REPORT

Supporting Information for Application for Amendment to EPML00370013

for Rolleston Coal Holdings Pty Ltd

10/05/2023

COAL ASSETS AUSTRALIA

GLENCORE

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1 Introduction

Mining and Energy Technical Services Pty Ltd (METServe) has been engaged by Rolleston Coal Holdings Pty Ltd (RCH), owner of Rolleston Open Cut Coal Mine (ROC) to prepare an application to amend Environmental Authority (EA) EPML00370013.

RCH seek approval to extend the current operation through the Spring Creek North Continuation Project (SCNCP). The SCNCP would extend the mining area of the existing ROC operation by mining north of the current Spring Creek pit on ML70307 and onto the northern section of ML70415.

Approval of the SCNCP would facilitate improved mine closure outcomes and increase resource recovery, however, the proposed SCNCP will not increase the mine's production rate or extend the life of mine (LoM) for the overall ROC operation.

This document provides a description of the proposed amendments to the approved ROC Environmental Authority and provides supporting environmental assessment and management considerations.

2 Current Approved Operations

2.1 Proponent

The ROC is owned and operated by Rolleston Coal Holdings Pty Ltd (RCH). RCH is owned by Glencore Operations Australia Pty Limited, which is owned by Glencore PLC (Glencore).

2.2 Description of the Existing Operation

The ROC is an open cut, thermal coal operation located in the Bowen Basin, a major coal producing region in Central Queensland. The ROC is situated approximately 275 kilometres (km) west of Gladstone and approximately 16 km west of the town of Rolleston in the Central Highlands Regional Council area.

The ROC commenced mining in 2005 within Mining Lease (ML) 70307. Since that time ROC has been granted additional ML's to facilitate expanded mining operations, as well as supporting infrastructure such as a rail loop, and for surface water management. Current, as well as future planned mining and rehabilitation activities will be undertaken on the 5 ML's that make up the ROC. These ML's are listed in **Table 1,** along with an overview of their approval date, areas, and purpose.

Table 1 ROC Mining Leases

Mining Lease (ML)	Approved Date	Name	Purpose	Area (ha)
70307	29/05/2003	Rolleston	Coal Mining	4,860
70415	02/02/2016	Rolleston West	Coal Mining	6,226
70416	17/02/2016	Rolleston South	Coal Mining	2,623
70418	31/05/2013	Rolleston Rail Loop	Rail, Sediment Dam	163
70458	02/02/2016	Springwood	Water Management	3,589

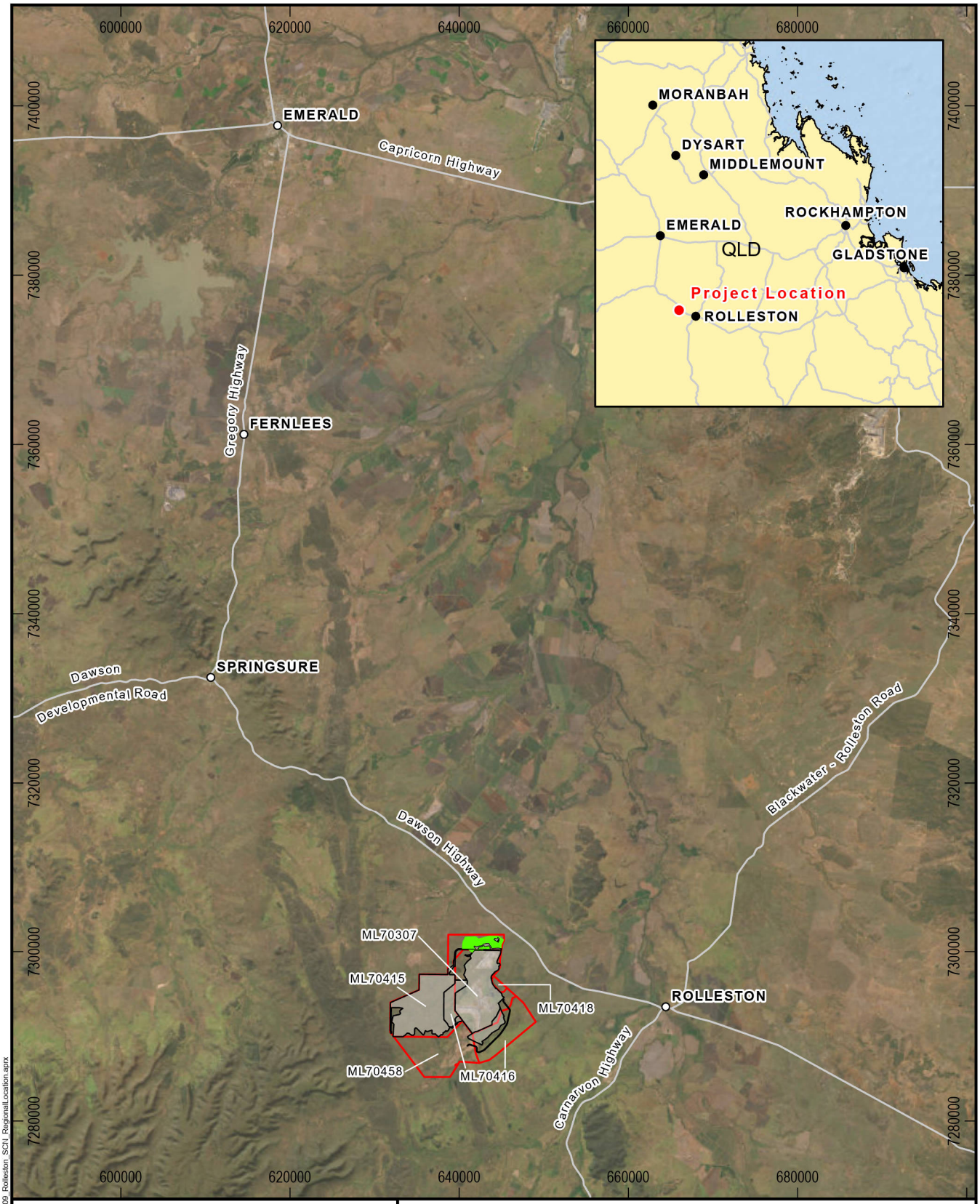
Immediately to the north of the SCNCP project area is Exploration Permit for Coal (EPC) 595, with EPC 538 located to the east. Both EPC's are held by RCH. To the west of the ROC is ML70452 (Meteor Downs South). This ML is held by Sojitz Blue Pty Ltd.

