the control of the holders
Proposed action/s	• Notify the administering authority.
Reporting and monitoring requirements	• Update the administering authority about any inconsistent development that is not subject to confidentiality requirements or once it is in the public domain. Apply to amend the PRC Plan accordingly.

9. Monitoring and maintenance

PRCP Guideline (Section 3.8)

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

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

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

The QER rehabilitation monitoring program is designed to track rehabilitation performance over time to identify compliance to milestone criteria and ensure continuous improvement in rehabilitation methodologies.

The QER rehabilitation monitoring program is designed to track rehabilitation performance over time to identify compliance to milestone criteria and ensure continuous improvement in rehabilitation methodologies

9.1. Milestone monitoring and scheduling

9.1.1. Rehabilitation monitoring phases

Table 9.1 provides an overview of the rehabilitation monitoring phases for rehabilitation of native ecosystem (bushland), freshwater wetland (lacustrine), freshwater wetland (palustrine), and water storage (stock use) PMLUs for the PRCP schedule provided in Section 11.

Table 9.1 Summary of key ecological indicators and frequency of monitoring for PMLUs and representative analogue sites

PMLU	Monitoring indicator	Method summary	Frequency of monitoring	Approximate timeframe for achieving PMLU (years)
Native ecosystem (bushland)	Planting success.	Transects and plots.	Annually.	<1 year
	Vegetation structure, number of native plant species, exotic species cover, stem density, tree height and basal area, coarse woody debris, tree species recruitment, litter cover and total soil carbon	BioCondition, QBEIS, soil sampling, and Remote sensing.	Every five years.	20
	Presence of fauna and habitat quality	Targeted fauna surveys and habitat quality assessments	Every five years.	10
	Presence of weeds and pests, focussing on climbing asparagus (<i>Asparagus plumosus</i>), Captain Cook pine (<i>Casabelia thevetia</i>), rubber vine (<i>Cryptostegia grandiflora</i>), lantana (<i>Lantana camara</i>), creeping lantana (<i>Lantana montevidensis</i>) and prickly pear (<i>Opuntia stricta</i>), deer (multiple species), European hare (<i>Lepus europaeus</i>) and feral pig (<i>Sus scrofa</i>).	Transects and plots surveys	Annually.	10
Native Ecosystem (Freshwater Wetland)	Water quality (physico-chemical, metals, metalloids, nutrients and hydrocarbons)	Queensland Monitoring and Sampling Manual or appropriate QLD Government guidance (DES, 2018).	Monitoring would be undertaken monthly until EC stabilises below 1,500 µS/cm, and quarterly thereafter.	5 ¹
	Sediment quality (metals and metalloids).	Sediment samples for laboratory analysis.	Annually.	5 ¹
	Macrophyte diversity, including presence of weeds, focussing on water hyacinth (<i>Eichhornia crassipes</i>), para grass (<i>Urochloa mutica</i>), salvinia (<i>Salvinia molesta</i>), olive hymenachne (<i>Hymenachne amplexicaule</i>), cabomba (<i>Cabomba caroliniana</i>), water lettuce (<i>Pistia stratiotes</i>), and alligator weed (<i>Alternanthera philoxeroides</i>)	Transect surveys and general observation.	Every six-months (approximately April and October).	5 ¹
	Macroinvertebrate diversity.	AusRivAS methods for edge habitats.	Every six-months (approximately April and October).	5 ¹
	Fish diversity.	Seine netting, baited traps, dip net and electrofishing.	Annually and after a stratification disassembly event.	5 ¹
	Fringing wetland vegetation structure and richness.	BioCondition (species richness and cover benchmarks). Remote sensing.	Annually.	10 ¹
	Presence and use of wetland by fauna, including pests such as cane toad (<i>Rhinella marina</i>), and gambusia (<i>Gambusia holbrooki</i>)	Targeted surveys including spotlighting, diurnal searches and camera traps.	Annually.	10 ¹
	Ecological burning of REs, once vegetation communities have been established	Per Table 9.8 in Section 9.2.2.8 and in accordance with a fire management plan	Various	20

Note 1: Approximate timeframe is based on the number of years to achieve water quality requirements after the final void reaches the equilibrium level.

9.1.2. Analogue sites and PMLU monitoring (RM9 and RM10)

9.1.2.1. Terrestrial ecology analogue sites

Analogue sites will be chosen to represent the REs or habitat conditions that rehabilitation aims to establish. Given that full production is not planned to recommence until 2043, selection of terrestrial analogue sites has been based on sites previously assessed.

Refinement of the location these terrestrial analogues will be considered prior to recommencement of full production in 2043. Ideally, analogue sites will be:

- located as close as possible to ML 80003, minimising regional differences in ecological values
- have a land use history that provides a meaningful comparison with a disturbed and rehabilitated ecological landscape
- contain similar ecological values, with which the condition of rehabilitated values can be benchmarked
- accessible, with respect to location and tenure, so that monitoring results at rehabilitated areas can be compared with those of analogue sites through time, allowing progress to be monitored

Two analogue sites were assessed by Landloch (2012) and provide examples of possible sites:

- Analogue Site 1 was established in a Forest Red Gum (*E. tereticornis*) dominated woodland on Ferrosol soil, interspersed with Narrow-leaved Ironbark (*E. crebra*), Curracabah (*Acacia crassa*) and Red Ash (*Alphitonia excelsa*).
- Analogue Site 2 was established in Forest Red Gum / Narrow-leaved Ironbark dominated woodland on Kandosol soil, interspersed with Lemon-scented Gum (*C. citriodora*) and Pink Bloodwood (*C. intermedia*).

These analogue sites were chosen based on the similarities in landform and dominant species composition to the rehabilitation monitoring sites. Analogue sites were also selected based on their representation of the REs surrounding the Project. A map showing the location of these analogues is presented in Figure 9.1.

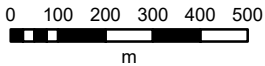
9.1.2.2. Aquatic ecology analogue sites

For aquatic ecosystems, some additional factors influence the suitability of analogue sites:

- similarity of water quality characteristics (which influences the type of macrophytes and biota that will establish and the associated structure of aquatic ecosystems)
- Wetland classification. Analogue sites should be the same wetland type as the rehabilitated area (i.e. lacustrine or palustrine)
- wetland size and depth (which influences the diversity of habitats available to aquatic ecosystems and associated composition of aquatic ecosystems). This is particularly relevant given the large size (approximately 70 ha) and depth (approximately 50 m) of the freshwater wetland that will occupy the final void



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



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Figure 9.1
Terrestrial analogue sites
(Essence, 2024)

Legend

- ML 80003
- Terrestrial analogue site

Date: 8/03/2024

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP0036_B

Requested by: John Linden

Sources:
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Two potentially suitable sites were identified within a 50 km radius of ML 80003, and selected as preferred analogue sites for RA12 (i.e. Freshwater wetland [lacustrine]) (Figure 9.2):

- **Byellee Wildlife Reserve wetland:** located 12 km south-east of ML 80003, the natural palustrine wetland is 5.2 ha in area and is located adjacent to the Calliope River. The intermittent wetland contains freshwater, with all vegetation being comprised of wetland REs. The wetland contains moderately dense vegetation cover, with sedges, grasses and herbs present. Soils are comprised primarily of clay and silty-clay (DESI 2024). The wetland's proximity to the Project site and location on land managed by the Gladstone Regional Council makes it a suitable analogue site for the Project's palustrine wetlands.
- **Wilmot Lagoon:** located 17 km west of ML 80003, the natural palustrine wetland is 4.3 ha in area and is located within the Calliope River catchment. The ephemeral wetland has sparse vegetation cover, with all vegetation being comprised of wetland REs (DESI 2024). Wilmot Lagoon is located close to a public road, with tenure of the wetland being mostly reserve with some privately owned (freehold) land areas. The wetland's proximity to the project site and ephemeral habitat make it a suitable analogue site for the Project's palustrine wetlands.

Two potentially suitable palustrine sites were identified within a 50 km radius of ML 80003, and selected as preferred analogue sites for RA14 (i.e. Freshwater wetland [palustrine]) (Figure 9.2):

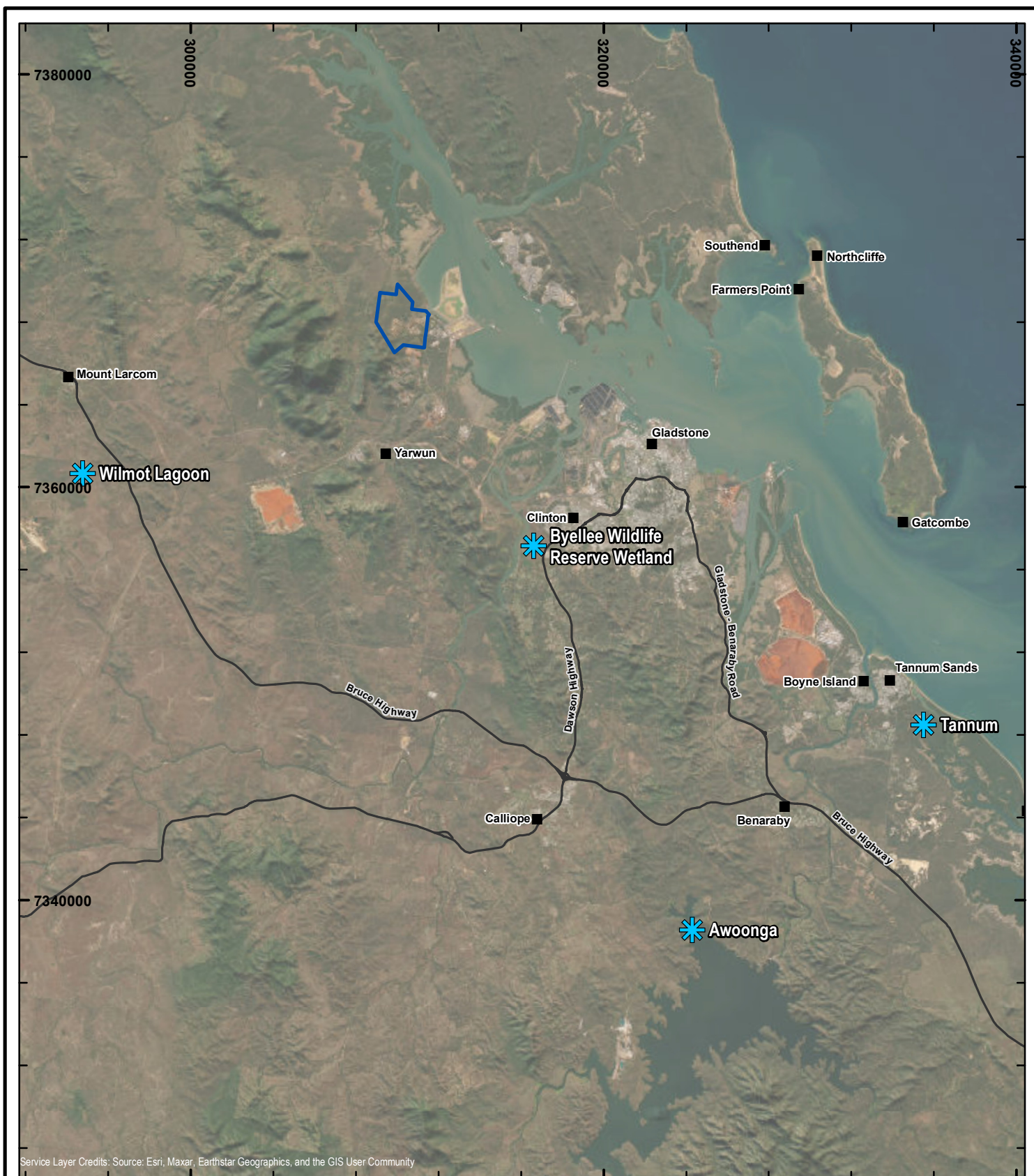
- **Byellee Wildlife Reserve wetland:** located 12 km south-east of ML 80003, the natural palustrine wetland is 5.2 ha in area and is located adjacent to the Calliope River. The intermittent wetland contains freshwater, with all vegetation being comprised of wetland REs. The wetland contains moderately dense vegetation cover, with sedges, grasses and herbs present. Soils are comprised primarily of clay and silty-clay (DESI 2024). The wetland's proximity to the Project site and location on land managed by the Gladstone Regional Council makes it a suitable analogue site for the Project's palustrine wetlands.
- **Wilmot Lagoon:** located 17 km west of ML 80003, the natural palustrine wetland is 4.3 ha in area and is located within the Calliope River catchment. The ephemeral wetland has sparse vegetation cover, with all vegetation being comprised of wetland REs (DESI 2024). Wilmot Lagoon is located close to a public road, with tenure of the wetland being mostly reserve with some privately owned (freehold) land areas. The wetland's proximity to the project site and ephemeral habitat make it a suitable analogue site for the Project's palustrine wetlands.

9.2. Monitoring methods

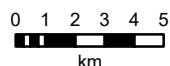
9.2.1. Soil and erosion monitoring

9.2.1.1. Soil conditions

Soil sampling and comparison against existing soils data for in situ soils to ensure suitable soil condition in relation to pH, EC, exchangeable cations, total N, total P, plant available P, K, S, particle size distribution (i.e. coarse fragments, sand, silt, clay). Monitoring will be completed at revegetation and biennially until achievement of the PMLU.



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



QUEENSLAND ENERGY RESOURCES

Stuart Kerogen Shale Project



GDA2020, MGA Zone 56



Figure 9.2
Analogue sites for monitoring
the development of ecological
values in the freshwater wetland

Legend

- ML 80003
- Major road
- Population centre
- ✱ Aquatic analogue site

Date: 2/12/2024

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_ECMAP0012_A

Requested by: John Linden

9.2.1.2. Erosion monitoring

Annual visual assessment to verify erosion is acceptable (until relinquishment), with transect monitoring to be completed every five years until Year 20. Thereafter, transects will be undertaken if annual visual assessment indicates accelerated erosion (e.g. gully formation).

The focus of visual assessment and transect erosion monitoring will be to ensure erosion is consistent with, and not exceeding, the erosion predictions in Table 7.5 of Section 7.1.5.4, with relevant aspects reproduced in Table 9.2.

Table 9.2 Erosion monitoring criteria

Erosion classification	Minor	Moderate	Severe
Sheet erosion	Shallow soil deposits downslope.	Partial exposure of roots; moderate soil downslope.	Loss of surface horizon; subsoil exposure; root exposure; substantial soil deposits downslope.
Rill/gully erosion	<15 rills/transect* and <0.3m deep	15-30 rills/transect* and <0.3m deep	>30 rills/transect* and/or any >0.3m deep
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 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.)

9.2.2. Terrestrial and aquatic ecology (RM9 and RM10)

Due to the more rapid succession of ecological change within aquatic ecosystems, monitoring of the freshwater wetland (lacustrine) PMLU (i.e. RA12) and freshwater wetland (palustrine) (i.e. RA14) PMLUs will be conducted more frequently than terrestrial communities within the native ecosystem (bushland) PMLUs (i.e. RA01, RA02, RA08, RA11, and RA13).

RA02 includes the Stuart Box Cut (2.6 ha), which was subject to reshaping, surface preparation, and revegetation works as early as 1991. Therefore, rehabilitation monitoring to verify achievement of surface requirements (i.e. native ecosystem [bushland] PMLU) and confirmation of achieving the target PMLU are the only rehabilitation aspects which apply to this area. Furthermore, due to the extent of existing rehabilitation at the Stuart Box Cut area, it proposed to achieve a “hybrid” class of rehabilitated native ecosystem (bushland) PMLU in this area, consistent with the definition of Spain et al. (2023).

9.2.2.1. Terrestrial and aquatic vegetation

Monitoring will be undertaken annually for the life of the Project (until achievement of the PMLU) and use two independent, but related sets of benchmarks:

- planting and management benchmarks
- ecosystem level benchmarks

Planting and management benchmarks

Benchmarks relating directly to the establishment works in the early stages of rehabilitation will focus on survivorship and growth of planted material and weed control according to standard industry practice. This monitoring can be undertaken by the rehabilitation contractor or a third party.

In its simplest form, operational monitoring will be achieved using permanently marked transects in representative areas of rehabilitated vegetation. These transects will be 50 m or 100 m long, with 5 x 5 m quadrats located at 10 or 20 m intervals respectively.

Within the quadrats, counts of the number of surviving and dead planted trees/shrubs and estimates of the cover of native grasses, native forbs, weeds, bare ground, and leaf litter can be made. Quantitative benchmarks for these criteria will be determined by the contractor. A similar approach will be taken with fringing aquatic vegetation.

This monitoring will be undertaken twice a year for the first five years, and then annually for the life of the Project until achievement of the PMLU. The rehabilitation contractor will design specific elements of the monitoring program.

Ecosystem benchmarks

Over the long term (5+ years), monitoring the development of ecological complexity and function at Project site will be achieved using the BioCondition framework (Eyre et al. 2015). or a modified version of the framework that has been adapted for a mine site rehabilitation context.

Benchmarks for all of the three terrestrial REs of interest in this PRC plan are published by the Queensland Herbarium:

- 12.3.3 *Eucalyptus tereticornis* woodland on Quaternary alluvium
- 12.11.6 *Corymbia citriodora* subsp. *variegata*, *Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics
- 12.11.14 *Eucalyptus crebra*, *E. tereticornis*, *Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics

Relevant analogue sites will be established in corresponding REs. BioCondition methods will be used to derive local benchmarks for each RE, to evaluate the suitability published benchmarks for use in rehabilitation monitoring. Published BioCondition benchmark descriptions applying to the project may be amended with approval of DETSI, using locally derived BioCondition data from sites within well managed, undisturbed analogue sites in good condition.

There is no direct analogue RE for the fringing aquatic and semi-aquatic vegetation that is suggested for the margins of water-filled voids. The closest equivalents are:

- 11.3.27c Mixed sedges or grasses with areas of open water +/- aquatic species. Dominated by a range of species including *Eleocharis* spp., *Nymphoides* spp. and sometimes *Phragmites australis*
- 12.3.8 Swamps with *Cyperus* spp., *Schoenoplectus* spp. and *Eleocharis* spp

Although the environments around the void waterbodies will not be swampy in nature, these REs provide benchmarks for species richness and cover suitable for the rehabilitation monitoring.