Current operations at the ROC utilise two BE 2570W draglines supported by three electric rope shovels (P&H 4100A, P&H 4100XPC and Cat7495), one hydraulic shovel (Hitachi EX5500), three hydraulic excavators (Cat6060), one front end loader (Komatsu WA1200), 42 rear dump trucks, 21 dozers, and various auxiliary equipment including graders, water trucks, service carts, drills. The support fleet principally move pre-strip material, post strip material and coal. All machinery operates on a seven-day per week roster.

There are currently four pits operating at the ROC. The 2023 LoM plan, based on current approvals, estimates production will continue until 2040 at a rate of up to 16 million tonnes per annum (mtpa). Production rates will decline from 2025 as strip ratios significantly increase. Discrete mining pits will commence and finish at various times throughout the mine life, with ongoing land reformation and rehabilitation planned as operational areas become available for progressive rehabilitation.

Pit areas are predominantly multi seam strip mining operations, with recovery of all coal meeting customer quality specifications. The mining strips are around 50 to 70 m wide, depending on depth and other constraints. Coal is loaded onto trains within ML70418 for transportation by rail to Gladstone, a total distance of 424 km via the 109 km connection to the Blackwater System. Trains are powered by diesel or electric locomotives and have a nominal capacity of 8,210 tonnes. ROC exports coal via the Port of Gladstone (RG Tanna and Wiggins Island Coal Terminals) as well as supplying domestic customers in Gladstone, including the Gladstone Power Station.

The ROC regional location is presented in **Figure 1**, while an overview of the current ROC site is presented in **Figure 2.**



Legend

- Towns
- Roads
- Mining Lease Boundary
- Approval Limit
- SCNCP Project Area

Source: State of Queensland (Department of Resources) 2022, Glencore 2022, METServe 2022, Earthstar Geographics, Geoscience Australia, Esri, GEBCO, DeLorme, NaturalVue.

Path: S:\Projects\GC009_Rolleston\ArcGIS\Project_Files\Projects\GC009_Rolleston_SCN_RegionalLocation.aprx

Spring Creek North Continuation Project

Regional Location

0 10 20

Kilometers

Scale: 1:650,000 (A4)

13/02/2023

Datum: GDA2020
Projection: MGA55

FIGURE 1

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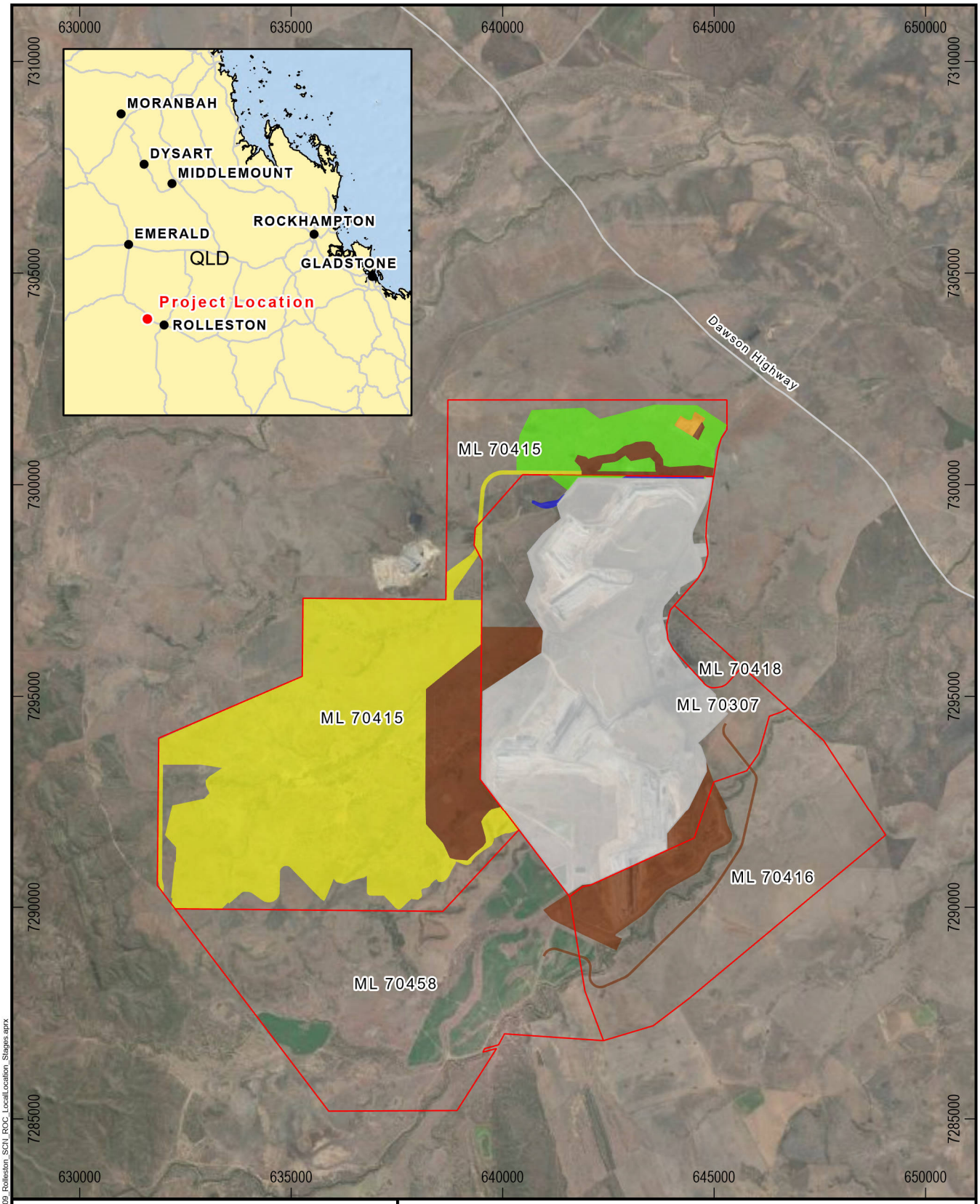

Legend

- Roads
- SCNCP Project Area
- RCEP Stage 1
- RCEP Stage 2
- ROC
- SC Diversion
- Village
- Mining Lease Boundary

Source: State of Queensland (Department of Resources) 2022, Glencore 2022, METServe 2023, Earthstar Geographics, Geoscience Australia, Esri, GEBCO, DeLorme, NaturalVue.

Path: S:\Projects\GC009_Rolleston\ArcGIS\Project_Files\Projects\GC009_Rolleston_SCN_ROC_LocalLocation_Stages.aprx

Spring Creek North Continuation Project

Rolleston Open Cut (ROC) Site Location

0 1 2 4

Kilometers

Scale: 1:130,000 (A4)

20/03/2023

Datum: GDA2020
Projection: MGA55

FIGURE 2

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3 Proposed Amendments

3.1 Spring Creek North Continuation Project

ROC seeks to extend the current operations with the Spring Creek North Continuation Project (herein referred to as 'the Project'). The Project would extend the mining area of the existing ROC Operation by including mining north of the current Spring Creek pit on ML70307 and onto the northern section of ML70415.

Though situated on existing ML's, the Project area has not previously been approved for mining. The Project is located outside of currently approved disturbance areas assessed by the 2015 Rolleston Coal Expansion Project (RCEP) Environmental Impact Statement (EIS), and approved by EA EPML00370013, and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approvals 2001/497, 2009/5175, and 2011/5965.

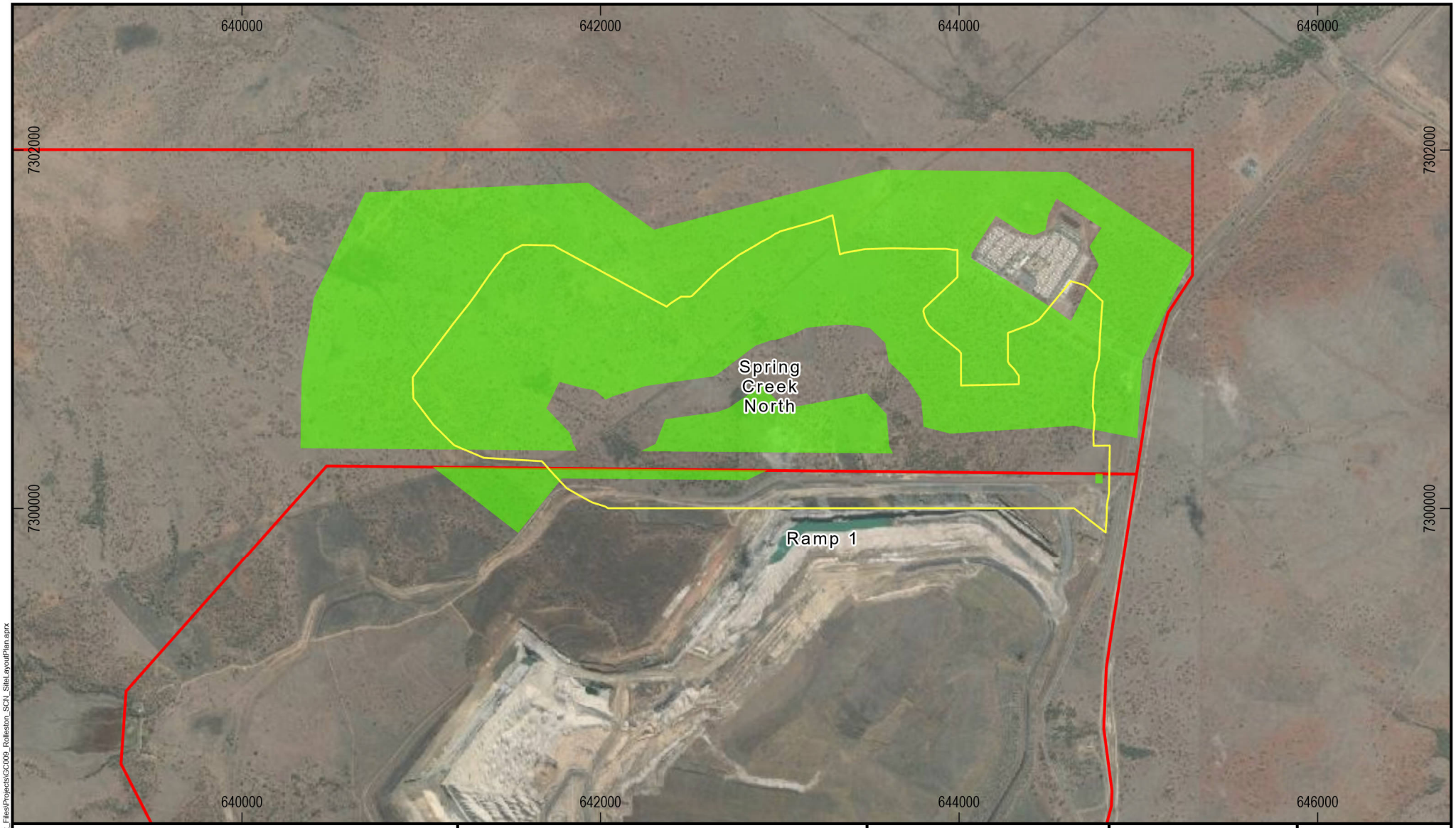
The Project will not increase the mine's production rate or extend the life of the project. No change in the method of mining is proposed. Mining will continue to be conducted using the open cut methods described in **Section 2**, with the recovery of all coal meeting customer quality specifications. The proposed Spring Creek North pit will yield approximately 35.7Mt of ROM coal over the life of the Project.