Benchmark data for each of these REs is provided in Table 9.3 and indicative locations for analogue sites are shown in Figure 9.1.

Table 9.3 BioCondition benchmarks for target Regional Ecosystems

Target RE	max_score_exclude_landscape	recruitment	nn_plant_cover	tree_sp_richness	shrub_sp_richness	grass_sp_richness	forb_other_sp_richness	emergent_canopy_height	tree_canopy_height	tree_subcanopy_height	emergent_canopy_cover	tree_canopy_cover	tree_subcanopy_cover	Large tree threshold _Eucalypt	Large tree threshold_ Non eucalypt	tot_num_large_trees_euc_ha	tot_num_large_trees_non_euc_ha	shrub_canopy_cover	native_per_grass	litter_grd_cov	woody_debris_length_ha
Terrestrial																					
12.3.3	80	100	0	5	5	9	25	na	25	9	na	40	8	54	na	14	na	4	52	20	588
12.11.6	80	100	0	5	5	9	25	na	25	9	na	40	8	54	na	14	na	4	52	20	588
12.11.14	80	100	0	6	7	8	23	na	25	13	na	40	22	41	25	33	3	4	45	30	260
Aquatic																					
11.3.27c	30	na	0	na	na	2	10	na	na	na	na	na	na	na	na	na	na	na	11	4	na
12.3.8	25	na	0	na	na	1	5	na	na	na	na	na	na	na	na	na	na	na	20	na	na

The process for using BioCondition benchmarks to assess rehabilitation progress involves selecting sites within the rehabilitated area that have been managed to conform to the target REs. Within each of these areas, it is suggested that permanent BioCondition assessment plots be established. The number of plots in each target RE will reflect the extent of rehabilitation works for each community (Table 9.4). However, to achieve acceptable replication to describe variable conditions within reference REs, a minimum of three plots is recommended for each RE, with replicates scaled according to the proportions in Table 9.4.

Benchmark site selection and baseline data collection for the analogue sites will be undertaken in the first-year of the rehabilitation program's implementation.

Table 9.4 Minimum numbers of reference and assessment plots for BioCondition monitoring based on published method

Target RE	Number of reference plots	Number of assessment plots
12.3.3	1	3
12.11.6	2	5
12.11.14	1	2

Some aspects of vegetation composition not explicitly covered by the BioCondition method will also be collected at analogue sites, to align with the method implemented at rehabilitation areas. This will include vegetation composition and non-native richness (Spain et al. 2023), with methods based on QBEIS (Neldner et al. 2023 and Queensland Herbarium and DES, 2022). The monitoring program will be implemented by an experienced ecologist. Benchmark site selection, local benchmark setting and baseline data collection for the analogue sites can be undertaken in the first year of the rehabilitation program's implementation.

Milestones for rehabilitation of terrestrial ecology values are provided in Table 9.5. A modified BioCondition method for mine site rehabilitation has been applied to vegetation communities, with benchmarks provided in Table 9.6. The assessment method is based on an unpublished report of DETSI, extracts of which were provided to QER for inclusion in the rehabilitation program.

Table 9.5 Milestones for rehabilitation of terrestrial ecology values

Reference milestones	Description of milestone	Minimum target
Revegetation	Complete seeding and plantings at densities outlined in Revegetation Plan	Within 2 years of final landform establishment
Achieve native bushland ecosystem Monitoring of vegetation community demonstrates progress towards RE description (based on comparisons with modified BioCondition milestone criteria in Table 9.6. BioCondition benchmarks for REs are provided in Table 9.3.	Native bushland ecosystem achieves BioCondition milestone criteria.	As set out in BioCondition benchmarks for each RE, presented in Table 9.6. Attribute benchmark descriptions may be amended with approval of DETSI if locally derived BioCondition benchmarks are found to more adequately represent local conditions in well managed, undisturbed analogue sites in good condition.
Weed and pest management	Distribution and abundance of weeds and pests comparable with analogue sites and not compromising ecological condition of RE. Restricted invasive Category 3 plants (defined by the Biosecurity Act 2014) observed at rehabilitated sites do not require specific management above that required at analogue sites. Weeds of National Significance to be controlled upon detection.	Ongoing throughout.

Reference milestones	Description of milestone	Minimum target					
Fire management	Ecological burning requirements of RE have been met (Table 9.8). RE-based fire regime initiated after 20 years (unless asset protection burning is required earlier), based on assessment of fuels and vegetation development.	5 Years 0% area burnt	10 Years 0% area burnt	15 to 20 Years Assess conditions for ecological burning			
Erosion/soil stability	No areas of erosion that compromise vegetation communities. Remedial works to be undertaken if assessed to be required.	5 Years <10% of area affected	10 Years <5% of area affected	15 to 20 Years 0% of area affected			
Fauna habitats	Native fauna habitats developed and assessed as suitable for target species and in a similar condition to those at analogue sites. BioCondition is used as a surrogate for fauna habitat in Queensland (Eyre et al. 2022).	Use BioCondition benchmark approach.					
Fauna use	Native fauna identified at analogue sites and prior to mining are present or indicators of these species have been recorded (e.g. scats, scratches, acoustic detection). Benchmarks for species richness can be developed for key vertebrate groups (reptiles, birds, mammals) from analogue sites.	5 Years >10% of species present (direct observation or signs)	10 Years >25% of species present (direct observation or signs)	15 to 20 Years >50% of species present (direct observation or signs)			
		At 30 years, >60% of sampled sites within rehabilitated area achieve at least 80% of the benchmark or at least 80% of the sites must achieve at least 60% of the benchmark. An acceptability matrix for assessing restoration success, based on percentages of sites achieving different levels of similarity with the mean of reference sites. Points are summed across cells and full recovery (high similarity to the reference ecosystem) is achieved when points total at least 15 (from Andersen et al. 2023):					
		Proportion (%) of sites					
			<20	20–39	40–59	60–79	≥80
Proportion (%) of target metric	≥80	4	5	6	12	20	
	60–79	3	4	5	8	14	
	40–59	2	3	4	5	6	
	20–39	1	2	3	4	5	
	<20	0	0	0	0	0	

Table 9.6 Modified BioCondition method for assessment of mine site rehabilitation (DETSI, unpublished)

BioCondition Assessable Attributes	BioCondition Assessable Attribute Weighting	Regional Ecosystem 12.3.3			Regional Ecosystem 12.11.6			Regional Ecosystem 12.11.14		
		BioCondition Benchmark ¹ Table 9.3	PRCP benchmark ²		BioCondition Benchmark ¹ Table 9.3	PRCP benchmark ²		BioCondition Benchmark ¹ Table 9.3	PRCP benchmark ²	
			c. 5yrs	c.10-15 yrs		c. 5yrs	c.10-15 yrs		c. 5yrs	c.10-15 yrs
Non-native plant cover (%)	10	0	5 < 25% non-native cover	5 < 25% non-native cover	0	5 < 25% non-native cover	5 < 25% non-native cover	0	5 < 25% non-native cover	5 < 25% non-native cover
Recruitment of canopy species (%)	5	100	0	3 >= 20% of dominant canopy species	100	0	3 >= 20% of dominant canopy species	100	0	3 >= 20% of dominant canopy species
Tree (native) Species richness	5	5	2.5 ≥25% of benchmark	5 trees ≥90%	5	2.5 ≥25% of benchmark	5 trees ≥90%	6	2.5 ≥25% of benchmarks	trees ≥90%
Shrub (native) Species richness	5	5	2.5 ≥25% of benchmark	2.5 ≥25% of benchmark	5	2.5 ≥25% of benchmark	2.5 ≥25% of benchmarks	7	2.5 ≥25% of benchmark	2.5 ≥25% of benchmark
Grass (native) Species richness ³	5	9	2.5 ≥25% of benchmark	2.5 ≥25% of benchmark	9	2.5 ≥25% of benchmark	2.5 ≥25% of benchmark	8	2.5 ≥25% of benchmark	2.5 ≥25% of benchmark
Forbes (native) and other species richness ³	5	25	2.5 ≥25% of benchmark	2.5 ≥25% of benchmark	25	2.5 ≥25% of benchmark	2.5 ≥25% of benchmark	23	2.5 ≥25% of benchmark	2.5 ≥25% of benchmark
Tree canopy Height (m)	5	25	0	3 ≥ 25% of benchmark height	25	0	3 ≥ 25% of benchmark height	25	0	3 ≥ 25% of benchmark height
Tree layer (canopy) cover	5	40	2 ≥10% relative to benchmark	5 ≥50% and ≤200% relative to benchmark	40	2 ≥10% relative to benchmark	5 ≥50% and ≤200% relative to benchmark	40	2 ≥10% relative to benchmark	5 ≥50% and ≤200% relative to benchmark
Shrub layer (canopy) cover	5	4	3 ≥10% relative to benchmark	5 ≥50% or ≤200% relative to benchmark	4	3 ≥10% relative to benchmark	5 ≥50% or ≤200% relative to benchmark	4	3 ≥10% relative to benchmark	5 ≥50% or ≤200% relative to benchmark
Native perennial grass cover (%)	5	52	3 ≥50 – 90% of benchmark cover	3 ≥50 – 90% of benchmark cover	52	3 ≥50 – 90% of benchmark cover	3 ≥50 – 90% of benchmark cover	45	3 ≥50 – 90% of benchmark cover	3 ≥50 – 90% of benchmark cover
Organic litter groundcover (%)	5	20	0	5 ≥50% and ≤200% of benchmark	20	0	5 ≥50% and ≤200% of benchmark	30	0	5 ≥50% and ≤200% of benchmark
Total BioCondition Assessable weighting score	60		>20 (Total of above = 23)	>35 (Total of above = 41.5)		>20 (Total of above = 23)	>35 (Total of above = 41.5)		>20 (Total of above = 23)	>35 (Total of above = 41.5)

¹ Source: https://www.qld.gov.au/data/assets/excel_doc/0023/170285/bioconditon-benchmark-database-table.xlsx.

² Indicative minimum scores for attributes - a site's BioCondition score can be comprised of different attribute scores but must meet or exceed the minimum (modified) BioCondition score for the relevant milestone. Attribute benchmark descriptions may be amended by application with approval of the administering authority if locally derived BioCondition Benchmarks are found to more adequately represent local conditions within well managed, undisturbed analogue sites in good condition. The 5-year PRCP benchmarks for BioCondition are intended as a guide to demonstrate rehabilitation is on an acceptable trajectory. It is acknowledged that progress may be affected (e.g. by a prolonged drought or other factors) and these factors will be taken into account when assessing rehabilitation progress / performance over short term intervals.

³ Species richness must be based on native species that occur in RE 12.3.3, RE 12.11.6 and RE 12.11.14 as per the RE technical description.

* The [BioCondition Site Assessment manual](https://www.qld.gov.au/environment/plants-animals/biodiversity/biocondition) provides an assessment protocol to measure how well an area of vegetation is functioning for the maintenance of biodiversity values and can be accessed: <https://www.qld.gov.au/environment/plants-animals/biodiversity/biocondition>

9.2.2.2. Fauna surveys

Targeted fauna surveys of rehabilitated vegetation communities will be conducted at least every five years until achievement of the PMLU, in accordance with relevant survey guidelines of State and Commonwealth agencies (e.g. Eyre et al. 2022).

Surveys will be conducted at a time of year to maximise detection of conservation significant species, and may include diurnal searches, spotlighting, acoustic recorders, camera traps and fauna trapping methods. The objectives of fauna surveys will be to determine habitat use of rehabilitated areas by fauna (with a focus on conservation significant species) and identify any factors that may be limiting habitat suitability.

Fauna surveys will also include identification of pests, such as:

- deer (multiple species)
- European hare (*Lepus europaeus*)
- feral pig (*Sus scrofa*)

Achievement of the relevant native ecosystem (bushland), freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs will include ensuring native fauna species identified are comparable to those at analogue sites; however, for the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs this will take into consideration differences in habitat.

9.2.2.3. Targeted wetland fauna surveys

Targeted surveys for wetland fauna in the littoral zone will be conducted at least every five years by qualified ecologists until achievement of the PMLU in accordance with relevant survey guidelines of State and Commonwealth agencies (e.g. Eyre et al. 2022). Surveys will be conducted at a time of year to maximise detection of conservation significant species, and may include diurnal searches, spotlighting, acoustic recorders, camera traps and fauna trapping methods. The objectives of fauna surveys will be to determine habitat use of rehabilitated areas by fauna (with a focus on conservation significant species) and identify any factors that may be limiting habitat suitability.

These will include searches for wetland birds, frogs, reptiles, and mammals including bats, which may use the wetland ecosystem for foraging, nesting, or drinking. Presence and use of wetland by fauna would include identification of pests, such as:

- cane toad (*Rhinella marina*)
- gambusia (*Gambusia holbrooki*)

Achievement of the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs will include ensuring native fauna species identified at the wetland are comparable to those at analogue sites, taking into consideration differences in habitat.

9.2.2.4. Macroinvertebrate monitoring

While the AusRivAS (DNRM, 2001) macroinvertebrate survey method was designed for flowing streams, it provides a standardised approach to assessing the diversity of macroinvertebrate communities. Net sweeps of edge habitats can be conducted in a consistent manner, with samples preserved and identified in a laboratory by a suitably qualified person.

Raw data (species and abundance) can then be compared among sites, over time and with results at analogue sites using a range of multivariate statistical analyses and diversity indices, to track the progress of ecological succession.

Diversity and community structure of macroinvertebrates will be assessed every six-months, ideally in April and October, until achievement of the PMLU.

Achievement of the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs will include ensuring macroinvertebrate diversity indices are similar to those of analogue sites and have reached a stable trajectory.

9.2.2.5. Fish surveys

A range of fish survey techniques are also available to determine the relative abundance and diversity of fish, which will be monitored annually until achievement of the PMLU.

Such monitoring will track the success of stocking programs for native species, while also detecting the movement of other species into the wetland, such as short-finned eels (which travel over land) and introduced species such as the mosquito fish.

A range of monitoring methods will be implemented by the aquatic ecologist conducting the surveys, including seine netting, dip netting, box traps and electrofishing. Diversity indices can be used to track the diversity of fish communities over time and with reference to analogue sites.

Achievement of the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs will include ensuring freshwater fish have formed self-sustaining populations and do not require supplementary stocking, with species diversity comparable to analogue sites, taking into consideration differences in habitat.

9.2.2.6. Macrophyte diversity

Transects across the littoral zone of the wetland can be used to assess macrophyte diversity and provide abundance estimates for species and the various growth forms. This will include recording the presence of weeds, focussing on:

- water hyacinth (*Eichhornia crassipes*)
- para grass (*Urochloa mutica*)
- salvinia (*Salvinia molesta*)
- olive hymenachne (*Hymenachne amplexicaule*)
- cabomba (*Cabomba caroliniana*)
- water lettuce (*Pistia stratiotes*)
- alligator weed (*Alternanthera philoxeroides*)

This will allow the succession of habitat complexity to be determined and provide a basis for interpretation of fauna monitoring data.

Diversity and abundance estimates of macrophytes will be assessed every six-months, ideally in April and October, until achievement of the PMLU.

Achievement of the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs will include ensuring the absence of blooms of algae or macrophytes which are sufficiently large, or prolonged in duration, to compromise the ecological functioning of the wetland.

9.2.2.7. Sediment quality

Condition E9 of the EA states that the rehabilitated freshwater wetland must comply with relevant sediment quality guidelines, which are presented in Table 9.7. The default guideline value indicates the concentrations below which there is a low risk of unacceptable effects on biota, and will be used with other lines of evidence to protect aquatic ecosystems. The Guideline Value (High) provides an indication of concentrations at which you might already expect to observe toxicity-related effects on biota (ANZG 2018).

Sediment quality monitoring will be conducted in accordance with the Monitoring and Sampling Manual of DES (2018).

Table 9.7 Sediment quality guidelines of ANZG (2018)

Sediment quality indicator	Default Guideline Value (mg/kg dry weight)	Guideline Value (High) (mg/kg dry weight)
Antimony	2.0	25
Arsenic	20	70
Cadmium	1.5	10
Chromium	80	370
Copper	65	270
Lead	50	220
Mercury	0.15	1.0
Nickel	21	52
Silver	1	4
Zinc	200	410
Total Petroleum Hydrocarbons	280	550

9.2.2.8. Ecological burning

Ecological burning guidelines for each RE are provided in Table 9.8 and will be followed once vegetation communities have been established. This includes guidance on the timing, intensity, and interval of fires, to best suit the ecological characteristics and requirements of each community.

These guidelines, updated as relevant, will be documented in a fire management plan to be updated as rehabilitation progresses, which will guide the use of fire as a tool to achieve rehabilitation objectives. This will include the requirement for:

- annual assessment of fuel loads and fuel characteristics
- preparation of post-burn monitoring reports

Table 9.8 Ecological burning guidelines (Essence, 2025)

RE	Ecological burning guidelines
11.3.25	SEASON: Primarily early dry season. INTENSITY: Low. INTERVAL: 3 - 5 years. STRATEGY: Protection relies on broad-scale management of surrounding country with numerous small fires throughout the year so that wildfires will be very limited in extent. c-g: Depending on position in the landscape, protection depends on broad-scale management of surrounding country, with numerous small fires throughout the year so that wildfires will be very limited in extent. ISSUES: Fringing communities are critical habitat. In some situations it may be best not to burn. Intense and extensive fires degrade vegetation structure and destroy fauna habitats. Restrict the extent and intensity of fires. Hollow trees are critical habitat. Green panic may be an issue and an intensive grazing regime for very short periods, may be necessary to limit potential of wildfire. c-g: If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants. Sedges are disadvantaged by repeated fires.
11.3.29	SEASON: Early dry season when there is good soil moisture, with some later fires in the early storm season or after good spring rains. INTENSITY: Various. INTERVAL: Most intervals between 5-10 years, with no shrubby woodlands receiving two consecutive intervals of < 6 years. STRATEGY: Once boundaries of the planned burning area are secure, ignite across the landscape in a patchwork, rather than continuous ignition strips. Use topographical features to help create a patchily burnt landscape. Where shrubby woodlands occur within a broader grassy landscape, attempt to burn the shrubby woodland during every second fire rotation in the grassy woodland, by burning early breaks around the shrubby areas. In sites with a history of wildfires recurring within 5 years, patchy burning in a few small strategic locations at 3 or 4 year intervals may reduce the incidence of extensive wildfires, while ensuring most shrubby woodland areas remain unburnt for > 5 years. ISSUES: Shrubby woodlands require longer fire intervals than grassy woodlands, because of the presence of fire-killed shrubs and the time required for post-fire regrowth to return to a mature structure. The seedlings of many fire-killed shrubs (such as some wattles) require 5 years or more before they mature. The creation of a fine-scale patchy mosaic can be more difficult to achieve in shrubby compared to grassy woodlands. Ensure seedlings of fire-killed shrubs mature and persist in the woodland. A mature shrubby woodland structure should be allowed to develop before a subsequent fire.