The Project has been designed to utilise existing approved ROC infrastructure wherever practical. This approach reduces the Project disturbance footprint by utilising approved ancillary infrastructure such as electricity lines, water supply pipelines, coal handling facilities (CHF), train load out facilities (TLO), haul roads and rail infrastructure. Although the Project will be able to largely utilise existing infrastructure, some additional mine infrastructure, as well as upgrades to some existing mine infrastructure, will be required. This will include a new clean water drain at the western end of the project area to separate clean water from mine affected water (MAW), as well as the extension of the current Spring Creek pit dewatering pipeline to the north of the proposed project area. A new 66 kV powerline will be installed to the north of the Project pit.

In addition to maintaining production rates, the Project will also enable RCH to propose an improved post mining land use within the ROC Progressive Rehabilitation and Closure Plan (PRCP). ROC is required to submit the PRCP to the Department of Environment and Science (DES, the Department) by April 2024. Ramp 1, in the existing Spring Creek mining area, has been mined out leaving a highwall that cannot be battered down without extending the slope outside of the current approval limit and into the Project footprint. Currently. the final Ramp 1 landform would not support the proposed post-mining land use (PMLU) of grazing, and so would require classification as a Non-Use Management Area (NUMA). Should the Project be approved for mining, the current pit would be extended north, and the existing Ramp 1 void filled with waste rock. A buffer has been included in the Project area to provide the ability to reshape the highwall batter to a grade that would support the PMLU (grazing) and prevent the final landform from being required to be classified as a NUMA.

The pit footprint for the purposes of this approval is presented in **Figure 2**. The north-eastern corner of the proposed Project pit footprint overlaps with the existing ROC accommodation camp, located within the north-eastern area of ML70415. The section of pit which overlaps with the camp is not currently scheduled to be mined until around 13 years into mining activities within the Project pit. Alternative accommodation options are being considered and approval will be sought through a separate specific approval process, as required. Options currently under consideration include the relocation of the camp within the approved disturbance footprint, or the removal of the camp from the ML altogether, with workforce accommodation sourced from neighbouring towns.

The revised site layout is presented in **Figure 3**. Proposed amendments to EA EPML00370013 to incorporate the proposed Project are provided in **Section 4.** Supporting information regarding the associated environmental values, potential impacts and mitigation measures proposed are outlined in **Section 5**.



Legend

- ROC Mining Lease Boundaries
- SCNCP Project Area
- Project Pit

Source: Glencore 2022, METServe 2023, Maxar.

Spring Creek North Continuation Project

Site Layout Plan

0 250 500 1,000

Meters

Scale: 1:30,000 (A4)

21/03/2023

Datum: GDA2020
Projection: MGA55

FIGURE 3

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Path: S:\Projects\GC009_Rolleston\ArcGIS\Project_Files\Projects\GC009_Rolleston_SCN_SiteLayoutPlan.aprx

3.2 EPML00370013 Table D3 Sodium Trigger Level Amendment

RCH also seek to amend the trigger levels for sodium within EA Table D3 – Release contaminant trigger investigation levels.

Although an amended EA was issued to RCH in October 2022, which updated the trigger limits for Sodium across ROC's surface water monitoring points, an administrative error meant that the value for Table D5 – Receiving waters contaminant trigger levels was replicated in Table D3.

It is proposed that the trigger level for Sodium in EA Table D3 (**Table 6**) is raised to 264,000 µg/L. This is based on the 80th percentile of surface water sample results taken from across the ROC site, using data from 2008 to 2022. The value of 115,000 µg/L will remain in place for EA Table D5 (**Table 7**), which presents contaminant trigger levels for the ROC's receiving waters.

As the trigger value for receiving waters (**Table 7**) will remain at 115,000 µg/L, it is not anticipated that the amendment to release trigger levels will have any impact on the downstream environment. If any of the ROC's downstream monitoring points detect levels of Sodium above 115,000 µg/L, and the downstream level is higher than levels at the relevant upstream monitoring point, any releases will cease and an investigation conducted as per EA condition D18.

4 Proposed Changes to Environmental Authority EPML00370013

This application to amend EPML00370013 is provided to the Department under Section 224 of the *Environmental Protection Act 1994* (EP Act). This EA amendment seeks authorisation to extend the current approved ROC mine disturbance footprint within the northern portion of ML's 70307 and 70415. The proposed extension is required to facilitate greater efficiency with respect to mining operations and improve rehabilitation and final landform outcomes.

For DES reference, the Project is assessed against the criteria in Guideline: Major and Minor Amendments (ESR/2015/4964) in **Table 2**. The Project meets the criteria for a minor amendment.

Table 2 EA Minor Amendment Thresholds

A minor amendment (threshold) for an EA is an amendment that the administering authority is satisfied:		
Criteria	**Satisfied (Y/N)**	**Justification**
a. Is not a change to a standard condition identified in the EA as a standard condition, other than a condition conversion or replacing a standard condition with a standard condition for the ERA;	Y	No standard conditions proposed to be amended.
b. Does not significantly increase the level of environmental harm caused by the relevant activity;	Y	Anticipated impacts to environmental matters are proportionally minor.
c. Does not change any rehabilitation objectives in the EA in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the EA;	Y	The Project will improve rehabilitation outcomes through removal of currently authorised NUMA.
d. Does not significantly increase the scale or intensity of the relevant activity;	Y	The Project will not increase currently approved production rates or LOM and the proposed footprint increase is proportionally minor.
e. Does not relate to a new relevant resource tenure for the EA that is: **i)** a new mining lease; or **ii)** a new petroleum lease; or **iii)** a new geothermal lease under the *Geothermal Energy Act 2010;* or **iv)** a new greenhouse gas injection and storage lease under the *Greenhouse Gas Storage Act 2009*;	Y	Project exists entirely within granted MLs.
f. Increases the existing surface area for the relevant activity by 10% or less; and	Y	The Project area of 606.8 ha represents a surface area increase of less than 7% against the currently approved ROC footprint of 9132.5ha
g. For an EA for a petroleum activity: **i)** involves constructing a new pipeline that does not exceed 150km in length; and **ii)** involves extending an existing pipeline by no more than 10% of the existing length of the pipeline;	N/A	N/A
h. If the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or greenhouse gas permit — the amendment application seeks an EA that is subject to the standard conditions for the relevant activity, to the extent it relates to the permit.	N/A	N/A

The following section outlines the required amendments to EPML00370013. The proposed amendment does not necessitate the addition of any new ERA's to EPML00370013.

4.1 Schedule A: General

No changes to Schedule A are proposed.

4.2 Schedule B: Air

No new sensitive receptors have been identified since the 2013 EIS assessment, and the Project will continue to implement the air quality management practices previously proposed and required within EPML00370013. As such, no amendments are proposed to current trigger limits presented in EPML00370013 – Schedule B.

4.3 Schedule C: Noise and Vibration

No new sensitive receptors have been identified since the 2013 EIS assessment, and the Project will continue to implement the noise and vibration management practices previously proposed and assessed. As such, no amendments are proposed to current trigger limits presented in EPML00370013 – Schedule C.

4.4 Schedule D: Water

Table D3: An amendment is sought to the trigger level for Sodium within EPML00370013 Table D3. As per **section 3.2**, a value of 264,000 µg/L is proposed. This value is derived from the 80th percentile of sample results taken across the ROC from 2008 to 2022 (latest available data).

No changes to the potential impacts or proposed management of surface water have been identified. The Project will continue to implement the surface water monitoring and management practices previously proposed and assessed and detailed in the Receiving Environment Monitoring Program (REMP). As such no further amendments are proposed to current trigger values and monitoring locations outlined in EPML00370013 – Schedule D, beyond Sodium levels within Table D3.

4.5 Schedule E: Groundwater

Three additional groundwater monitoring bores have been installed to monitor and assess any impacts on groundwater resulting from the Project. As such an amendment will be required to EPML00370013 Table E2 – Groundwater monitoring locations and frequency, to include the new monitoring locations. ROC will undertake a period of baseline monitoring at the three new groundwater bores prior to the development of the Project area. ROC intends to implement the groundwater monitoring and management practices previously proposed and assessed. No amendments are currently proposed to current trigger values outlined in EPML00370013 Table E3 – Groundwater parameter trigger values.

4.6 Schedule F: Sewage Treatment

No changes to the potential impacts or proposed management of sewage have been identified. As such, no amendments to conditions within Schedule F are proposed.

4.7 Schedule G: Land and Rehabilitation

No changes to the proposed management of land or rehabilitation have been identified. As such, no changes to conditions within Schedule G are proposed.

ROC has been issued with a transition notice, requiring the development and submission of a Progressive Rehabilitation and Closure Plan (PRCP) for the entire ROC operation to the Department by April 2024. It is anticipated that, once approved, the SCNCP will be included within the PRCP to be submitted in April 2024. In addition to the PRCP addressing all closure and rehabilitation milestones for the ROC operation, the existing Rehabilitation Management Plan will be updated to include the

Project area and submitted to the Department. It is proposed that the EA conditions will specify the requirement for the ROC to develop and maintain a PRCP.

4.8 Schedule H: Waste

No changes to the potential impacts or proposed management of waste have been identified. As such, no amendments to conditions within Schedule F are proposed.

4.9 Schedule I: Watercourse Diversions

The Project does not impact on any defined watercourses under the *Water Act 2000*. Hence, no changes to conditions within Schedule I are proposed.

4.10 Schedule J: Regulated Structures

No changes to the potential impacts or proposed management of regulated structures have been identified. As such, no amendments to conditions within Schedule J are proposed.

4.11 Schedule K: Biodiversity

Condition K1: An amendment will be required to **EPML00370013 Table K1 – Significant Residual Impacts to Prescribed Environmental Matters** to include the prescribed environmental matters within the Project impact area. **EPML00370013 Figures 4 to 8** are also required to be amended to reflect the updates to **Table K1.**

Table 3 Significant Residual Impacts to Prescribed Environmental Matters (Updated EA Table K1)

Prescribed Environmental Matters	Maximum Extent of Impact (ha)	Offset Requirement
Endangered Regional Ecosystem 11.4.9*	39	No
Endangered Regional Ecosystem 11.3.21*	73	Yes **
Endangered Regional Ecosystem 11.4.7	7.0	Yes
Of concern Regional Ecosystem 11.3.2	45	Yes
Of concern Regional Ecosystem 11.3.3*	62	Yes **
Of concern Regional Ecosystem 11.8.11*	1358.1	Yes **
Of concern Regional Ecosystem 11.9.4*	1	No
Regional ecosystems that intersect a wetland on the vegetation management wetlands map: RE 11.3.27	23	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.3.25	124	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.3.27	6.6	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.3.3	7.3	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.3.4	0.3	Yes

Prescribed Environmental Matters	Maximum Extent of Impact (ha)	Offset Requirement
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.3.6	48.6	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.3.6/11.3.2	0.7	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.4.4	1.8	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.4.9	0.8	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.8.11	135	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.8.5	24.5	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.8.5/11.8.11	0.26	Yes
Regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map: RE 11.8.11/11.8.5	2	Yes
Connectivity area	78	Yes
Habitat for an animal that is endangered wildlife – Koala – *Phascolarctos cinereus**	424.8	No
Habitat for an animal that is vulnerable wildlife – Squatter pigeon – *Geophaps scripta scripta**	1518	No
Habitat for an animal that is vulnerable wildlife – Black-breasted button-quail– *Turnix melanogaster**	50	No
Habitat for an animal that vulnerable wildlife – Ornamental snake – *Denisonia maculata**	148	No
Habitat for a plant that is endangered – Belyando cobbler's pegs – *Trioncinia retroflexa*	124.1	Yes
Habitat for a plant that is vulnerable – King blue grass – *Dichanthium queenslandicum**	1573.2	No
Habitat for a plant that is vulnerable – *Cyperus Clarus*	536.2	Yes

* These matters will be offset under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) approval conditions.