RE	Ecological burning guidelines
11.11.15	SEASON: Late wet to early dry season when there is good soil moisture. Early storm season or after good spring rains. INTENSITY: Various. INTERVAL: 6-15 years (shorter intervals north of bioregion: 5 - 10 years). STRATEGY: Burn less than 30% in any year. Burn under conditions of good soil moisture and when plants are actively growing. All shrubby areas will carry fire after a good season. ISSUES: Management of this fire tolerant vegetation type should be based on maintaining vegetation composition, structural diversity, animal habitats and preventing extensive wildfire. Maintaining a fire mosaic will ensure protection of habitat and mitigate against wildfires. Planned burns have traditionally been carried out in the winter dry season; further research required.
12.3.3	SEASON: Summer to late-autumn. INTENSITY: Low. INTERVAL: 3-6 years. STRATEGY: Aim to burn 40-60% of any given area. Spot ignition in cooler or moister periods encourages mosaics. ISSUES: Control of weeds is a major focus of planned burning in most areas. Maintain ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas.
12.3.6	SEASON: Late summer to mid-winter (after rain). INTENSITY: Planned and occasional unplanned burns (typically of higher intensity) influence the ecology of melaleuca ecosystems. INTERVAL: Heath 8-12 years, Sedge 12-20 years, Mixed grass/shrub 6-20 years. STRATEGY: Aim for a 25-70% burn mosaic (in association with surrounding ecosystems, as melaleuca ecosystems often just occur in patches or along natural drainage lines). Fires may, depending on the conditions and type of vegetation, burn areas larger than just the melaleuca ecosystem. Ensure secure boundaries from non-fire-regime adapted ecosystems. Consider the needs of melaleuca ecosystems based on understorey (i.e., heath dominated, sedge dominated or mixed grass/shrub) when planning burns. High soil moisture (or presence of water on the ground) is required, as avoidance of peat-type fires must be maintained. ISSUES: Fire regimes for melaleuca ecosystems require further fire research. Melaleuca forests are fire-adapted, but too high an intensity or frequent fire will slow or prevent regeneration and lead to lower species richness (since these communities contain numerous obligate seed regenerating species that require sufficient fire intervals to produce seed). High intensity fires may kill trees and lead to whipstick regeneration. Too frequent fire may result in a net loss of nutrients over time from an already nutrient poor system. Fire associations are significantly influenced by understorey composition. Melaleuca communities with a heath understorey should burn in a similar way to coastal heath (8-12 years). Sedge understorey communities will burn in association with the surrounding ecosystems (so will often burn with them but sometimes not, such that these communities have a slightly less fire frequency). Mixed understorey communities burn in a similar way to dry sclerophyll, in association with the surrounding dry sclerophyll, though somewhat less frequently due to the additional moisture present in melaleuca communities.
12.5.1	SEASON: Summer to winter. INTENSITY: Low to moderate. INTERVAL: 4-25 years. STRATEGY: Aim for 40-60% mosaic burn. Burn with soil moisture and with a spot ignition strategy so that a patchwork of burnt/unburnt country is achieved. ISSUES: The fire regime should maintain a mosaic of grassy and shrubby understoreys. Control of weeds is a major focus of planned burning in most areas. Careful thought should be given to maintaining ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas. Variability in season and fire intensity is important, as well as spot ignition in cooler or moister periods to encourage mosaics.
12.11.6	SEASON: Summer to winter. INTENSITY: Low to moderate. INTERVAL: 4-25 years. STRATEGY: Aim for 40-60% mosaic burn. Burn with soil moisture and with a spot ignition strategy so that a patchwork of burnt/unburnt country is achieved. ISSUES: The fire regime should maintain a mosaic of grassy and shrubby understoreys. Control of weeds is a major focus of planned burning in most areas. Careful thought should be given to maintaining ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas. Variability in season and fire intensity is important, as well as spot ignition in cooler or moister periods to encourage mosaics.
12.11.14	SEASON: Summer to late-autumn. INTENSITY: Low. INTERVAL: 3-6 years. STRATEGY: Aim to burn 40-60% of any given area. Spot ignition in cooler or moister periods encourages mosaics. ISSUES: Control of weeds is a major focus of planned burning in most areas. Maintain ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas.

9.2.3. Groundwater (RM9)

Continued quarterly groundwater monitoring and annual review for all parameters listed in the EA, monitoring records and trends for groundwater levels and quality.

This monitoring will be undertaken at the monitoring bore locations shown on Figure 7.15 and Figure 7.16, and identified in Table 7.10.

Current groundwater quality criteria for the Project during rehabilitation and closure is provided in Table 7.11 and Table 7.12, associated with the monitoring locations provided in Table 7.10. During the R&D phase of the Project, QER will develop site-specific groundwater quality values and apply to amend the values listed in Table 7.11 and Table 7.12.

9.2.4. Surface water (RM9 to RM10)

9.2.4.1. Water quality criteria

Surface water quality monitoring for the Project during rehabilitation and closure will be undertaken at the upstream and downstream locations shown on Figure 7.15 and identified in Table 7.8.

Current surface water quality criteria for the Project during rehabilitation and closure is provided in Table 7.9, associated with the monitoring locations provided in Table 7.8. During the R&D phase of the Project, QER will develop site-specific surface water quality values and apply to amend the values listed in Table 7.9.

9.3. Achieving monitoring across the PRCP schedule

The timescales over which rehabilitation activities will be conducted can be expected to vary considerably between the native ecosystem (bushland), and freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs.

The establishment of functional woodland ecosystems (i.e. native ecosystem (bushland) PMLU) can be expected to take approximately 20 years, due to the slow growth rates of canopy vegetation. However, a range of incremental benefits in habitat value for ecosystem services can be expected throughout this period (e.g. once established, small trees and their understory can be expected to reduce soil erosion and create some fauna habitat). This progress can be enhanced by the placement of microhabitat features (e.g. hollow logs and leaf litter) and nest boxes within the rehabilitated community.

In contrast, the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs can be expected to form functional ecosystems over shorter timeframes of 5 to 10 years once water quality within the final void has stabilised. The shorter timeframes for rehabilitation relate to:

- the fast growth rate of macrophytes
- natural recruitment of macroinvertebrates
- the ability to introduce aspects of the trophic system to the wetland, including macro-crustaceans, fish and possibly frogs and freshwater turtles (in accordance with required permits and approvals)

However, the freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs may be sensitive to imbalances in the system over the first few years, while inter-relationships between water quality, flora and biota are being established. A summary of key stages expected in the rehabilitation of terrestrial and aquatic ecosystems of ML 80003 is provided in Table 9.9.

Table 9.9 Summary of anticipated phases in the progress of rehabilitation of native ecosystem (bushland), and freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs

Timing	Native ecosystem (bushland)	Freshwater wetland (lacustrine) and freshwater wetland (palustrine)
< 6 months	• Enhance establishment of planted seedlings with irrigation and use of mulch. • Protect seedlings from foraging pressure associated with wildlife and pests.	• Water quality is variable while reaching equilibrium, which may be easily disrupted by rain events or changes in weather. • After equilibrium is reached, planted macrophytes establish, • Phytoplankton and periphyton (algae) develop and may require management. • Macroinvertebrate communities develop (likely dominated by tolerant species).
6 months to 3 years	• Reduce abundance of weeds and pests, which may outcompete seedlings. • Supply additional irrigation water as needed during dry periods.	• Water quality becomes more predictable and stable. • Macrophytes and fringing vegetation such as sedges establish, increasing diversity and habitat complexity. • Diverse assemblages of macroinvertebrates establish. • Smaller fish species may be introduced and build up numbers through natural recruitment. • Simple food web structures begin to develop.

Timing	Native ecosystem (bushland)	Freshwater wetland (lacustrine) and freshwater wetland (palustrine)
3 to 5 years	- Reduce abundance of weeds and pests, which may outcompete seedlings. - Supply additional water as needed during dry periods. - Microhabitat features may be artificially enhanced and provide some value to wildlife.	- Water quality stable, unless impacted by rare weather event. - Wetland vegetation well established, keeping algal blooms in check and creating a variety of habitats for aquatic fauna. - Larger fish species may be introduced. - Complex food web structures begin to develop.
5 to 10 years	- Start developing layers of vegetation to add to ecological complexity and microhabitats for wildlife. - Some limited use by fauna tolerant of a wide variety of conditions.	- Further development of ecological processes and habitat complexity. - Increased use of wetland by mobile terrestrial species, such as water birds, mammals and reptiles.
10 to 20 years	- Vegetation community takes on structure of Regional Ecosystem. - Ecological processes develop and require management (e.g. controlled burning). - Habitat values for wildlife establish and are commonly used.	Final freshwater wetland and associated fauna habitats develop.
20+ years	Final vegetation community and associated fauna habitats establish.	Continued persistence of freshwater wetland and associated fauna habitats.

9.4. Maintenance

Maintenance will be undertaken when monitoring identifies issues with the rehabilitation, or milestone criteria are not being met (Section 9.6). In order to select the most appropriate remedial actions, the likely cause will be assessed. Contributing factors may be related to:

- climatic conditions (i.e. droughts)
- weed presence
- poor drainage
- insufficient vegetation cover
- influence of adjacent land use
- soil type

Required rehabilitation actions are to be entered into QER's work management system for actioning.

9.5. Data analysis and reporting

Rehabilitation monitoring data will be collected and analysed by appropriately qualified and experienced persons and assessed against the milestone criteria. The data will be analysed to identify changes and trends, as well as map the trajectory of rehabilitation to identify whether it is on track to achieve the rehabilitation milestones or requires remedial actions or maintenance.

The rehabilitation data will be stored and processed within internal geospatial and document management systems.

9.6. Quality assurance and quality control

The QA/QC process to be followed as part of QER's ongoing rehabilitation monitoring provides for initial execution of the rehabilitation in accordance with the rehabilitation measures, followed by verification of how this execution as undertaken (again, according to these measures).

Based on the verification outcomes, allowance is made for implementation of corrective action and/or maintenance, as needed. The rehabilitated areas as well as corrected and/or maintenance areas then undergo further rehabilitation monitoring; and subsequent execution of the rehabilitation measures.

This process allows for a repetitive execution-verification-monitoring QA/QC approach, to ensure rehabilitation areas progress on a trajectory towards achievement of milestone criteria and eventual certification.

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Part B – PRCP Schedule

11. PRCP Schedule

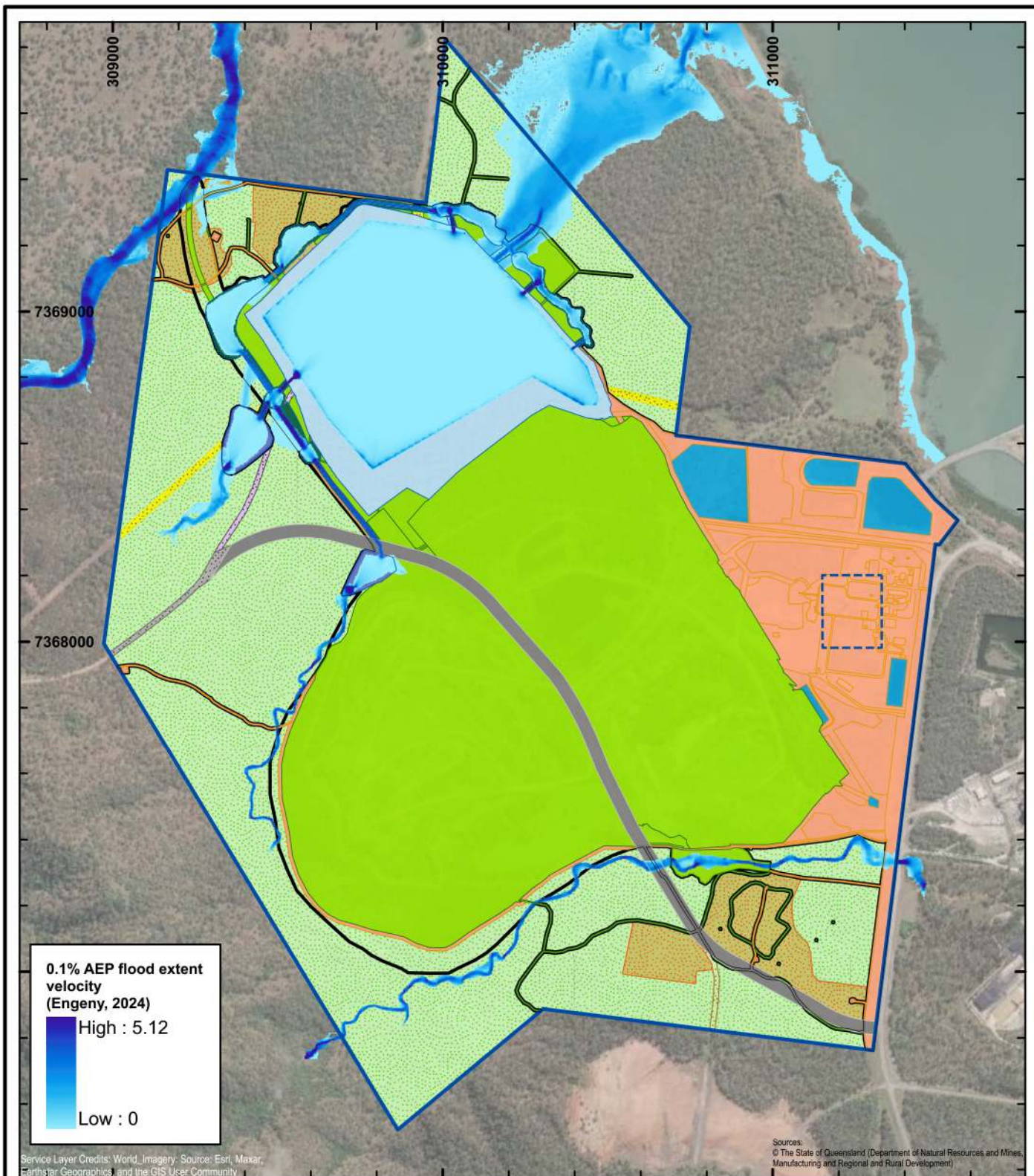
Legislative Requirement

In accordance with Section 126D(1) of the EP Act, the PRCP schedule in the PRC plan must:

- *describe the area of each resource tenure either a post-mining land use or non-use management area;*
- *for each post-mining land use state:*
 - *each rehabilitation milestone required to achieve a stable condition; and*
 - *when each rehabilitation milestone is to be achieved;*
- *for each non-use management area state:*
 - *each management milestone; and*
 - *when each management milestone is to be achieved;*
- *include maps showing the land mentioned in (a), (b) and (c).*

11.1. Final site design

The final site design for the Project, including the approved disturbance footprint, tenure boundaries, the PMLUs and the 0.1% flood event extent is shown in Figure 11.1.



QUEENSLAND ENERGY RESOURCES

Stuart Kerogen Shale Project

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GDA2020, MGA Zone 56



Figure 11.1
Post Mining Land use

Legend

ML 80003

EA Approved Disturbance Area

PFL 8

Mining and Project Areas

- Industrial
- Native ecosystem (bushland)
- Permanent infrastructure - Forest Road
- Freshwater wetland (lacustrine)
- Freshwater wetland (palustrine)
- Water Storage - Stock Use
- Water Storage - Industrial Use

Balance of ML, Non-mining Areas

- Native Ecosystem - No Disturbance Area
- Native Ecosystem
- Agriculture
- Permanent Infrastructure - Forest Road
- Permanent Infrastructure - Unused Forest Road
- Permanent Infrastructure - Power and services

Date: 21/03/2025

Drawn By: Chris Schlebusch

RTP_L_QER_STPRC_PRCMAP1001_C

Requested by: John Linden

11.2. Post mining land uses milestones

The Project RAs and relevant RMs are shown in Table 11.1. These are illustrated in the reference map provided in Section 11.4.

Table 11.1 Project Rehabilitation Areas and relevant Rehabilitation Milestones

RA ID ¹	Relevant activities	PMLU	Relevant RMs
RA01	Out-of-pit MRA	Native ecosystem (bushland)	RM1, RM2, RM3, RM4, RM5, RM8, and RM12
RA02	In-pit MRA	Native ecosystem (bushland)	RM1, RM2, RM3, RM4, RM5, RM8, and RM12
RA03	Settling ponds, Sediment dams, and CWHPs	Water storage (industrial use)	RM1, RM2, RM3, and RM11
RA04	Sediment dams and CWHPs	Industrial	RM1, RM2, RM3, RM4, and RM11
RA05	Detention ponds	Water storage (stock use)	RM1, RM2, RM3, RM10, and RM14
RA06	Plant site, haul road, and infrastructure	Industrial	RM1, RM2, RM3, RM4, and RM11
RA07	Forest Road realignment	Road reserve	RM1, RM2, RM3, and RM7
RA08	Infrastructure, and Final void perimeter	Native ecosystem (bushland)	RM1, RM2, RM3, RM4, RM5, RM8, and RM12
RA09	Exploration tracks and pads, and Ore stockpile area	Industrial	RM1, RM2, RM3, RM4, and RM11
RA10	Fuel and storage areas, and Sewage disposal area	Industrial	RM1, RM2, RM3, RM4, and RM11
RA11	Exploration tracks and pads	Native ecosystem (bushland)	RM1, RM2, RM3, RM4, RM5, RM8, and RM12
RA12	Final void	Freshwater wetland (lacustrine)	RM1, RM2, RM3, RM4, RM6, RM9, and RM13
RA13	Farm detention dam (Gully B) and Stuart Box Cut	Native ecosystem (bushland)	RM1, RM2, RM3, RM9 and RM12
RA14	Void perimeter	Freshwater wetland (palustrine)	RM1, RM2, RM3, RM4, RM6, RM9, and RM13

Extraction and processing of kerogen ore at a rate of up to 60 t/d or 2.5 t/h is proposed during the R&D period and within the next 10 years (i.e. prior to, and after, 2033). As a result, emplacement of waste (i.e. overburden/interburden and processed shale) will be required at the Out-of-pit MRA between 2023 and 2043. Therefore, the In-pit MRA Out-of-pit MRAs are not considered available for rehabilitation during the R&D period in accordance with Clause 125D(5)(ba) of the EP Act.