**Partial offset requirement – The following impacts on Matters of State Environmental Significance are authorised under EPBC 2011/5965 as they partially overlap with Matters of National Environmental Significance: RE 11.3.3 – 26.5ha, RE 11.8.11 – 693.2ha and RE 11.3.21 – 25.61ha.

5 Description of Environmental Values, Potential Impacts and Mitigation Measures

This section provides a description of the environmental values relevant to the proposed amendments, potential impacts of the amendments and the associated mitigation and management measures proposed. The RCEP Environmental Impact Statement (EIS) included the Project area in its study area but not in the impact area. Where appropriate, the information presented in that EIS has been drawn upon for this amendment application and is presented in the assessment provided in this section. Where the update of this information has been required, contemporary baseline and impact assessments have been completed. These are also discussed in **Section 5** and are appended to this document.

5.1 Land

The proposed Project disturbance footprint covers an area of approximately 592.2 ha across ML's 70307 and 70415, with the proposed SCN pit covering approximately 454 ha. The properties, tenure, usage, and landowners within the Project footprint are provided in **Table 4.**

The Project is located within the Central Highlands Regional Council (CHRC) local government area, which has a distinct mining influence with multiple significant coal mining operations throughout the Local Government area.

The Project site is dominated by grasslands and open eucalypt woodland on black soils derived from Cainozoic basalt. Located approximately 60km from the Project site, and forming a backdrop to Project site is the Black Alley Range, part of the Carnarvon Range.

Land uses surrounding the Project are generally agricultural or relate to the existing ROC operation. However, the Albinia National Park is located immediately to the east of the Project site and is declared for the conservation of endangered native blue grass communities. Another mining operation, Sojitz Blue's Meteor Downs Mine, is located 4km to the west of the existing Spring Creek pit. There is also a small basalt quarry within the Albinia National Park area (Albinia Resources Reserve). Agricultural land uses are largely pastoral, with areas suitable for cropping to the south of the ROC. Easements and tenures supporting the existing ROC, such as those held for road, rail, power, and accommodation related infrastructure form the major land uses immediately adjacent to the Project site, as well as agricultural and rural residential land uses.

Table 4 Land Tenure and Real Property Descriptions for the Project

Lot/Plan	Tenement	Usage	Owner
1SP174071	ML's 70415 & 70307	Extractive	Rolleston Coal Holdings PTY Limited
1SP164068	ML 70415	Extractive	Rolleston Coal Holdings PTY Limited
4SP170740	ML 70415	Extractive	Rolleston Coal Holdings PTY Limited

The Project is located within existing Special Industry zoning areas of the CHRC planning scheme. The nearest townships, Rolleston and Springsure, are 16 km east and 58 km north-west of the Project area along the Dawson Highway, respectively. The townships provide accommodation for locally based mine workers and contractors, as well as other industries that support employment in the region. The majority of mine workers and contractors at the ROC are accommodated in the existing accommodation camp located in the north-eastern corner of ML70415.

The post-mining land use (PMLU) for the disturbed areas of the Project are proposed to be low intensity cattle grazing. This was the pre-mining land use for the Project area and stakeholder consultation during the development of the ROC Rehabilitation Management Plan (RMP) confirmed stakeholder support of cattle grazing as the preferred PMLU.
Further discussion regarding environmental values of land, including terrestrial ecology and soil are provided below in **Sections 5.4** and **5.6** respectively.

5.2 Surface Water

An updated Surface Water Assessment Report has been prepared for the Project and is provided in **Appendix A – Surface Water Assessment** (Engeny Australia Pty Ltd (Engeny), 2022). Engeny was engaged to undertake a surface water assessment for the Project, which assessed environmental values and existing conditions, and detailed the potential surface water impacts and mitigation measures.

5.2.1 Receiving Waterways

The ROC is located within the Comet River sub-basin of the greater Fitzroy Basin. Three watercourses as defined under the *Water Act 2000* - Meteor Creek, Sandy Creek and Bootes Creek – as well as two drainage features – Gibbs Gully and Spring Creek, flow generally in a north-east direction through the ROC operation (**Figure 4**). These streams are ephemeral with little or no flow between April and November and high flows in the summer months. Streamflow recharge to groundwater systems occurs during infrequent, sustained flood events.

Bootes Creek arises approximately 8.2 km to the west of the mining leases and flows east through the MLs. Two smaller tributaries (Spring Creek and Gibbs Gully) join Bootes Creek within the ROC. Bootes Creek eventually flows into Meteor Creek downstream of the ML.

Meteor Creek rises on the Great Dividing Range (Carnarvon Range). It runs in a general north-easterly direction (through MLs 70458 and 70416 as well as Albinia National Park) for approximately 125km to enter the Comet River as a fifth-order stream. The headwater tributaries have a steep gradient while the downstream half of Meteor Creek is relatively flat, dropping only 100m in the last 60km of its flow to the Comet River. About 21 km downstream of the confluence of Meteor Creek and Bootes Creek, Meteor Creek joins the Comet River.

Only two of these waterways, Bootes Creek and Spring Creek, are situated in an area of the mine where impacts from the proposed Project may be experienced.

5.2.1.1 Bootes Creek

Bootes Creek is the second largest watercourse traversing the ROC, with a catchment area of roughly 100 km² to the existing confluence location with Gibbs Gully. Bootes Creek has a deep incised active channel which is highly sinuous with a tight channel meander radius. Bootes Creek has two permanent diversions, one licensed under the *Water Act 2000* (Stage 1) and one Authorised under the site Environmental Authority (Stage 2).

The Bootes Creek Stage 1 Diversion starts immediately downstream of the confluence with the Spring Creek Diversion drain and is located south of the Spring Creek mining area. It was constructed in several stages from 2010 to 2016 through a rehabilitated mined area. The area was backfilled with mine overburden in several stages to allow for settlement, with the top 2-3m layer comprising of tertiary clay fill.

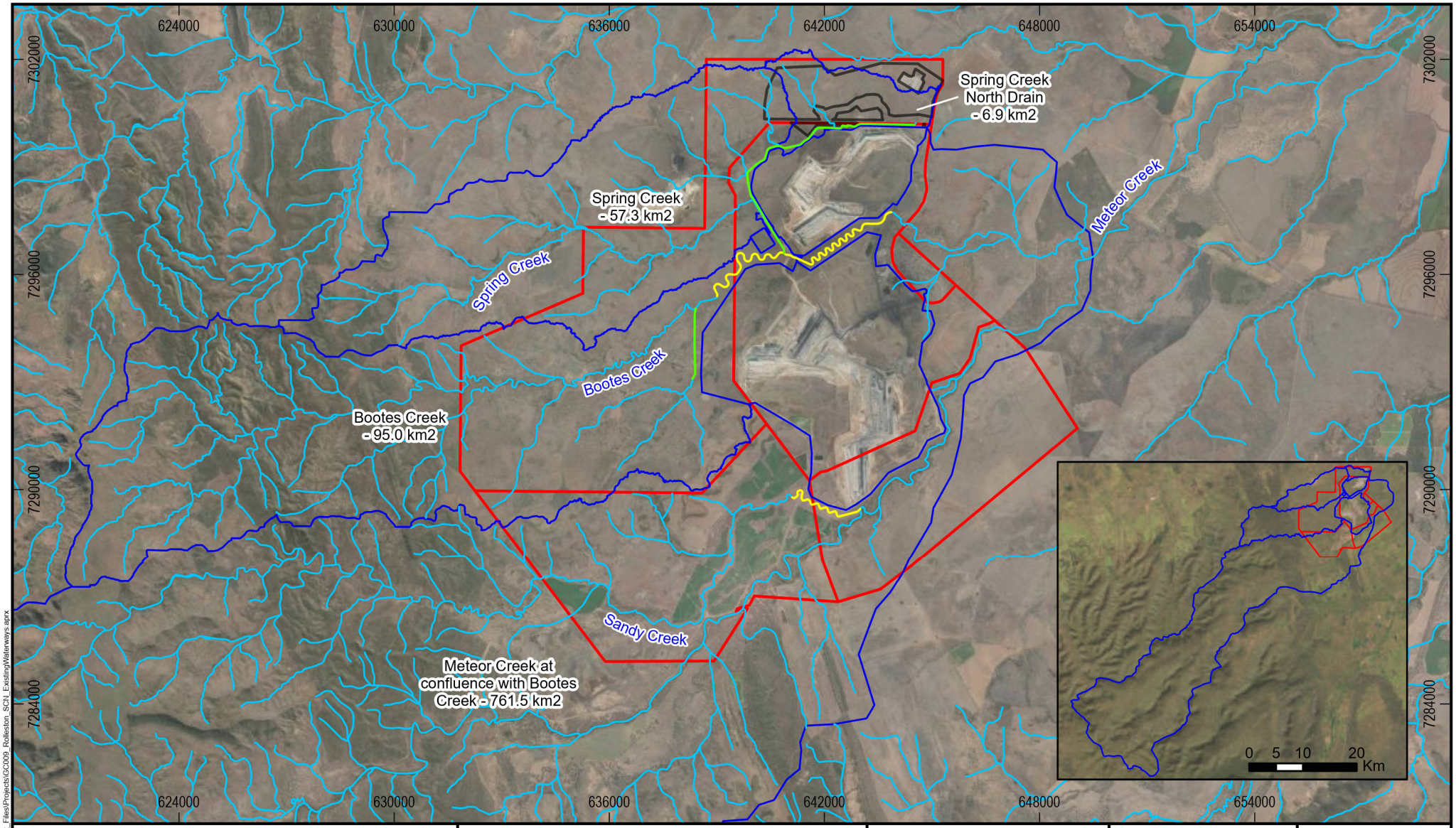
The Bootes Creek Stage 2 Diversion is currently under construction and will divert a 4km reach of the existing channel located upstream of the Spring Creek drain confluence. The Stage 2 diversion is an excavated channel with upstream and downstream plug embankments to direct flows through the new channel and provide pit flood protection. No impacts to the Bootes Creek Stage 2 Diversion will be observed as a result of mining in the Project area.

5.2.1.2 Spring Creek

Spring Creek is not a defined watercourse under the *Water Act 2000*. It is a stream order 3 drainage feature with its catchment originating to the west and north of ROC.

Spring Creek drains in an easterly direction towards Spring Creek Pit, before being diverted south by the Spring Creek Diversion Drain. An upper catchment tributary of Spring Creek is impounded by an existing clean water storage (Naroo Dam) which overflows to the diversion drain. The Spring Creek Diversion Drain reports to the Bootes Creek Stage 1 Diversion which runs to the immediate south of the Spring Creek Pit.

The total area currently diverted around the northern side of Spring Creek Pit is 6.9 km². This represents just over 10% of the total Spring Creek catchment before its confluence with Bootes Creek, which is 64.2 km².



Legend

- Waterway
- Clean Catchment Diversion Drain
- Watercourse Diversion
- ROC Mining Lease Boundaries
- SCNCP Project Area
- Waterway Catchment

Source: Engeny 2023, Glencore 2023, METServe 2023, Earthstar Geographics.

Spring Creek North Continuation Project

Existing Waterways

0 2 4 6

Kilometers

Scale: 1:150,000 (A4)

28/04/2023

Datum: GDA2020
Projection: MGA55

FIGURE 4

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5.2.2 Flooding

Flooding associated with Bootes Creek and Spring Creek within the ROC MLs is limited to the lower floodplain areas, where it is managed by an existing licenced diversion and associated levees (only required for Bootes Creek). The drainage system around the northern side of Spring Creek pit conveys local stormwater runoff and is not influenced by larger waterway flooding of the main Spring Creek or Bootes Creek systems.