The RMs and milestone criteria for the Project are shown in Table 11.2.

Table 11.2 Project Rehabilitation Milestones and milestone criteria

RM reference	Rehabilitation milestone	Milestone criteria
RM1	Infrastructure decommissioning and removal	1.1 With the exception of any infrastructure to remain as part of the post mining land use (PMLU) and where infrastructure is to be retained by the landholder as evidenced by a signed landholder agreement. The following are complete: (a) All services disconnected, terminated and removed. (b) All buildings and associated infrastructure dismantled and removed offsite. (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed. (d) All fencing that is not part of PMLU requirements removed. (e) All pipelines drained and removed. (f) All waste removed. (g) All surface water drainage infrastructure removed. (h) All drillholes, bores, sediment ponds and sumps decommissioned. (i) All machinery and equipment removed from site. (j) All water storages dewatered, desilted and liners removed (as relevant).
RM2	Identification, remediation and removal of contaminated land	2.1 Contaminated Land Investigation Document completed in accordance with the EP Act, including a site investigation report, and, where required, a Validation Report and/or a draft Site Management Plan. 2.2 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site. Identification, remediation and removal of contaminated land 2.3 Any residual ore in infrastructure or surface areas has been removed and buried.
RM3	Landform development, and reshaping/reprofiling	All rehabilitation areas 3.1 All major earthworks completed, which include the earthworks to achieve required landform and slopes and general reshaping and pushing/trimming to achieve final landform. 3.2 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 3.3 AQP certifies that as constructed landform achieves design criteria for geotechnical stability with a FOS ≥ 1.5. Additional for Out-of-pit MRA (RA01) and In-pit MRA (RA02) 3.4 Reshaping and reprofiling works completed to achieve: (a) Maximum slope angles of 12 degrees. (b) PAF material does not report to the surface of the landform. (c) The landform is capped with ≥ 2 m of NAF overburden and interburden (waste). (d) design geometries are achieved to ± 0.2 m vertical height measured over a maximum distance of 50 m. (e) no weathered tertiary sediment waste rock less than moderately to highly weathered is present on the final landform surfaces. (f) An AQP confirms the achievement of items (a) to (e) including testing of the top 2m of cover for items (b), (c) and (e). 3.5 Completion of bunding works, including construction of the crest-bunding included in the landform design. 3.6 maximum 0.3 m of surface cross-slope ripping of batter slopes using a tyned machine with tynes spaced no wider than 0.5 m. 3.7 Completion of a geotechnical assessment to be carried out by an AQP to ensure slopes and void overflow points are stable. Freshwater wetland (lacustrine) (RA12) 3.8 Reshaping and reprofiling works completed to achieve: (a) Maximum slope angles of 16.7 degrees. (b) Average slope of ≤ 11.3 degrees across the void slopes. (c) slope length ≤ 30 m with a vertical height of maximum 10 m. (d) Landform is capped with ≥ 2 m of NAF overburden and interburden. (e) Tw3 waste and PAF material is not present at the final landform surfaces. (f) Littoral zone/s established as per Figure 7.18 for all void slopes reporting to the final void wetland. 3.9 Completion of a geotechnical assessment to be carried out by a suitably qualified person to ensure slopes and overflow points are stable. 3.10 Surface water runoff to the mining void do not exceed the parameters of Table 7.9. 3.11 To minimise the potential for algae blooms and aquatic weeds development in the void, structures have been established in the landform to manage surface water runoff from disturbed land e.g. the establishment of interception or drainage structures to meet the objectives of 'Treatment wetlands' of administering agency's Wetland Info Treatment wetlands — Planning and design (Department of the Environment, Tourism, Science and Innovation). Fringing wetland (palustrine) (RA14) 3.12 Reshaping and reprofiling works completed to achieve: (a) Depressions and drainage features suitable to fringing palustrine wetlands around the perimeter of the final void that are comparable to analogue sites (Byellee Wildlife Reserve wetland and Wilmot Lagoon). (b) A gentle slope of ≤ 12 degrees. (c) Reshaping varied around the waterbody to create both wider (shallower angle) and narrower (steeper angle) vegetation zones, increasing habitat variability around the wetland. (d) Littoral zone/s established as per Figure 7.19 along the edges of all wetland ponds.
RM4	Surface preparation	RA01, RA02 (excluding northern drainage zone), RA08, RA11 4.1 Soil health and suitability is assessed and documented by an AQP to confirm growth media is suitable for the PMLU and target vegetation establishment specified in RM5. 4.2 An assessment of the need for soil amelioration undertaken and applied at rates determined by an AQP to achieve the properties outlined in point 4.6 below and suitable for the PMLU. 4.3 Completion of surface ripping to a minimum of 0.3 m. 4.4 Topsoil is applied to a minimum depth of 0.3 m.

RM reference	Rehabilitation milestone	Milestone criteria
		4.5 Growth media is scarified to incorporate soil ameliorants but not to a depth that will bring waste material to the surface (i.e. less than 0.3 m, the minimum depth of growth media). 4.6 Soil depth (0 to 0.3m) demonstrates properties to support the PMLU including: (a) cation exchange capacity of >20cmol+/kg. (b) major macronutrient concentrations. i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) ≤0.5 dS/m. (e) Exchangeable sodium percentage (ESP)(%) < 6. (f) Emerson aggregate class: >3. 4.7 The surface and groundwater monitoring network is installed and monitoring commenced. Northern drainage zone (RA02) 4.8 Topsoil is spread to a minimum depth of 0.5 m. 4.9 Placement of rock cover/armour has been completed to achieve 30% rock cover. 4.10 Rock used for rock cover/armour must be NAF and have minimum slake durability of 85% after two cycles and resistant to chemical and mechanical breakdown in-situ) and must not contribute to any increase in salinity or sodicity of the soil. Freshwater wetland (lacustrine) (RA12) 4.11 The pit has filled with water to an equilibrium level of 8.1 mAHd (expected to take approximately 18 years post closure). 4.12 Results of an external groundwater review completed at closure (2060) confirming the relevant compliance bores, water quality criteria, and monitoring schedule. Fringing wetlands (palustrine) (RA14) 4.13 Conducting sampling and testing to confirm Acid Sulphate Soils are not exposed in the wetland, completed by an AQP. 4.14 Fringing wetland fills with water during which time surface water quality monitoring will be undertaken by AQP. Industrial PMLU (RA03, RA04, RA05, RA06, RA07, RA09, RA10) 4.15 Apply a groundcover over all bare ground through revegetation with grass species listed in Table 7.13 for RE 12.11.14 and/or RE 12.3.3.
RM5	Revegetation – native ecosystem (bushland) PMLU	RA01, RA08, and RA11 5.1 Seeding (or planting of tubestock) of all topsoiled surfaces completed using a species mix and seeding rate stated in Table 7.13 for RE 12.11.6 (for RA1); RE 12.11.6, RE 12.3.3, and RE 12.11.14 (for RA2); RE 12.11.6, RE 12.11.14, and RE12.3.3 (for RA8); and RE 12.11.16 (for RA11). 5.2 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 5.3 Tilling on the contour with tyne spacing no greater than 0.5 m.
RM6	Revegetation – water storage (stock use), freshwater wetland (lacustrine), and freshwater wetland (palustrine) PMLUs	6.1 Non-native seed has not been used for the revegetation (except for when sterile cover crops are used). 6.2 Tilling on the contour with tyne spacing no greater than 0.5 m. RA5 (water storage [stock use]) 6.3 Seeding of all topsoiled surfaces completed using the seed mix and seeding rate stated in Table 7.13 for RE 12.11.6. 6.4 Aquatic plant species tube stock have been planted, in the relevant zones, as detailed in Table 7.15. RA12 (freshwater wetland [lacustrine]) and RA14 (freshwater wetland [palustrine]) 6.5 Seeding of all topsoiled surfaces completed using the seed mix and seeding rate stated Table 7.13 for RE 12.11.6. 6.6 Aquatic plant species tube stock, in the relevant zones, as detailed in Table 7.15. 6.7 Native fish and macro-crustacean species introduced (once food webs develop), as detailed in Table 7.14.
RM7	Achievement of Forest Road Realignment	7.1 The realignment of Forest Road is gazetted as a State Road and accepted by the relevant QLD Government Department (i.e. Gladstone Regional Council and/or Department of Transport and Main Roads [TMR]).
RM8	Achievement of surface requirements – native ecosystem (bushland) PMLU	8.1 A BioCondition assessment is completed by an AQP using the methodology outlined in the latest version of the Queensland Herbarium's 'BioCondition Assessment Manual'. 8.2 The BioCondition assessment completed under (RM8.1) complies with the >20/60 PRCP Benchmark for the PMLU as per Table 9.6. 8.3 Where RM8.2 is not achieved, an AQP has confirmed that the ecosystem is on a trajectory to achieving the biocondition benchmarks 10-15 years of Table 9.6. 8.4 Species used in revegetation remain present and showing evidence of natural recruitment. Evidence of flora recruitment from rehabilitation monitoring data. 8.5 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 8.6 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 8.7 Weed presence is a maximum of 10% of total vegetative groundcover. 8.8 AQP confirms through annual monitoring that the ground cover achieves RM 8.6. 8.9 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 8.10 No evidence of salt accumulation at soil surface, prolonged water ponding, or bare areas greater than 10m². 8.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity of >20cmol+/kg. (b) major macronutrient concentrations:

RM reference	Rehabilitation milestone	Milestone criteria
		i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. (c) pHw range is between 6.0 to 7.5. (d) salinity (EC1:5) is less than 0.5 dS/m. (e) Exchangeable sodium percentage (ESP) (%) <6. (f) Fencing has been assembled around RAs, as applicable. (g) Emerson aggregate class: >3. 8.12 Fencing has been assembled around RAs, as applicable. 8.13 Surface water runoff from rehabilitated areas is non-polluting to receiving waters and complies with Table 7.9.
RM9	Achievement of surface and water quality requirements – freshwater wetland (lacustrine) and freshwater wetland (palustrine) PMLUs	9.1 Absence of blooms of algae or macrophytes which are sufficiently large, or prolonged in duration, to compromise the ecological functioning of the wetland. 9.2 AQP confirms that any algal or macrophyte blooms present is not of an extent that would compromise the ecological function of the wetland. 9.3 Macroinvertebrate diversity indices are similar to those of analogue sites (Figure 9.2) and have reached a stable trajectory. 9.4 Freshwater native fish have formed self-sustaining populations and do not require supplementary stocking. Species diversity comparable to analogue sites, taking into consideration differences in habitat. 9.5 AQP confirms the species presence and colonisation of Macroinvertebrates and species required to support the trajectory for the wetlands to be self-sustaining. 9.6 Native fauna species identified are comparable to those at analogue sites and of a presence that supports the wetlands to be self-sustaining i.e. frogs and fish at various lifecycles and insignificant to no populations of cane toads. 9.7 Aquatic plant species from Table 7.15 have established a continuous fringe of dense aquatic vegetation along the littoral zone depicted in Figure 7.18. 9.8 Supplemental hand planting of trees and shrubs, based on success of seed germination, has been completed. 9.9 Final tree/shrub density of 600 to 800 trees per hectare has been achieved. 9.10 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 9.11 Annual soil condition monitoring confirms growth media depth (0-0.3m) meets the following suitability criteria: (a) cation exchange capacity and major macronutrient (N, P, K, and organic C) concentrations: i. Nitrogen: Total >0.2%. ii. Phosphorus: at the recommendation of an AQP. iii. Potassium: available K>200mg K/kg soil. iv. Organic C: at the recommendation of an AQP. b. pHw range is between 6.0 to 7.5. c. primary growth media salinity (EC1:5) is less than 0.5 dS/m. d. Exchangeable sodium percentage (ESP) (%) < 6. e. Fencing has been assembled around RAs. 9.12 Water quality results at representative locations of the wetlands and locations identified in Table 7.8 monitored monthly are compliant with Table 7.9 values for a minimum period of 5 consecutive years. 9.13 If the surface water quality exceeds criteria (RM9.12), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site, then the water quality is deemed compliant with RM9.12. 9.14 For a minimum of five consecutive years groundwater quality must be monitored quarterly at compliance bores specified as Alluvium in Table 7.10. Groundwater quality results must not exceed any value for 3 consecutive results.
RM10	Achievement of water quality requirements – water storage (stock use) PMLU	10.1 All retained water storages assessed and confirmed as safe for humans, wildlife and stock and stable by an AQP. 10.2 Dams are safe for stock access and have vegetated banks. 10.3 Surface water quality results monitored quarterly must not exceed the values in Table 7.9.
RM11	Achievement of PMLU to stable condition - Industrial PMLU and Permanent Infrastructure PMLU	11.1 Minimum 70% groundcover is achieved through revegetation with grass species. 11.2 Weed presence is a maximum of 10% of total vegetative groundcover in annual monitoring. 11.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 11.4 A Hazard and Safety Assessment is completed by an AQP that demonstrates: a. Hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. b. All retained water storages (banks and spillways) are safe and stable. 11.5 Erosion and sediment control systems are installed as per the construction design and verified by an AQP. 11.6 An AQP certifies that the as constructed landform achieves design criteria and is geotechnically stable. 11.7 An AQP certifies that retained infrastructure is stable and non-polluting. 11.8 All retained water storages to be assessed and approved as safe and stable by an AQP. 11.9 Surface water runoff is non-polluting to receiving waters and complies with the values in Table 7.9. 11.10 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 11.11 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 11.12 If the surface water quality exceeds criteria (RM11.11), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM11.11.

RM reference	Rehabilitation milestone	Milestone criteria
		11.13 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, bores specified Alluvium in Table 7.10, identified in Figure 7.15 and Figure 7.16, for all quality characteristics listed in Table 7.11 and Table 7.12. 11.14 Groundwater quality results at Alluvium sites in Figure 7.15 must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.
RM12	Achievement of PMLU to stable condition – native ecosystem (bushland) PMLU	12.1 Completion of a Hazard and Safety Assessment by an AQP to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. 12.2 Water quality results monitored monthly at, but not limited to, downstream locations specified in Table 7.8, must achieve criteria specified in Table 7.9, for a minimum period of 5 consecutive years. 12.3 Where the surface water quality exceeds criteria (RM12.2), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM12.2. 12.4 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, compliance bores specified as Alluvium in Table 7.10, for all quality characteristics listed in Table 7.11 and Table 7.12. 12.5 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results. 12.6 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 12.7 An assessment of BioCondition benchmarks for Native Ecosystem (Bushland) complies with the >40/60 PRCP Benchmark for the PMLU as per Table 9.6.
RM13	Achievement of PMLU to a stable condition – Freshwater wetland (lacustrine) and freshwater wetland (palustrine)	RA12 (freshwater wetland [lacustrine]) 13.1 For the final void: (a) highwalls and low walls are internally draining. (b) void banks, spillway, and upstream water management drainage systems to manage catchment inflows to the void are assessed as safe and stable. (c) stratification modelling conducted with analysis confirming that the effects of disassembly does not impact on the achievement of the achievement and maintenance of the freshwater (lacustrine) wetland and survivability of fauna. (d) Assessment using Queensland Government's Wetland Condition Assessment Tool confirms that the lacustrine wetland is comparable to the analogue sites (Northern embayment of Lake Awoonga). (e) AQP confirms that disassembly events do not impact on the achievement of the freshwater (lacustrine) wetland. (f) is protected from flood water ingress. (g) will not cause environmental harm outside of the relevant tenure boundary. (h) is safe to humans, wildlife and livestock. (i) certification of the final void by an AQP will be undertaken to verify criteria (a) to (h) above. 13.2 Hazard and Safety Assessment completed by a appropriately qualified person demonstrates: (a) hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. (b) retained water storages (banks and spillways) are safe and stable. RA14 (freshwater wetland [palustrine]) 13.3 The palustrine wetland: (a) is stable. (b) is protected from marine flood water ingress. (c) will not cause environmental harm outside of the relevant tenure boundary. (d) is safe to humans, wildlife and livestock. (e) Assessment using Queensland Government's Wetland Condition Assessment Tool confirms that the lacustrine wetland is comparable to the analogue sites (Byelley Wildlife Reserve wetland and Wilmot Lagoon). (f) Certification by an AQP to verify criteria (a) to (e) above. 13.4 Hazard and Safety Assessment completed by an AQP demonstrates: (a) hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. (b) retained water storages (banks and spillways) are safe and stable.
RM14	Achievement of PMLU to stable condition – water storage (stock use) PMLU	14.1 Hazard and Safety Assessment completed by an AQP demonstrates: (a) hazards are of a similar type and not significantly different to hazards in neighbouring landscapes subject to a similar land use. (b) retained water storages (banks and spillways) are safe and stable. 14.2 Dams are safe for stock access and have vegetated banks. 14.3 No evidence of erosion classified as 'moderate' or 'severe' as defined by Table 9.2. 14.4 Surface water quality results monitored quarterly must not exceed the values in Table 7.9, for a minimum of 5 consecutive years. 14.5 Surface water runoff is non-polluting to receiving waters and complies with Table 7.9. 14.6 Surface water quality results monitored within 48 hours of flow at, but not limited to, downstream locations specified in Table 7.8, must not exceed the limits in Table 7.9, for a minimum of 5 consecutive years. 14.7 If the surface water quality exceeds criteria (RM14.6), the applicable upstream site must be compared to the downstream site result; if the quality result measured at a downstream site is equal to or less than the quality result measured at the applicable upstream site then the water quality is deemed compliant with RM14.6. 14.8 For a minimum of five consecutive years groundwater quality must be monitored quarterly at, but not limited to, alluvium bores specified in Table 7.10 and Figure 7.15, for all quality characteristics listed in Table 7.11 and Table 7.12. 14.9 Groundwater quality results must not exceed the values in Table 7.11 and Table 7.12, for 3 consecutive results.

11.3. Non-use management area milestones

Not applicable to the Project as there are no NUMAs.

11.4. Reference maps

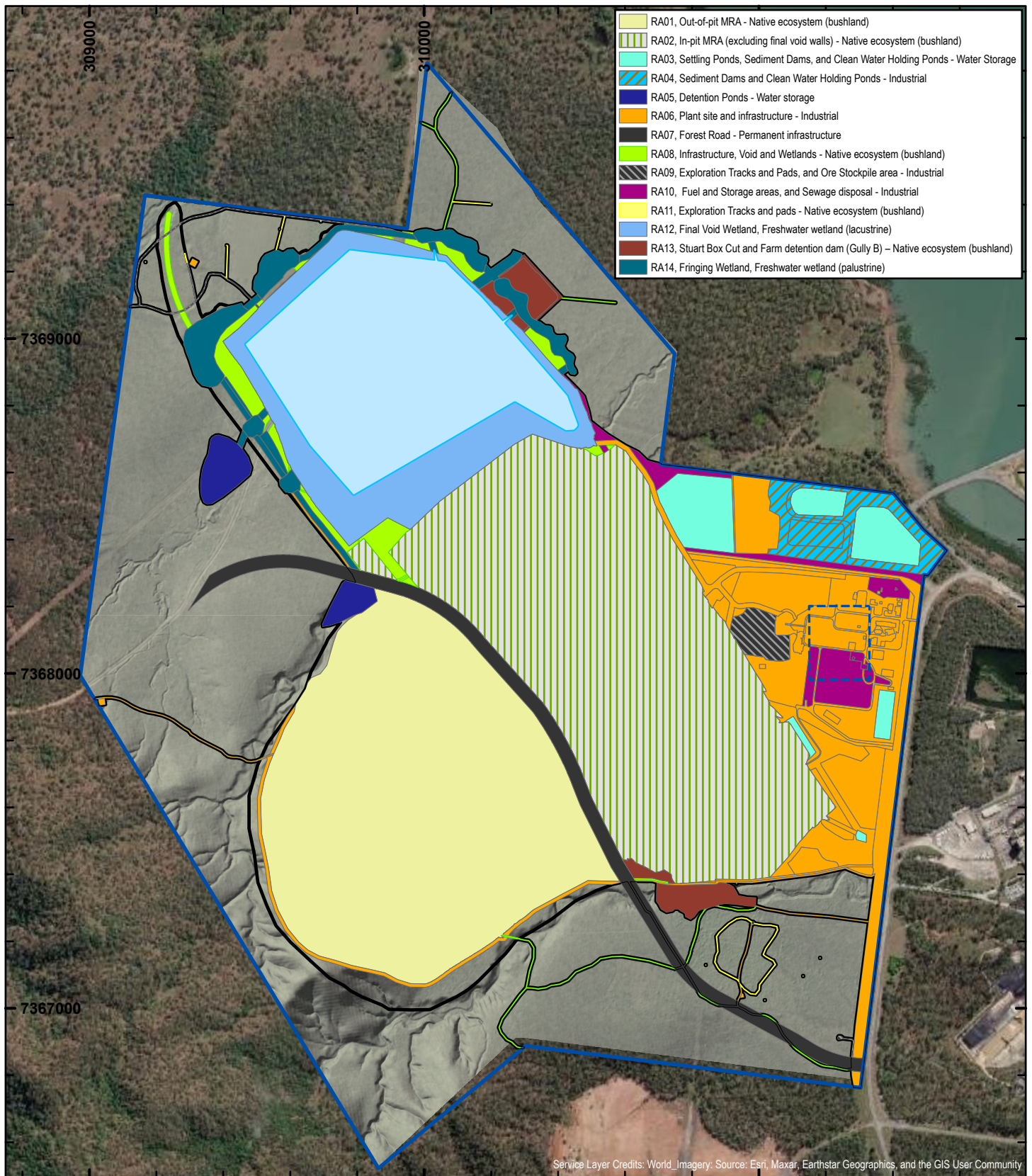
The Project reference map showing the RAs is shown in Figure 11.2.

11.5. Schedule

The schedule is based on the land being rehabilitated as soon as practicable after the land becomes available, as required under section 126D(4) of the EP Act.

While some areas will be available for rehabilitation during the R&D period, extraction, and processing of kerogen ore at a rate of up to 60 t/d or 2.5 t/h is proposed during the R&D period and within the next 10 years (i.e. prior to, and after, 2033). As a result, emplacement of waste (i.e. overburden/interburden and processed shale) resulting from extraction and processing works during the R&D period will be required at the Out-of-pit MRA between 2023 and 2043. Therefore, the In-pit MRA and Out-of-pit MRAs are not considered available for rehabilitation during the R&D period in accordance with Clause 126D(5)(ba) of the EP Act.

The proposed PRCP schedule is provided in the following pages.



0 100 200 300 400 500
m

QUEENSLAND ENERGY RESOURCES

Stuart Kerogen Shale Project

N
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GDA2020, MGA Zone 56

Figure 11.2
Post-closure
rehabilitation areas

Legend

- ML 80003
- PFL 8
- EA Approved Disturbance Area
- Typical Water Level (RL 8.1m)



Date: 12/03/2025

Drawn By: Chris Schlebusch

RTPL_QER_STPRC_PRCMAP1002_B

Requested by: John Linden

Sources:
© The State of Queensland (Department of Natural Resources and Mines,
Manufacturing and Regional and Rural Development)

11.5.1. RA01: Out-of-pit MRA – Native ecosystem (bushland) PMLU

Post-mining land uses (PMLU)				
Rehabilitation area	RA01			
Relevant activities	Out-of-pit MRA			
Total rehabilitation area size (ha)	80			
Commencement of first milestone: RM1	10/12/2045			
PMLU	Native ecosystem (bushland)			
Date area is available	10/12/2045			
Cumulative area available (ha)	80	80	80	80
Milestone completed by	10/12/2048	10/12/2050	10/12/2080	10/12/2085
Milestone Reference	Cumulative area achieved (ha)			
RM1	80			
RM2	80			
RM3	80			
RM4		80		
RM5		80		
RM8			80	
RM12				80

11.5.2. RA02: In-pit MRA – Native ecosystem (bushland) PMLU

Post-mining land uses (PMLU)																							
Rehabilitation area				RA02																			
Relevant activities				In-pit MRA																			
Total rehabilitation area size (ha)				88.5																			
Commencement of first milestone: RM1				10/12/2045																			
PMLU				Native ecosystem (bushland)																			
Date area is available	10/12/2045	10/12/2046	10/12/2047	10/12/2048	10/12/2049	10/12/2050			10/12/2055		10/12/2060												
Cumulative area available (ha)	10.3	16.9	22.7	28.5	34.2	40.1			60.8		88.5										88.5		
Milestone completed by	10/12/20248	10/12/2049	10/12/2050	10/12/2051	10/12/2052	10/12/2053	10/12/2054	10/12/2055	10/12/2058	10/12/2060	10/12/2063	10/12/2065	10/12/2068	10/12/2069	10/12/2070	10/12/2071	10/12/2072	10/12/2073	10/12/2074	10/12/2078	10/12/2079	10/12/2083	10/12/2088
Milestone Reference	Cumulative area achieved (ha)																						
RM1	10.3	16.9	22.7	28.5	34.2	40.1			60.8		88.5												
RM2	10.3	16.9	22.7	28.5	34.2	40.1			60.8		88.5												
RM3	10.3	16.9	22.7	28.5	34.2	40.1			60.8		88.5												
RM4			10.3	16.9	22.7	28.5	34.2	40.1		60.8		88.5											
RM5			10.3	16.9	22.7	28.5	34.2	40.1		60.8		88.5											
RM8													10.3	16.9	22.7	28.5	34.2	40.1		60.8		88.5	
RM12														10.3	16.9	22.7	28.5	34.2	40.1		60.8		88.5

11.5.3. RA03: Settling ponds, Sediment dams, and Clean water holding ponds – Water storage (industrial use) PMLU

Post-mining land uses (PMLU)		
Rehabilitation area	RA03	
Relevant activities	Settling ponds, Sediment dams, and Clean water holding ponds (CWHPs)	
Total rehabilitation area size (ha)	9.3	
Commencement of first milestone: RM1	10/12/2068	
PMLU	Water storage (industrial use)	
Date area is available	10/12/2068	
Cumulative area available (ha)	9.3	9.3
Milestone completed by	10/12/2070	10/12/2075
Milestone Reference	Cumulative area achieved (ha)	
RM1	9.3	
RM2	9.3	
RM3	9.3	
RM4	9.3	
RM11		9.3

11.5.4. RA04: Sediment dams and Clean water holding ponds – Industrial PMLU

Post-mining land uses (PMLU)		
Rehabilitation area	RA04	
Relevant activities	Sediment dams and Clean water holding ponds (CWHPs)	
Total rehabilitation area size (ha)	6.3	
Commencement of first milestone: RM1	10/12/2060	
PMLU	Industrial	
Date area is available	10/12/2060	
Cumulative area available (ha)	6.3	6.3
Milestone completed by	10/12/2063	10/12/2068
Milestone Reference	Cumulative area achieved (ha)	
RM1	6.3	
RM2	6.3	
RM3	6.3	
RM4	6.3	
RM11		6.3

11.5.5. RA05: Detention ponds – Water storage (stock use) PMLU

Post-mining land uses (PMLU)		
Rehabilitation area	RA05	
Relevant activities	Detention ponds	
Total rehabilitation area size (ha)	3.3	
Commencement of first milestone: RM1	10/12/2060	
PMLU	Water storage (stock use)	
Date area is available	10/12/2060	
Cumulative area available (ha)	3.3	3.3
Milestone completed by	10/12/2063	10/12/2068
Milestone Reference	Cumulative area achieved (ha)	
RM1	3.3	
RM2	3.3	
RM3	3.3	
RM4	3.3	
RM10	3.3	
RM14		3.3

11.5.6. RA06: Plant site, haul road, and infrastructure– Industrial PMLU

Post-mining land uses (PMLU)			
Rehabilitation area	RA06		
Relevant activities	Plant site, haul road, and infrastructure		
Total rehabilitation area size (ha)	39.5		
Commencement of first milestone: RM1	10/12/2065		
PMLU	Industrial		
Date area is available	10/12/2065		
Cumulative area available (ha)	39.5	39.5	39.5
Milestone completed by	10/12/2068	10/12/2069	10/12/2074
Milestone Reference	Cumulative area achieved (ha)		
RM1	39.5		
RM2		39.5	
RM3		39.5	
RM4		39.5	
RM11			39.5

11.5.7. RA07: Roads (Forest Road) – Permanent infrastructure PMLU

Post-mining land uses (PMLU)	
Rehabilitation area	RA07
Relevant activities	Forest Road Realignment
Total rehabilitation area size (ha)	11
Commencement of first milestone: RM1	10/12/2053
PMLU	Road reserve
Date area is available	10/12/2053
Cumulative area available (ha)	11
Milestone completed by	10/12/2055
Milestone Reference	Cumulative area achieved (ha)
RM1	11
RM2	11
RM3	11
RM4	11
RM7	11

11.5.8. RA08: Infrastructure, and Final void and wetlands – Native ecosystem (bushland) PMLU

Post-mining land uses (PMLU)			
Rehabilitation area	RA08		
Relevant activities	Infrastructure, and Final void perimeter		
Total rehabilitation area size (ha)	6.4		
Commencement of first milestone: RM1	10/12/2060		
PMLU	Native ecosystem (bushland)		
Date area is available	10/12/2060		
Cumulative area available (ha)	6.4	6.4	6.4
Milestone completed by	10/12/2061	10/12/2091	10/12/2096
Milestone Reference	Cumulative area achieved (ha)		
RM1	6.4		
RM2	6.4		
RM3	6.4		
RM4	6.4		
RM5	6.4		
RM8		6.4	
RM12			6.4

11.5.9. RA09: Exploration tracks and pads, and Ore stockpile area – Industrial PMLU

Post-mining land uses (PMLU)			
Rehabilitation area	RA09		
Relevant activities	Exploration tracks and pads, and Ore stockpile area		
Total rehabilitation area size (ha)	2.62		
Commencement of first milestone: RM1	10/12/2060		
PMLU	Industrial		
Date area is available	10/12/2060		
Cumulative area available (ha)	2.62	2.62	2.62
Milestone completed by	10/12/2061	10/12/2062	10/12/2067
Milestone Reference	Cumulative area achieved (ha)		
RM1	2.62		
RM2		2.62	
RM3		2.62	
RM4		2.62	
RM11			2.62

11.5.10. RA10: Fuel and storage areas, and Sewage disposal area – Industrial PMLU

Post-mining land uses (PMLU)			
Rehabilitation area	RA10		
Relevant activities	Fuel and storage areas, and Sewage disposal area		
Total rehabilitation area size (ha)	6		
Commencement of first milestone: RM1	10/12/2065		
PMLU	Industrial		
Date area is available	10/12/2065		
Cumulative area available (ha)	6	6	6
Milestone completed by	10/12/2068	10/12/2069	10/12/2074
Milestone Reference	Cumulative area achieved (ha)		
RM1	6		
RM2		6	
RM3		6	
RM4		6	
RM11			6

11.5.11. RA11: Exploration tracks and pads – Native ecosystem (bushland) PMLU

Post-mining land uses (PMLU)			
Rehabilitation area	RA11		
Relevant activities	Exploration tracks and pads		
Total rehabilitation area size (ha)	0.42		
Commencement of first milestone: RM1	10/12/2025		
PMLU	Native ecosystem (bushland)		
Date area is available	10/12/2025		
Cumulative area available (ha)	0.42	0.42	0.42
Milestone completed by	10/12/2027	10/12/2056	10/12/2061
Milestone Reference	Cumulative area achieved (ha)		
RM1	0.42		
RM2	0.42		
RM3	0.42		
RM4	0.42		
RM5	0.42		
RM8		0.42	
RM12			0.42

11.5.12. RA12: Final void and lacustrine wetland (Water storage [freshwater lacustrine wetland] PMLU)

Post-mining land uses (PMLU)				
Rehabilitation area	RA12			
Relevant activities	Final void			
Total rehabilitation area size (ha)	68.6			
Commencement of first milestone: RM1	10/12/2060			
PMLU	Freshwater wetland (lacustrine)			
Date area is available	10/12/2060			
Cumulative area available (ha)	68.6	68.6	68.6	68.6
Milestone completed by	10/12/2063	10/12/2082	10/12/2102	10/12/2103
Milestone Reference	Cumulative area achieved (ha)			
RM1	68.6			
RM2	68.6			
RM3	6.86			
RM4		68.6		
RM6		68.6		
RM9			68.6	
RM13				68.6

11.5.13. RA13: Farm detention dam (Gully B) – Native ecosystem (bushland) PMLU

Post-mining land uses (PMLU)		
Rehabilitation area	RA13	
Relevant activities	Farm detention dam (Gully B) and Stuart Box Cut	
Total rehabilitation area size (ha)	4.5	
Commencement of first milestone: RM1	10/12/2026	
PMLU	Native ecosystem (bushland)	
Date area is available	10/12/2026	
Cumulative area available (ha)	4.5	4.5
Milestone completed by	10/12/2041	10/12/2046
Milestone Reference	Cumulative area achieved (ha)	
RM1	4.5	
RM2	4.5	
RM3	4.5	
RM9	4.5	
RM12		4.5

11.5.14. RA14: Fringing palustrine wetland (Water storage – freshwater wetland [palustrine] PMLU)

Post-mining land uses (PMLU)				
Rehabilitation area	RA12			
Relevant activities	Void perimeter			
Total rehabilitation area size (ha)	9.2			
Commencement of first milestone: RM1	10/12/2060			
PMLU	Water storage – freshwater wetland (palustrine)			
Date area is available	10/12/2060			
Cumulative area available (ha)	9.2	9.2	9.2	9.2
Milestone completed by	10/12/2063	10/12/2068	10/12/2088	10/12/2089
Milestone Reference	Cumulative area achieved (ha)			
RM1	9.2			
RM2	9.2			
RM3	9.2			
RM4		9.2		
RM6		9.2		
RM9			9.2	
RM13				9.2

Part C - Appendices

Appendix A

PRCP Transition Notice (Ref: 101/0005990-001[E])

Appendix B

PRC plan Stuart Kerogen Shale Project DES
engagement memorandum

Appendix C

Final Land Use and Rehabilitation Plan

Appendix D

Environmental Impact Assessment

Appendix E

The Stuart R&D Project MLA 80003 Environmental
Overview Management Strategy (EMOS)

Appendix F

Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste

Appendix G

Contaminated Site Assessment

Appendix H

Landform Cover Design

Appendix I

Rehabilitation Landform Design

Appendix J

Revegetation Plan

Appendix K

Hydrology and Water Management Technical Study

Appendix L

Hydrogeological Report

Appendix M

Terrestrial and Aquatic Ecology Technical Report

Appendix N

Risk Assessment

N.1 Combined specialist report risk assessment

Table N.1 Combined specialist report risk assessments

Scenario #	Scenario	Hazard / source of risk / threats	Control / treatment	Consequence	Likelihood	Risk rating
Final landform/final void failure						
1	Out-of-pit and In-pit MRAs Erosion of MRA batters causing damage to cover material exposing contaminants with the potential to impact surface water quality.	Flooding in existing waterways interacting with the Out-of-pit MIRA causing erosion.	Assessment of the PMF event in natural gullies surrounding the mine landform show negligible interaction with the mine landform and therefore is improbable to occur.	2 – Minor	1 – Improbable	Low
2	Out-of-pit and In-pit MRAs Climate changing assessed flood behaviour resulting in flood risks not identified in the flooding assessment.	Climate change causing increased storm intensity resulting in larger rare flooding events.	Flooding assessment shows negligible impacts associated with the PMF and therefore increased magnitude of more frequent events due to climate change is not expected to result in flood risks unidentified by the assessment.	2 – Minor	2 – Unlikely	Low
3	Out-of-pit and In-pit MRAs Erosion of MRA batters causing damage to cover material exposing contaminants with the potential to impact surface water quality.	Rainfall runoff on the MRA surface not well managed causing concentrated flow and erosion.	Rehabilitation milestones for the cover and revegetation of the mine landform to confirm surface water runoff is adequately managed.	2 – Minor	2 – Unlikely	Low
4	Out-of-pit MRA Seepage from Out-of-pit MRA reporting to local waterways impacting the receiving waterway quality.	Rainfall infiltration through the Out-of-pit MRA seeping at the toe to the receiving environment instead of reporting to the pit lake.	MRA emplacement configured so seepage will be contained within the pit shell and report to the final void. Out-of-pit MRA cover designed to improve drainage relief to reduce infiltration and the generation of seepage.	2 – Minor	2 – Unlikely	Low
5	Out-of-pit and In-pit MRAs / Final void Excess rainfall infiltration through the Out-of-pit and In-pit MRA surfaces reporting to the pit lake impacting water quality and the PMLU.	Cover on the MRA is not completed to design due to material availability or poor construction.	MRA cover designed to improve drainage relief to reduce infiltration and the generation of seepage. Geotechnical investigations for available construction materials to be conducted during operations.	2 – Minor	2 – Unlikely	Low
6	Final void Pit lake water quality deteriorating and spilling to downstream waterway causing impacts to the receiving waters environmental values.	Inflows to the pit lake are of poorer water quality than expected resulting in poorer water quality during overflow events.	Water quality monitoring of the pit lake and drainage gullies during the pit lake filling period.	3 – Moderate	1 – Improbable	Medium
7	Final void Pit lake does not overtop resulting in concentration of water quality from evaporation and groundwater impacting the PMLU.	Water inflow volumes are less than expected due to poor diversion of catchments or assumed runoff characteristics resulting in a lower equilibrium level with a reduced spill frequency.	Water level and volume monitoring of the pit lake during the filling period to validate water balance model assumptions and the predicted pit lake behaviour.	3 – Moderate	2 – Unlikely	Medium
8	Out-of-pit & In-pit MRA/ Final Void Pit Lake Poor rehabilitation implementation result in contaminants remaining post closure resulting in contaminated runoff entering the receiving waterways.	Construction of the mine landform rehabilitation is not adequate with contaminants remaining at the surface post closure.	Certifying engineers to be involved in construction quality assurance and review of monitoring data during rehabilitation establishment.	2 – Minor	1 – Improbable	Low
9	Final void Flood ingress causing erosion or failure of the pit walls.	Climate change causing increased storm intensity resulting in larger rare flooding events.	Flooding assessment shows negligible impacts associated with the PMF and therefore increased magnitude of more frequent events due to climate change is not expected to result in flood risks unidentified by the assessment.	2 – Minor	2 – Unlikely	Low
10	Final void Flood ingress causing erosion or failure of the pit walls.	Extreme flooding in Targinie Creek entering the pit void at an uncontrolled location.	Assessment of the PMF event in Targinie Creek shows no interaction with the pit lake.	1 – Insignificant	1 – Improbable	Low
11	Final void Flood ingress causing erosion or failure of the pit walls.	Flood management lagoons around the pit highwall fail and cause excess concentrated flow entering the pit lake.	Detailed design of the lagoons during the operational phase of the mine including assessment of failure and erosion protection to be completed.	3 – Moderate	2 – Unlikely	Medium
Alteration of hydrogeological conditions						
12	Drawdown from dewatering As groundwater is extracted during periods of mining, a cone of depression has developed, and it will intermittently change in depth and extent as the pit progresses to the north	If groundwater discharge to the surface water features in question had been reduced as a consequence of drawdown, there could be impacts to the Aquatic GDE (i.e. the constructed dam southeast of the Project site).	With respect to the constructed dam area and the Boat Creek area, Not present – currently no impact is observed; the future impact will not occur because mining and the cone of depression will progress to the north (away from the GDE or potential GDE). No control/treatment necessary.	2 – Minor	0 – Not possible	Highly improbable

Scenario #	Scenario	Hazard / source of risk / threats	Control / treatment	Consequence	Likelihood	Risk rating
13	Drawdown from dewatering As groundwater is extracted during periods of mining, a cone of depression has developed, and it will intermittently change in depth and extent as the pit progresses to the north	If groundwater discharge to the surface water features in question had been reduced as a consequence of drawdown, there could be impacts to the Aquatic GDE (i.e. potential spring zones along Humpy and Targinie Creek).	With respect to the potential spring zones, the pathway is highly unlikely to be present – drawdown west of the Western Faulted Zone is very limited and unlikely to impact over the distance to these creeks. No control/treatment necessary.	2 – Minor	1 – Improbable	Low
14	Onsite water storages, excluding the pit void Saline and sulfate-enriched seepage is possible, if improbable, given the results from onsite water quality monitoring.	If the solute enriched water were to flow to any of the potential receptors, it could impact the Aquatic GDEs (i.e. the constructed dam southeast of the Project site and potential spring zones along Humpy and Targinie Creek).	Groundwater flow is to the northeast, and not towards any of the potential aquatic GDEs. No control/treatment necessary.	2 – Minor	0 – Not possible	Highly improbable
15	Pit void The existing pit void has held acidic water. Acid and sulfate-enriched drainage generation on exposed pit wall is likely due to the exposure of sulfide-bearing ore to oxidation. This process will be lessened at closure when pit walls are submerged.	If the solute enriched water were to flow to any of the potential receptors, it could impact the Aquatic GDEs (i.e. the constructed dam southeast of the Project site and potential spring zones along Humpy and Targinie Creek).	Groundwater flow is locally toward the pit void (during operations) and regionally to the northeast, and not towards any of the potential aquatic GDEs. No control/treatment necessary.	2 – Minor	0 – Not possible	Highly improbable
16	Surface MRA (the Out-of-pit MRA stockpile) Saline and sulfate-enriched drainage/seepage is possible. The engineered cover for the Out-of-pit and In-pit MRAs will lessen the potential risk.	If the solute enriched water were to flow to any of the potential receptors, it could impact the Aquatic GDEs (i.e. the constructed dam southeast of the Project site and potential spring zones along Humpy and Targinie Creek).	Groundwater flow is to the northeast, and not towards any of the potential aquatic GDEs. No control/treatment necessary.	2 – Minor	0 – Not possible	Highly improbable
17	In-pit MRA Saline and sulfate-enriched water above or below the saturated zone is possible. These risks are considered relatively low and detailed in Terrenus (2023) because the salinity generated by processed shale is expected to result in leachate with an EC, which is below the background salinity of the groundwater in the Project site.	If the solute enriched water were to flow to any of the potential receptors, it could impact the Aquatic GDEs (i.e. the constructed dam southeast of the Project site and potential spring zones along Humpy and Targinie Creek).	Groundwater flow is to the northeast, and not towards any of the potential aquatic GDEs. No control/treatment necessary.	2 – Minor	0 – Not possible	Highly improbable
18	Drawdown from dewatering, Surface MRA (the Out-of-pit MRA, In pit MRA, and stockpile) and the final void	If water level or water quality changes occur these have the potential to impact stygofauna likely present, though noted to be species not considered to be unique in the regional context	Impact is considered insignificant, with any potential impact limited to individuals which have no biodiversity value.	1 – Insignificant	3 – Possible	Low
19	Drawdown from dewatering As groundwater is extracted during periods of mining, a cone of depression has developed, and it will intermittently change in depth and extent as the pit progresses to the north	If groundwater levels beneath the terrestrial GDEs are lowered, vegetation access to water could be restricted. If the terrestrial GDEs are reliant only on moisture in the unsaturated zone, drawdown of the water table is not a pathway that can affect the availability of that water.	Drawdown is present but is not a likely pathway Records show that groundwater level decline is potentially present in areas beneath the mapped REs within ML 80003. However, it is not expected that this decline could act as a pathway for impact, as the terrestrial ecosystem is only likely to be reliant on moisture above the water table. No control/treatment necessary.	2 – Minor	1 – Improbable	Low
20	Drawdown from dewatering As groundwater is extracted during periods of mining, a cone of depression has developed, and it will intermittently change in depth and extent as the pit progresses to the north	If groundwater levels beneath the terrestrial GDEs are lowered, vegetation access to water could be restricted. If the terrestrial GDEs are reliant only on moisture in the unsaturated zone, drawdown of the water table is not a pathway that can affect the availability of that water.	Drawdown is present but is not a likely pathway With respect to the mapped GDE area outside of ML 80003 (i.e., the area to the northeast of the Project), the potential reliance on moisture from the water table is unknown. Because the Project will progress to the north, drawdown in this area of these potential GDEs is possible, but highly unlikely because of the proximity of these potential GDEs to the coast. No control/treatment necessary.	2 – Minor	1 – Improbable	Low
21	Drawdown from dewatering As groundwater is extracted during periods of mining, a cone of depression has developed, and it will intermittently change in depth and extent as the pit progresses to the north	If groundwater levels beneath the terrestrial GDEs are lowered, vegetation access to water could be restricted. If the terrestrial GDEs are reliant only on moisture in the unsaturated zone, drawdown of the water table is not a pathway that can affect the availability of that water.	Drawdown is not present There is no pathway for mining activities to change the amount of soil moisture or vadose zone water that is available to the terrestrial GDEs. This is dictated by the amount of rainfall, infiltration, and evaporation. Although clearing for mining may have increased infiltration (e.g., due to decreased transpiration), this is not linked to impacts from groundwater changes. No control/treatment necessary.	2 – Minor	0 – Not possible	Highly improbable
22	Onsite water storages, excluding the final void Saline and sulfate-enriched seepage is possible, if improbable, given the results from onsite water quality monitoring.	If impacted groundwater is present in the rooting zone of vegetation, then it could impact the GDEs. If the terrestrial GDEs are reliant only on infiltrating moisture in the unsaturated zone, then migration or diffusion from infiltrating seepage below water storages could form a viable pathway for impact.	Not present and unlikely in future There are no REs of concern or mapped potential GDEs near the onsite water storages. Furthermore, groundwater near the water storages is saline and unlikely to be accessed by vegetation on this basis. No control/treatment necessary.	2 – Minor	1 – Improbable	Low

Scenario #	Scenario	Hazard / source of risk / threats	Control / treatment	Consequence	Likelihood	Risk rating
23	Onsite water storages, excluding the final void Saline and sulfate-enriched seepage is possible, if improbable, given the results from onsite water quality monitoring.	If impacted groundwater is present in the rooting zone of vegetation, then it could impact the GDEs. If the terrestrial GDEs are reliant only on infiltrating moisture in the unsaturated zone, then migration or diffusion from infiltrating seepage below water storages could form a viable pathway for impact.	Not present There are no potential terrestrial GDEs that directly overlie the onsite water storages, therefore, there is no pathway for impact from infiltration or diffusion in the unsaturated zone. No control/treatment necessary.	2 – Minor	0 – Not possible	Highly improbable
24	Final void The existing pit void has held acidic water. Acid and sulfate-enriched drainage generation on exposed pit wall is likely due to the exposure of sulfide-bearing ore to oxidation. This process will be lessened at closure when pit walls are submerged.	If impacted groundwater is present in the rooting zone of vegetation, then it could impact the GDEs. If the terrestrial GDEs are reliant only on infiltrating moisture in the unsaturated zone, then migration or diffusion from infiltrating seepage below water storages could form a viable pathway for impact.	Present In the area of future pit void, REs of concern are mapped. However, the groundwater dependence of the vegetation in these REs is uncertain (and unlikely); groundwater in the area of the future void is saline and it is unlikely to be relied upon by vegetation because of its natural salinity; additionally, the predicted long-term pit water quality of the final void is generally of higher quality (i.e. lower salinity) than nearby groundwater (Terrenus, 2023). No control/treatment necessary.	2 – Minor	1 – Improbable	Low
25	Final void The existing pit void has held acidic water. Acid and sulfate-enriched drainage generation on exposed pit wall is likely due to the exposure of sulfide-bearing ore to oxidation. This process will be lessened at closure when pit walls are submerged.	If impacted groundwater is present in the rooting zone of vegetation, then it could impact the GDEs. If the terrestrial GDEs are reliant only on infiltrating moisture in the unsaturated zone, then migration or diffusion from infiltrating seepage below water storages could form a viable pathway for impact.	Present With respect to the mapped GDE area outside of ML 80003 (i.e. the area to the northeast of the Project), the potential reliance on moisture from the water table is unknown. However, the predicted long-term pit water quality of the final void is generally of higher quality (i.e., lower salinity) than nearby groundwater (Terrenus, 2023). No control/treatment necessary.	2 – Minor	1 – Improbable	Low
26	Final void The existing pit void has held acidic water. Acid and sulfate-enriched drainage generation on exposed pit wall is likely due to the exposure of sulfide-bearing ore to oxidation. This process will be lessened at closure when pit walls are submerged.	If impacted groundwater is present in the rooting zone of vegetation, then it could impact the GDEs. If the terrestrial GDEs are reliant only on infiltrating moisture in the unsaturated zone, then migration or diffusion from infiltrating seepage below water storages could form a viable pathway for impact.	Not present There are no potential terrestrial GDEs that directly overlie the void, therefore, there is no pathway for impact from infiltration or diffusion in the unsaturated zone. No control/treatment necessary.	2 – Minor	0 – Not possible	Highly improbable
27	Surface MRA (the Out-of-pit MRA stockpile) Saline and sulfate-enriched drainage/seepage is possible. The engineered cover for the Out-of-pit and In-pit MRAs will lessen the potential risk.	If impacted groundwater is present in the rooting zone of vegetation, then it could impact the GDEs. If the terrestrial GDEs are reliant only on infiltrating moisture in the unsaturated zone, then migration or diffusion from infiltrating seepage below water storages could form a viable pathway for impact.	Not present (for the Out-of-pit MRA and stockpile) and unlikely in future in the In-pit MRA There are not potential GDEs above or near the Out-of-pit MRA or stockpile. In the area of In-pit MRA, there are existing REs of concern of mapped. However, the groundwater dependence of the vegetation in these REs is uncertain (and unlikely); groundwater in the area of the future In-pit MRA is saline and it is unlikely to be relied upon by vegetation because of its natural salinity. No control/treatment necessary.	2 – Minor	1 – Improbable	Low
28	Surface MRA (the Out-of-pit MRA stockpile) Saline and sulfate-enriched drainage/seepage is possible. The engineered cover for the Out-of-pit and In-pit MRAs will lessen the potential risk.	If impacted groundwater is present in the rooting zone of vegetation, then it could impact the GDEs. If the terrestrial GDEs are reliant only on infiltrating moisture in the unsaturated zone, then migration or diffusion from infiltrating seepage below water storages could form a viable pathway for impact.	Potentially present There is potential REs of concern mapped directly over the future In-pit MRA, there is a pathway for impact from infiltration or diffusion in the unsaturated zone. However, this area is also proposed to be impacted by physical disturbance (i.e., clearing due to pit progression). No control/treatment necessary.	2 – Minor	1 – Improbable	Low
29	Drawdown from dewatering As groundwater is extracted during periods of mining, a cone of depression has developed, and it will intermittently change in depth and extent as the pit progresses to the north	Groundwater bores used for aquaculture, irrigation, or livestock watering There are no irrigation or stock watering bores within ML 80003, but these are known EVs within the greater Project site, most commonly in the Targinie Quartz Monzonite. However: if groundwater levels at the locations of existing or potential future irrigation or livestock bores is lowered, groundwater user access to water could be restricted. There is no known aquaculture in the greater Project area, but this is listed on Schedule 1 of the EPP Water for the area. Any potential future aquaculture projects are highly likely to utilise surface water rather than groundwater.	Unlikely to be present The historical cone of depression is mainly contained within ML 80003 to the west and almost exclusively within the Rundle Formation, which hosts water that is too saline for these uses. The current and predicted cone of depression does extend beyond ML 80003 to the north and south; however, this is limited to <1.6 km, within the Rundle Formation. No control/treatment necessary.	2 – Minor	1 – Improbable	Low
30	Drawdown from dewatering As groundwater is extracted during periods of mining, a cone of depression has developed, and it will intermittently change in depth and extent as the pit progresses to the north	Groundwater bores used for aquaculture, irrigation, or livestock watering There are no irrigation or stock watering bores within ML 80003, but these are known EVs within the greater Project site, most commonly in the Targinie Quartz Monzonite. However: if groundwater below or near these infrastructure locations was impacted by enriched solute loads, and it flowed towards existing or theoretical future bores, the water quality at those bores could be impacted.	Not present and highly unlikely in future It is highly unlikely that existing or theoretical future bores are located close enough or in the correct direction (i.e., northeast of ML 80003) to be impacted. Additionally, groundwater within the Rundle Formation is too saline for these groundwater users, thus development of future bore fields for irrigation or stock water in the impacted areas (close to the disturbance zone) is highly unlikely. No control/treatment necessary.	2 – Minor	1 – Improbable	Low

Scenario #	Scenario	Hazard / source of risk / threats	Control / treatment	Consequence	Likelihood	Risk rating
		There is no known aquaculture in the greater Project area, but this is listed on Schedule 1 of the EPP Water for the area. Any potential future aquaculture projects are highly likely to utilise surface water rather than groundwater.				
31	Drawdown from dewatering As groundwater is extracted during periods of mining, a cone of depression has developed, and it will intermittently change in depth and extent as the pit progresses to the north	Water used for visual recreational use Unknown and unspecified users in the greater region. Water must be visible at the surface. Thus, for this receptor to exist, there must be significant contributions of groundwater to the theoretical recreation area. If groundwater levels at the locations of visual recreational use is lowered during operational pumping periods, groundwater to springs could be restricted.	Not present Although there may be some groundwater contributions to surface water bodies in the Project area, these are a minor (<15%) component of surface flows and reduction in groundwater discharge is not likely to impact any capacity for visual recreational use of that surface water feature. No control/treatment necessary.	1 – Insignificant	0 – Not possible	Highly improbable
32	Surface MRA (the Out-of-pit MRA stockpile) Saline and sulfate-enriched drainage/seepage is possible. The engineered cover for the Out-of-pit and In-pit MRAs will lessen the potential risk.	N/A. None – groundwater quality changes do not impact visual use of water.	N/A. None – groundwater quality changes do not impact visual use of water. No control/treatment necessary.	1 – Insignificant	0 – Not possible	Highly improbable
33	Drawdown from dewatering As groundwater is extracted during periods of mining, a cone of depression has developed, and it will intermittently change in depth and extent as the pit progresses to the north	Water used for industrial purposes (mining) Industrial use is proposed PMLU for the Project site. If groundwater levels at the locations of potential industrial bores is lowered during operational pumping periods, groundwater user access to water could be restricted.	Currently present, absent in closure Records show that moderate groundwater level decline is present in areas where groundwater has been extracted near the existing void; however, the final void is predicted to be a groundwater source, which will prevent groundwater drawdown in the long term (post-closure). No control/treatment necessary.	1 – Insignificant	3 – Possible	Low
34	Surface MRA (the Out-of-pit MRA stockpile) Saline and sulfate-enriched drainage/seepage is possible. The engineered cover for the Out-of-pit and In-pit MRAs will lessen the potential risk.	Water used for industrial purposes (mining) Industrial use is proposed PMLU for the Project site. However, groundwater is not a significant source of industrial water. Water quality of the groundwater is saline, and therefore limits the beneficial use for industrial purposes. If groundwater quality at the locations of potential industrial bores is altered to exceed certain water quality objectives, impacts may be experienced by the groundwater user.	Not present and highly unlikely in future Water quality changes that may have or might occur are highly unlikely to change the utility of water used for industrial purposes (i.e., solute concentrations for Project groundwater are already greater than required by most industrial processes). In addition, post-mining impact to groundwater quality is expected to include some dilution of saline groundwater with fresher water from the final void, as the void is predicted to be a source to groundwater. Therefore, negative impact regarding water quality for industrial use is further unlikely. No control/treatment necessary.	1 – Insignificant	1 – Improbable	Low
35	Drawdown from dewatering, Surface MRA (the Out-of-pit MRA, In pit dump, and stockpile) and the final void	Cultural and spiritual value Spiritual values of groundwater in the Project site are likely linked to the cultural and spiritual values of surface waters. As such, all potential pathways and risks are as listed above for aquatic GDEs.	As above for aquatic GDEs.	As above for aquatic GDEs.	As above for aquatic GDEs.	As above for aquatic GDEs.
Alteration of surface water hydrology						
36	Surface water management: Out-of-pit and In-pit MRAs Erosion of MRA batters causing damage to cover material exposing contaminants with the potential to impact surface water quality.	Rainfall runoff on the MRA surface not well managed causing concentrated flow and erosion.	Rehabilitation milestones for the cover and revegetation of the mine landform to confirm surface water runoff is adequately managed.	2 – Minor	2 – Unlikely	Low
37	Surface water management: Out-of-pit MRA Seepage from Out-of-pit MRA reporting to local waterways impacting the receiving waterway quality.	Rainfall infiltration through the Out-of-pit MRA seeping at the toe to the receiving environment instead of reporting to the pit lake	MRA emplacement configured so seepage will be contained within the pit shell and report to the final void. Out-of-pit MRA cover designed to improve drainage relief to reduce infiltration and the generation of seepage.	2 – Minor	2 – Unlikely	Low
38	Surface water management: Out-of-pit and In-pit MRAs/ Final void Excess rainfall infiltration through the Out-of-pit and In-pit MRA surfaces reporting to the pit lake impacting water quality and the PMLU.	Cover on the MRA is not completed to design due to material availability or poor construction.	MRA cover designed to improve drainage relief to reduce infiltration and the generation of seepage. Geotechnical investigations for available construction materials to be conducted during operations.	2 – Minor	2 – Unlikely	Low
39	Surface water management: Final void Pit lake water quality deteriorating and spilling to downstream waterway causing impacts to the receiving waters environmental values.	Inflows to the pit lake are of poorer water quality than expected resulting in poorer water quality during overflow events.	Water quality monitoring of the pit lake and drainage gullies during the pit lake filling period.	3 – Moderate	1 – Improbable	Medium

Scenario #	Scenario	Hazard / source of risk / threats	Control / treatment	Consequence	Likelihood	Risk rating
40	Surface water management: Final void Pit lake does not overtop resulting in concentration of water quality from evaporation and groundwater impacting the PMLU.	Water inflow volumes are less than expected due to poor diversion of catchments or assumed runoff characteristics resulting in a lower equilibrium level with a reduced spill frequency.	Water level and volume monitoring of the pit lake during the filling period to validate water balance model assumptions and the predicted pit lake behaviour.	3 – Moderate	2 – Unlikely	Medium
41	Surface water management: All Poor rehabilitation implementation result in contaminants remaining post closure resulting in contaminated runoff entering the receiving waterways.	Construction of the mine landform rehabilitation is not adequate with contaminants remaining at the surface post closure.	Certifying engineers to be involved in construction quality assurance and review of monitoring data during rehabilitation establishment.	2 – Minor	1 – Improbable	Low
Alteration of flood hydrology						
42	Flooding: Out-of-pit and In-pit MRAs Erosion of MRA batters causing damage to cover material exposing contaminants with the potential to impact surface water quality.	Flooding in existing waterways interacting with the Out-of-pit MIRA causing erosion.	Assessment of the PMF event in natural gullies surrounding the mine landform show negligible interaction with the mine landform and therefore is improbable to occur.	2 – Minor	1 – Improbable	Low
43	Flooding: Natural drainage paths Change in flow behaviour causing erosion or scour in existing waterways.	Increased catchment reporting to existing waterways or restriction of the existing flow path increase flow velocity in large flood events.	Overland catchment from the mine landform reports mostly to the pit lake resulting in negligible increase in catchment to the natural gullies surrounding the mine landform.	2 – Minor	1 – Improbable	Low
44	Flooding: All Climate changing assessed flood behaviour resulting in flood risks not identified in the flooding assessment.	Climate change causing increased storm intensity resulting in larger rare flooding events.	Flooding assessment shows negligible impacts associated with the PMF and therefore increased magnitude of more frequent events due to climate change is not expected to result in flood risks unidentified by the assessment.	2 – Minor	2 – Unlikely	Low
45	Flooding: Final void Flood ingress causing erosion or failure of the pit walls.	Extreme Flooding in Targinie Creek entering the pit void at an uncontrolled location.	Assessment of the PMF event in Targinie Creek shows no interaction with the pit lake.	1 – Insignificant	1 – Improbable	Low
46	Flooding: Final void Flood ingress causing erosion or failure of the pit walls.	Flood management lagoons around the pit highwall fail and cause excess concentrated flow entering the pit lake.	Detailed design of the lagoons during the operational phase of the mine including assessment of failure and erosion protection.	3 – Moderate	2 – Unlikely	Medium
Impact on rehabilitation of terrestrial ecological values						
47	Alteration of ecological systems	Edge effects of adjacent industrial development to impact on the quality of vegetation and fauna habitat.	Provide continuation of vegetation communities in adjacent areas, where possible. Maximise the patch size of re-vegetated areas within constraints of the project design.	2 – Minor	3 – Possible	Medium
48	Alteration of ecological systems	Poor establishment of planted material due to narrow genetic base, disease susceptibility.	Develop and implement a detailed restoration plan, involving the sourcing of plant material from appropriate sources.	2 – Minor	2 – Unlikely	Low
49	Ineffective management of rehabilitation activities	Poor weed control or introduction of new weeds.	Implement a weed management plan for rehabilitated areas.	2 – Minor	3 – Possible	Medium
50	Ineffective management of rehabilitation activities	Planted material impacted by pest species (e.g. deer, hares, and pigs).	Implement a pest management plan for rehabilitated areas.	2 – Minor	3 – Possible	Medium
51	Variable climate conditions	Exposure to adverse climate conditions (i.e. drought or extreme wet weather).	Monitor planted material and soil moisture. Increase irrigation during periods of drought. Use appropriate tools to increase soil moisture, such as mulch around plantings and stormwater management systems.	2 – Minor	2 – Unlikely	Low
52	Ineffective management of rehabilitation activities	Vegetation communities are impacted by fire, or subject to fire regimes that are inconsistent with their long-term persistence.	Develop and implement fire management plan for rehabilitated areas, which aligns with the ecological requirements of each RE.	2 – Minor	2 – Unlikely	Low
53	Ineffective management of rehabilitation activities	The long periods of time taken to regenerate vegetation communities hinders the success of the rehabilitation program.	Develop and implement a detailed restoration plan. Carefully monitor and support vegetation, particularly in early years, to avoid setbacks. Introduce microhabitat features for key fauna species (e.g. logs, leaf litter).	2 – Minor	2 – Unlikely	Low
54	Inappropriate rehabilitation design	Edaphic conditions of the landform are not suitable for planted vegetation. This may include inappropriate topsoil, structure of underlying rock base, high concentrations of contaminants in soil.	Obtain specialist input into the design of landform specifications.	2 – Minor	3 – Possible	Medium
Impact on rehabilitation of aquatic ecological values						
55	Alteration of ecological systems	Invasion of wetland habitats by pest species (e.g. cane toads), which outcompete native species and reduce diversity.	Ensure good establishment of fringing aquatic vegetation, including sedges.	2 – Minor	4 – Likely	Medium
56	Inappropriate rehabilitation design	Inappropriate landform design (e.g. banks too steep), reducing the size of the wetland margins that may be colonised by macrophytes.	Ensure landform design allows for appropriate slopes and distances to deep water, facilitating the establishment of a functional littoral zone.	2 – Minor	2 – Unlikely	Low

Scenario #	Scenario	Hazard / source of risk / threats	Control / treatment	Consequence	Likelihood	Risk rating
57	Inappropriate rehabilitation design	Inconsistent water balance, which results in too much or not enough freshwater recharge from surface water runoff, affecting the equilibrium of the wetland.	Consider the results of water balance modelling in the design of the final landform.	2 – Minor	2 – Unlikely	Low
58	Alteration of ecological systems	Incursions of weeds, algae, or dominant native macrophyte species (e.g. <i>Azolla</i>) which dominate the aquatic ecosystem and impact on water quality (e.g. low dissolved oxygen).	Monitor for the presence of weeds and control infestations using appropriate methods, in accordance with a management plan.	3 – Moderate	3 – Possible	Significant
59	Ineffective management of rehabilitation activities	Poor water quality, caused by runoff of sediments, nutrients, or contaminants from disturbed parts of catchment. Inputs of groundwater with poor water quality.	Implement effective erosion and sediment control practices in the wetland catchment, to protect water quality of the final void. Limit the introduction of contaminants to the wetland catchment (e.g. clean up spills, use clean topsoil). Conduct groundwater study to assist in the design of the freshwater wetland.	2 – Minor	3 – Possible	Medium
60	Ineffective management of rehabilitation activities	Poor sediment quality due to the settling of contaminants at concentrations that impact on biota.	Implement effective erosion and sediment control practices in the wetland catchment, to protect water quality of the final void. Limit the introduction of contaminants to the wetland catchment (e.g. clean up spills, use clean topsoil).	2 – Minor	2 – Unlikely	Low
61	Alteration of ecological systems	Interruption of ecosystem processes due to thermal or salinity-based stratification of the lake or food web disruptions.	Use surface water modelling to inform the design of the wetland. Monitor the wetland for stratification seasonally and implement practices to improve water quality in deeper sections of the wetland if required. Carefully establish aquatic ecosystem food webs before introducing higher order predators (e.g. larger fish species)	2 – Minor	3 – Possible	Medium
Insufficient, inadequate, or inappropriate soil and capping material required for rehabilitation activities						
62	Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land use is not achieved.	Potential impacts including: - erosion; - sediment transport; - topsoil loss; and - failure of vegetation (poor vegetation growth or incorrect vegetation affecting PMLU). The above potentially being a result of: - poor soil fertility; - unstable material (erosive, dispersive); - weed infestation; - disturbance by fauna (movement, burrowing, etc.); - incorrect placement depth and surface treatment; - incorrect soil characterisation and amelioration requirements; - insufficient topsoil; and/or - inappropriate topsoil stockpiling and management.	Mitigating controls include: - monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works; and - repair erosion areas, retest soil and revegetate. These would be achieved through: - initial topsoil survey, mapping and material balancing; - provide data into the mine plan to drive correct placement of materials; - review the topsoil material balance periodically during operations to ensure sufficient volumes for the rehabilitation needs; - undertake rehabilitation planning and preparation in accordance with the specific requirements for soil, seed and management for the relevant PMLU; - management of topsoil stripping and application during rehabilitation; and - topsoil assessment by suitably qualified person to determine ameliorant and fertiliser requirements.	3 – Moderate	2 – Improbable	Medium
Inadequate and/or inappropriate revegetation						
63	Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land use is not achieved.	Potential impacts including: - exposed soils due to poor vegetation establishment and growth, resulting in enhance erosion rates; - increased weed establishment and growth; and - need for ongoing corrective action – soil sampling and analysis, amelioration and revegetation. The above potentially being a result of: - unfavourable climatic conditions and/or weather events; - incorrect or poor seed quality species mix; - weed contaminated seed; - poor quality topsoil or seed bed preparation; and - erosion.	Mitigating controls include: - monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works; and - repair erosion areas, retest soil, review seed mix and revegetate. These would be achieved through: - topsoil assessment by suitably qualified person to determine ameliorant and fertiliser requirements; - management of seed selection and quality; and - plant at optimal time of year.	3 – Moderate	2 – Improbable	Medium
Deterioration of built infrastructure conditions						
64	Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land use is not achieved.	Potential impacts including: reduced soil fertility to support the PMLU of native ecosystem (bushland); and	Mitigating controls include: undertake a PSI prior to the completion of the approved activities, identify if any areas require a further DSI and remediation plan developed if required; and	2 – Minor	2 – Improbable	Low

Scenario #	Scenario	Hazard / source of risk / threats	Control / treatment	Consequence	Likelihood	Risk rating
		potential contamination of surface water runoff affecting integrity of local catchments. The above potentially being a result of: 1. Potential soil contamination around infrastructure and industrial areas.	- conduct ongoing maintenance. These would be achieved through: - clean up and remediate contamination during operational period; and - undertake PSI contaminated land assessment post mining to identify any areas requiring further DSI.			

N.2 Geochemical Source-Pathway-Risk Assessment

A source-pathway-receptor (SPR) assessment has been undertaken with regard to the potential environmental geochemical impacts from mineral waste facilities (and the final void) on potential (plausible) receptors. The SPR outlines the relationship between potential sources of run-off and seepage (e.g. final landforms), plausible receptors (e.g. creeks, groundwater) and the pathways between the two (e.g. run-off, seepage). The SPR for the geochemical assessment focuses on surface water and groundwater pathways and receptors, these being the most relevant pathways and receptors for AMD, OD and salinity from final landforms and the final void.

The likelihood of a landform or final void walls developing AMD was determined based on the AMD hazard scoring of a final landform and final void (Table N.1).

Table N.1 AMD hazard scoring for final landforms and final void

Component	Rating	Category	Definition
AMD Hazard scoring matrix for final landforms			
Propensity for AMD generation, per landform, for all landform components: - waste rock; and - processed shale.	1	Implausible	Geochemical properties suggest that the vast majority of the source material has a negligible potential for AMD generation (less than 5% of the samples with potential for AMD)
	5	Plausible	Geochemical properties suggest that a significant proportion of the source material may have potential for AMD generation (5-40% of the samples with potential for AMD)
	7	Expected	Geochemical properties suggest that the source material has a high potential for AMD generation but has not yet been observed in the field (due to lag time) -(>40% of the samples with potential for AMD)
	15	Certain	AMD issues have been observed in the field from the source material
AMD Capacity Per landform, for all landform components: - waste rock; and - processed shale.	1	Low	Source material has an implausible propensity (1) for AMD generation – as AD and/or NMD and/or SD.
	3	Low-Moderate	Source material has an implausible (1) or plausible (5) propensity to generate AMD, with 75 th percentile total S less than 0.8%; or Source material has a plausible (5) or expected (7) propensity to generate NMD and/or SD only (i.e. not AD), with 75 th percentile total S greater than 1.0%.
	5	Moderate	Source material has an expected (7) or certain (10) propensity to generate AMD, with 75 th percentile total S less than 1.0% and with potential to generate AD
	7	Moderate-High	Source material has an expected (7) or certain (10) propensity to generate AMD, with 75 th percentile total S ranging from 1.0% to 1.5% and with potential to generate AD
	10	High	Source material has an expected (7) or certain (10) propensity to generate AMD, with 75 th percentile total S greater than 1.5% and with potential to generate AD
AMD Quantity Per landform for all landform components: - waste rock; and - processed shale.	1	Low	All source material rated LOW for AMD capacity
	3	Low-Moderate	Less than 10% of source material (in the landform) classified as 'PAF' or NAF-S and rated as Low or Low-Moderate for AMD capacity
	5	Moderate	Less than 10% of source material (in the landform) classified as 'PAF' or NAF-S and rated as Moderate for AMD capacity; or Greater than 10% of source material (in the landform) classified as 'PAF' or NAF-S and rated as Low-Moderate or Moderate for AMD capacity
	7	Moderate-High	Less than 10% of source material (in the landform) classified as 'PAF' or NAF-S and rated as Moderate-High or High for AMD capacity
	10	High	Greater than 10% of source material (in the landform) classified as 'PAF' or NAF-S and rated as Moderate-High or High for AMD capacity

Component	Rating	Category	Definition
AMD hazard scoring matrix for the final void			
Propensity for AMD generation for all final void wall and floor components: - waste rock; and - processed shale.	1	Implausible	Geochemical properties suggest that the vast majority of the exposed material has a negligible potential for AMD generation (less than 5% of the samples with potential for AMD)
	5	Plausible	Geochemical properties suggest that a significant proportion of the exposed material may have potential for AMD generation (5-40% of the samples with potential for AMD)
	7	Expected	Geochemical properties suggest that the exposed material has a high potential for AMD generation but has not yet been observed in the field (due to lag time) -(>40% of the samples with potential for AMD)
	15	Certain	AMD issues have been observed in the field from the exposed material
AMD Capacity All final void wall and floor components: - waste rock; and - processed shale.	1	Low	Exposed material has an implausible propensity (1) for AMD generation – as AD and/or NMD and/or SD; or exposed material is less than 1% of total exposure
	3	Low-Moderate	Exposed material has an implausible (1) or plausible (5) propensity to generate AMD, with 75 th percentile total S less than 0.8%; or exposed material is less than 1% of total exposure. <u>OR</u> Source material has a plausible (5) or expected (7) propensity to generate NMD and/or SD only (ie. not AD), with 75 th percentile total S greater than 1.0%; or exposed material is less than 1% of total exposure.
	5	Moderate	Exposed material has an expected (7) or certain (10) propensity to generate AMD, with 75 th percentile total S less than 1.0% and with potential to generate AD
	7	Moderate-High	Exposed material has an expected (7) or certain (10) propensity to generate AMD, with 75 th percentile total S ranging from 1.0% to 1.5% and with potential to generate AD
	10	High	Exposed material has an expected (7) or certain (10) propensity to generate AMD, with 75 th percentile total S greater than 1.5% and with potential to generate AD
AMD Quantity All final void wall and floor components: - waste rock; and - processed shale.	1	Low	Less than 5% of exposed wall and floor (combined) area are classified as 'PAF' or NAF-S. Exposed means above water (exposed to air).
	3	Low-Moderate	Between 5% and 15% of exposed wall and floor (combined) area are classified as 'PAF' or NAF-S. Exposed means above water (exposed to air).
	5	Moderate	Between 15% and 30% of exposed wall and floor (combined) area are classified as 'PAF' or NAF-S. Exposed means above water (exposed to air).
	7	Moderate-High	Between 30% and 50% of exposed wall and floor (combined) area are classified as 'PAF' or NAF-S. Exposed means above water (exposed to air).
	10	High	Greater than 50% of exposed wall and floor (combined) area are classified as 'PAF' or NAF-S. Or, AMD affected water in final void.

To support the assessment of the AMD closure risks, the AMD hazard scores are assigned likelihood rankings (Table N.2).

Table N.3 AMD hazard ranking and final landform / final void AMD likelihood ranking

AMD hazard ranking	Landform AMD likelihood ranking
0 – 5	Highly Unlikely: Highly unusual; may occur in extreme circumstances
5 – 10	Unlikely / Plausible: Known to occur, but only rarely
10 – 15	Probable: May reasonably occur
15 – 20	Likely: Could easily occur
>20	Highly Likely: Expected to occur

A residual risk rating matrix (Table N.4) has been adopted to assess the risks associated with SPR from the mineral waste landforms and the final void. In reference to the risk matrix, the SPR assessment includes the likelihood (chance) of the event occurring, the severity of the event (should the event occur) and the calculated risk rating (likelihood x severity). SPR assessment results are provided in Table N.5.

Table N.4 Risk matrix for SPR assessment

Risk Rating = Likelihood x Severity		Severity				
		S1	S2	S3	S4	S5
Likelihood	Highly Likely (>80%)	Medium	Medium to High	High	High	High
	Likely (50-80%)	Low to Medium	Medium	Medium to High	High	High
	Probable (20-50%)	Low	Low to Medium	Medium	Medium to High	High
	Unlikely / Plausible (5-20%)	Low	Low	Low to Medium	Medium	Medium to High
	Highly Unlikely (<5%)	Low	Low	Low	Low to Medium	Medium

Table N.5 SPR assessment results

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk rating
Out-of-pit landform: Surface water receptors via run-off and via seepage (shallow groundwater) and final void receptor via seepage (groundwater)						
Out-of-pit landform (post-closure) Comprised of approximately: 75% weathered waste rock; 8% unweathered waste rock; 17% ATP processed shale; and - Contains small proportion of Paraho processed shale from TDP. AMD source hazard is Low Salinity (non-oxidative) source hazard is Low-Moderate Run-off estimated to be approximately 10% of average annual rainfall. Infiltration into the landform (beyond the root zone) estimated to be approximately 7% of average annual rainfall.	Surface water run-off into water storage (stock use) [then wetland lagoon system]. Distance <100m to receptor (north) <i>Potential for AMD to enter surface water run-off: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900µS/cm to enter surface water run-off: Unlikely/Plausible</i>	Water storage (stock use) @ northern side of landform (via surface water run-off). <i>Potential for AMD to reach water storage (stock use): Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach water storage (stock use): Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting water storage (stock use) [via run-off] Neutral metalliferous drainage: Metals and metalloids impacting water storage (stock use) [via run-off] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting water storage (stock use) [via run-off] Saline drainage (non-oxidative): Salt impacting water storage (stock use) [via run-off]	Highly Unlikely Unlikely Highly Unlikely Probably	S2 S2 S2 S2	Low Low Low Low
	Seepage into shallow permeable strata then into water storage (stock use). Distance <100m to receptor (north) <i>Potential for AMD to enter shallow permeable strata: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: Unlikely/Plausible</i>	Water storage (stock use) @ northern side of landform (via shallow permeable strata): <i>Potential for AMD to reach water storage (stock use): Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach water storage (stock use): Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting water storage (stock use) [via seepage] Neutral metalliferous drainage: Metals and metalloids impacting water storage (stock use) [via seepage] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting water storage (stock use) [via seepage] Saline drainage (non-oxidative): Salt impacting water storage (stock use) [via seepage]	Highly Unlikely Unlikely Highly Unlikely Unlikely	S2 S2 S2 S2	Low Low Low Low
	Surface water run-off into Gully B. Distance <100m to receptor (south) <i>Potential for AMD to enter surface water run-off: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900µS/cm to enter surface water run-off: Unlikely/Plausible</i>	Ephemeral creek (via run-off): Gully B @ southern side of landform. <i>Potential for AMD to reach Gully B: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach Gully B: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting Gully B [via run-off] Neutral metalliferous drainage: Metals and metalloids impacting Gully B [via run-off] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Gully B [via run-off] Saline drainage (non-oxidative): Salt impacting Gully B [via run-off]	Highly Unlikely Unlikely Highly Unlikely Probable	S2 S2 S2 S2	Low Low Low Low
	Seepage into shallow permeable strata then into ephemeral Gully B. Distance <100m to receptor (south) <i>Potential for AMD to enter shallow permeable strata: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: Unlikely/Plausible</i>	Ephemeral creek (via shallow permeable strata): Gully B @ southern side of landform. <i>Potential for AMD to reach Gully B: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach Gully B: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting Gully B [via seepage] Neutral metalliferous drainage: Metals and metalloids impacting Gully B [via seepage] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Gully B [via seepage] Saline drainage (non-oxidative): Salt impacting Gully B [via seepage]	Highly Unlikely Unlikely Highly Unlikely Unlikely	S2 S2 S2 S2	Low Low Low Low
	Seepage into alluvial aquifer then into final void. Distance <100m to receptor (northeast) <i>Potential for AMD to enter alluvial aquifer: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to enter alluvial aquifer: Unlikely/Plausible</i>	Final void (via alluvial aquifer) @ northeast of landform. <i>Potential for AMD to reach final void: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach final void: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting alluvial aquifer and/or final void [via seepage] Neutral metalliferous drainage: Metals and metalloids impacting alluvial aquifer and/or final void [via seepage] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting alluvial aquifer and/or final void [via seepage] Saline drainage (non-oxidative): Salt impacting alluvial aquifer and/or final void [via seepage]	Highly Unlikely Unlikely Highly Unlikely Unlikely	S2 S2 S2 S2	Low Low Low Low
In-pit landform: Surface water receptors via runoff and via seepage (shallow groundwater) and final void receptor via seepage (groundwater)						
In-pit landform (post-closure) Comprised of approximately: 35% weathered waste rock; 4% unweathered waste rock; and 60% Paraho processed shale. AMD source hazard is Low-Moderate	Surface water run-off into final void. Distance <100m to receptor (north) <i>Potential for AMD to enter surface water run-off: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900µS/cm to enter surface water run-off: Unlikely/Plausible</i>	Final void @ northern side of landform (via surface water run-off). <i>Potential for AMD to reach final void: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach final void: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting final void [via run-off] Neutral metalliferous drainage: Metals and metalloids impacting final void [via run-off] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting final void [via run-off] Saline drainage (non-oxidative): Salt impacting final void [via run-off]	Highly Unlikely Unlikely Highly Unlikely Probable	S1 S1 S1 S1	Low Low Low Low
	Seepage into final void. Distance <100m to receptor (north) <i>Potential for AMD to enter seepage pathway to final void: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to enter seepage pathway to final void: Unlikely/Plausible</i>	Final void @ northern side of landform (via seepage). <i>Potential for AMD to reach final void: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach final void: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting final void [via seepage] Neutral metalliferous drainage: Metals and metalloids impacting final void [via seepage] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting final void [via seepage] Saline drainage (non-oxidative): Salt impacting final void [via seepage]	Highly Unlikely Unlikely Unlikely Unlikely	S1 S1 S1 S1	Low Low Low Low

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk rating
<i>Salinity (non-oxidative) source hazard is Low</i> Run-off estimated to be approximately 10% of average annual rainfall. Infiltration into the landform (beyond the root zone) estimated to be approximately 7% of average annual rainfall.	<u>Surface water run-off into Gully B, Gully C, Gully D or water storage (industrial use).</u> Distance <100m to receptors (south, northeast and east) <i>Potential for AMD to enter surface water run-off: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900µS/cm to enter surface water run-off: Unlikely/Plausible</i>	Ephemeral creek and dam (via run-off): Gully B south of landform, gullies C and D northeast of landform, and water storage (industrial use) east of landform. <i>Potential for AMD to reach receptors: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach receptors: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting gullies B, C, D and/or water storage (industrial) Dam [via run-off] Neutral metalliferous drainage: Metals and metalloids impacting gullies B, C, D and/or water storage (industrial use) [via run-off] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting gullies B, C, D and/or water storage (industrial use) [via run-off] Saline drainage (non-oxidative): Salt impacting gullies B, C, D and/or water storage (industrial) Dam [via run-off]	Highly Unlikely	S2	Low
				Unlikely	S2	Low
				Highly Unlikely	S2	Low
				Probable	S2	Low
	<u>Seepage into shallow permeable strata then into ephemeral Gully B, Gully C and/or Gully D.</u> Distance <100m to receptors (south, northeast and east) <i>Potential for AMD to enter shallow permeable strata: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to enter shallow permeable strata: Unlikely/Plausible</i>	Ephemeral creek (via shallow permeable strata): Gully B south of landform and gullies C and D northeast of landform. <i>Potential for AMD to reach Gully B, Gully C and/or Gully D: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach gullies B, C and/or D: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting gullies B, C, D and/or water storage (industrial) Dam [via seepage] Neutral metalliferous drainage: Metals and metalloids impacting gullies B, C, D and/or water storage (industrial use) [via seepage] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting gullies B, C, D and/or water storage (industrial use) [via seepage] Saline drainage (non-oxidative): Salt impacting gullies B, C, D and/or water storage (industrial) Dam [via seepage]	Highly Unlikely	S2	Low
				Unlikely	S2	Low
				Unlikely	S2	Low
				Unlikely	S2	Low
Final void: End-of-mining void walls and floor – void receptor prior to wall/floor capping – <i>The end-of-mining SPR scenario is temporary, until such time that the void floor and walls are reshaped and the void begins filling with water (post-closure). Runoff and seepage into the void prior to reshaping (ie. until the post-mining void becomes a 'final void') will be treated and released as per the management of the existing mine pit.</i>						
Final void: end-of-mining void (dry) (post-mining, prior to reshaping of pit floor and walls) Walls and floor, <u>assuming all rock is exposed</u>, comprises approximately: 37.9% moderately to extremely weathered waste rock (Qa, Tw1 and Tw2); 3.3% slightly to moderately weathered waste rock (Tw3); 2.4% unweathered CF; and 56.4% unweathered KCK. PAF exposure on walls and floor conservatively estimated at 47% (final void walls/floor surface area). Based on this, <i>AMD source hazard is Moderate and Salinity (non-oxidative) source hazard is Unlikely</i> Assuming walls are covered by mineral waste during void reshaping (to cover PAF rock), PAF exposure on final void walls and floor will be much less –	Surface water run-off from exposed walls/floor into void. Post-mining void is a groundwater sink. <i>Potential for AMD to enter pathway (run-off into the void): Likely</i> <i>Potential for salt (non-oxidative) >900µS/cm to enter pathway (run-off into the void): Unlikely/Plausible</i>	Post-mining void. <i>Potential for AMD to reach receptor (post-mining void): Likely</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach the void: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting post-mining void water quality	Likely	S3	Medium to High
			Metalliferous drainage: Metals and metalloids impacting post-mining void water quality	Likely	S2	Medium
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting post-mining void water quality	Likely	S2	Medium
			Saline drainage (non-oxidative): Salt impacting post-mining void water quality	Unlikely	S2	Low

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk rating
indicatively about 10-15%, which would result in an <i>AMD source hazard of Low-Moderate and Salinity (non-oxidative) source hazard of Unlikely.</i>						
Final void (water-filled) surface water receptors via final void overflow and groundwater receptors via seepage from final void						
Final void (water filled) (post closure freshwater wetland) Approximately 26% of the total final void wall and floor area will be exposed (above 8.2 mAHD). The exposed materials comprise approximately: 96% moderately to extremely weathered waste rock (Qa, Tw1 and Tw2); 2.5% slightly to moderately weathered waste rock (Tw3); and 1.5% unweathered - Rock (mostly KCK; minor CF). <i>AMD source hazard is Low-Moderate.</i> <i>Salinity (non-oxidative) source hazard is Low.</i>	<u>Overflow (surface water run-off) into Gully E and/or wetland lagoon system.</u> Distance <100m to receptor (east) <i>Potential for AMD to cross spillway: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900µS/cm to cross spillway: Unlikely/Plausible</i>	Ephemeral creek (via final void spillway): Gully E @ eastern side of final void (via final void surface water run-off). <i>Potential for AMD to reach Gully E: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach Gully E: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting Gully E [via final void spilling] Neutral metalliferous drainage: Metals and metalloids impacting Gully E [via final void spilling] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Gully E [via final void spilling] Saline drainage (non-oxidative): Salt impacting Gully E [via final void spilling]	Highly Unlikely Highly Unlikely Highly Unlikely Highly Unlikely	S1 S1 S1 S1	Low Low Low Low
	<u>Seepage from final void into shallow aquifer.</u> Distance <100m to receptor <i>Potential for AMD to enter shallow alluvial aquifer: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to enter shallow alluvial aquifer: Unlikely/Plausible</i>	Shallow (alluvial) aquifer at the final void. <i>Potential for AMD to reach the shallow alluvial aquifer from the water-filled final void: Highly Unlikely</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach the aquifer from the water-filled final void: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting the shallow aquifer [via seepage from the water-filled final void] Neutral metalliferous drainage: Metals and metalloids impacting the shallow aquifer [via seepage from the water-filled final void] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting the shallow aquifer [via seepage from the water-filled final void] Saline drainage (non-oxidative): Salt impacting the shallow aquifer [via seepage from the water-filled final void]	Highly Unlikely Unlikely Unlikely Unlikely	S1 S2 S2 S2	Low Low Low Low
	<u>Seepage from final void into fractured (Rundle) aquifer.</u> Distance <100m to receptor <i>Potential for AMD to enter fractured rock (Rundle) aquifer: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to enter fractured rock (Rundle) aquifer: Unlikely/Plausible</i>	Fractured rock (Rundle) aquifer at the final void. <i>Potential for AMD to reach the fractured rock (Rundle) aquifer from the water-filled final void: Highly Unlikely</i> <i>Potential for salt (non-oxidative) >900 µS/cm to reach the fractured rock (Rundle) aquifer from the water-filled final void: Unlikely/Plausible</i>	Acid/acidic drainage: Low pH water impacting the fractured rock (Rundle) aquifer [via seepage from the water-filled final void] Neutral metalliferous drainage: Metals and metalloids impacting the fractured rock (Rundle) aquifer [via seepage from the water-filled final void] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting the fractured rock (Rundle) aquifer [via seepage from the water-filled final void] Saline drainage (non-oxidative): Salt impacting the fractured rock (Rundle) aquifer [via seepage from the water-filled final void]	Highly Unlikely Unlikely Unlikely Unlikely	S1 S2 S2 S2	Low Low Low Low
	<u>Seepage from final void into groundwater then to the terrestrial GDE at the coast.</u> Distance ~1km to receptor (northeast) <i>Potential for AMD to enter pathway: Unlikely/Plausible</i> <i>Potential for salt (non-oxidative) >900 µS/cm to enter pathway: Unlikely/Plausible</i>	Terrestrial GDE at the coast ~1km from the final void. <i>Potential for AMD from the void to reach the terrestrial GDE at the coast via groundwater: Highly Unlikely</i> <i>Potential for salt (non-oxidative) >900 µS/cm from the void to reach the terrestrial GDE at the coast via groundwater: Highly Unlikely</i>	Acid/acidic drainage: Low pH water impacting the terrestrial GDE at coast [via seepage from the water-filled final void] Neutral metalliferous drainage: Metals and metalloids impacting the terrestrial GDE at coast [via seepage from the water-filled final void] Saline drainage (from sulfide oxidation): Salt (sulfate) impacting the terrestrial GDE at coast [via seepage from the water-filled final void] Saline drainage (non-oxidative): Salt impacting the terrestrial GDE at coast [via seepage from the water-filled final void]	Highly Unlikely Highly Unlikely Highly Unlikely Highly Unlikely	S1 S2 S2 S2	Low Low Low Low

Appendix O

Community Consultation Register

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