Existing flooding behaviour of Bootes Creek and Spring Creek for a very rare flood event (0.1% Annual Exceedance Probability) is shown in **Appendix A – Figures 2.2** and **2.3.**

The existing flood model indicates:

- The existing Spring Creek clean water drain is situated at a higher elevation relative to the Bootes Creek system;
- The existing Spring Creek Diversion has sufficient capacity and does not require further modification or upgrading; and
- Mining in the Project area will reduce the catchment area reporting to Bootes Creek and ultimately Meteor Creek, and therefore flood impacts are also expected to be reduced.

5.2.3 Environmental Values

Under the Environmental Protection Policy (EPP Water and Wetland Biodiversity), waters are defined as including the bed and banks of waters. Surface waters are defined as water other than groundwater. The term watercourse is used generically and includes watercourses defined under the *Water Act 2000* (Water Act) as well as streams/gullies that do not meet watercourse criteria under the Water Act (i.e., they do not necessarily have defined bed and banks or a change of vegetation across the drainage line).

Part 3 of the EPP (Water and Wetland Biodiversity) states that environmental values (EV) are to be protected or enhanced. The ROC site is part of the 'western tributaries' of the Comet River (Basin 130). The EV and Water Quality Objectives (WQO) are described in Sections 2 and 3 of the Comet River Sub-basin Environmental Values and Water Quality Objectives. The Comet River sub-basin environmental values are presented below in **Table 5**. The management intent for ROC is 'aquatic ecosystem - moderately disturbed'.

Table 5 ROC Environmental Values (Engeny ,2022)

Value	Description
Aquatic Ecosystem	ROC mine site has ecological values considered to be moderately disturbed under the EPP (Water and Wetland Biodiversity). Under Schedule 2 of the EPP (Water), moderately disturbed is water in which the biological integrity of the water is adversely affected by human activity to a relatively small but measurable degree. High ecological value areas are present immediately upstream (HEVa2122 and HEVa2123) and downstream (HEVa2124) of the Project.
Recreation	Suitable for use as primary, secondary or visual recreation, this includes activities such as swimming.
Stock	Suitable as a drinking water supply for livestock.
Irrigation	Suitable for irrigation water supply, for example for irrigation of crops, pasture, parks, gardens, and recreational areas.
Industrial	Suitable as an industrial water supply. Open cut coal mining, manufacturing and other industrial activities occur within the area and account for approximately 0.3% of land use.
Farm Use	Suitable for domestic farm water supply, other than drinking water, e.g., laundry and produce preparation.

Value	Description
Human Consumption of Aquatic Species	Suitable for human consumption of aquatic food e.g., fish, crustaceans, and shellfish.
Drinking Water	Suitable drinking water supply. Rolleston town water supply is drawn from the Comet River, upstream of the confluence of Meteor Creek and the Comet River. The water supply of the town of Comet is approximately 100km downstream and is considered too far away to be affected by the Project.
Cultural and Spiritual Values	Custodial use of water resources by local traditional owners, upstream and downstream. Cultural and spiritual values of water are defined in the EPP (Water and Wetland Biodiversity) as being cultural and spiritual values, including its aesthetic, historical, scientific, social or other significance, to the present generation or past or future generations.

5.2.4 Water Quality Objectives

Under the EPP (Water and Wetland Biodiversity), the objectives are specific water quality parameters for the protection of specific EVs identified at the site. The WQOs have been established on the principle that water quality downstream of the site should be similar to that of an unmodified reference site. The default approach as specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000) uses the 20th and 80th percentiles to achieve protection of moderately disturbed waters. Consequently, WQOs for the catchment waters are primarily based on the guidelines developed for aquatic ecosystem EV protection. The current trigger investigation levels and contaminant trigger levels as per the Rolleston Open Cut EA are shown in **Table 6** and **Table 7.**

Table 6 Release Contaminant Trigger Investigation Levels (EA Tables D2, D3 & D4)

MAW Release Trigger Levels		
Electrical Conductivity (EC)	µS/cm	Bootes Creek: 280 – 1800 (Dependant on flow rate)
		Meteor Creek: 324 – 1800 (Dependant on flow rate)
pH	pH Units	Low flow: 6.5 – 9.0
		Medium and high flow: 6.5 – 9.5
Turbidity	NTU	NA
Suspended Solids	mg/L	Bootes Creek: 1050
		Meteor Creek: 1200
Sulphate (SO42-)	mg/L	250
Aluminium	µg/L	270
Arsenic	µg/L	13
Cadmium	µg/L	0.2
Chromium	µg/L	2
Copper	µg/L	5
Iron	µg/L	300
Zinc	µg/L	58
Molybdenum	µg/L	34
Selenium	µg/L	10
Silver	µg/L	1
Uranium	µg/L	1
Vanadium	µg/L	10
Ammonia	µg/L	900
Nitrate	µg/L	1100

MAW Release Trigger Levels		
Petroleum hydrocarbons (C6-C9)	µg/L	20
Petroleum hydrocarbons (C10-C36)	µg/L	100
Fluoride (total)	µg/L	2000
Sodium	µg/L	115,000*

*Proposed to be amended to 300,000 µg/L as part of this EA amendment application

Table 7 Receiving Waters Contaminant Trigger Levels (EA Table D5)

Quality Characteristic	Units	Trigger Levels
Electrical Conductivity (EC)	µS/cm	Bootes Creek: 1000
		Meteor Creek: 700
pH	pH Units	6.5 – 9.5
Suspended Solids	mg/L	1300
Sulphate (SO42-)	mg/L	250
Sodium	mg/L	115

5.2.5 Surface Water Monitoring

ROC has developed and continues to implement a Receiving Environment Monitoring Program (REMP) to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity (ROC, 2022). This includes monitoring the effects of the mine on the receiving environment periodically (under natural flow conditions) and while mine affected water is being discharged from the site.

The ROC REMP provides surface water monitoring procedures for the following:

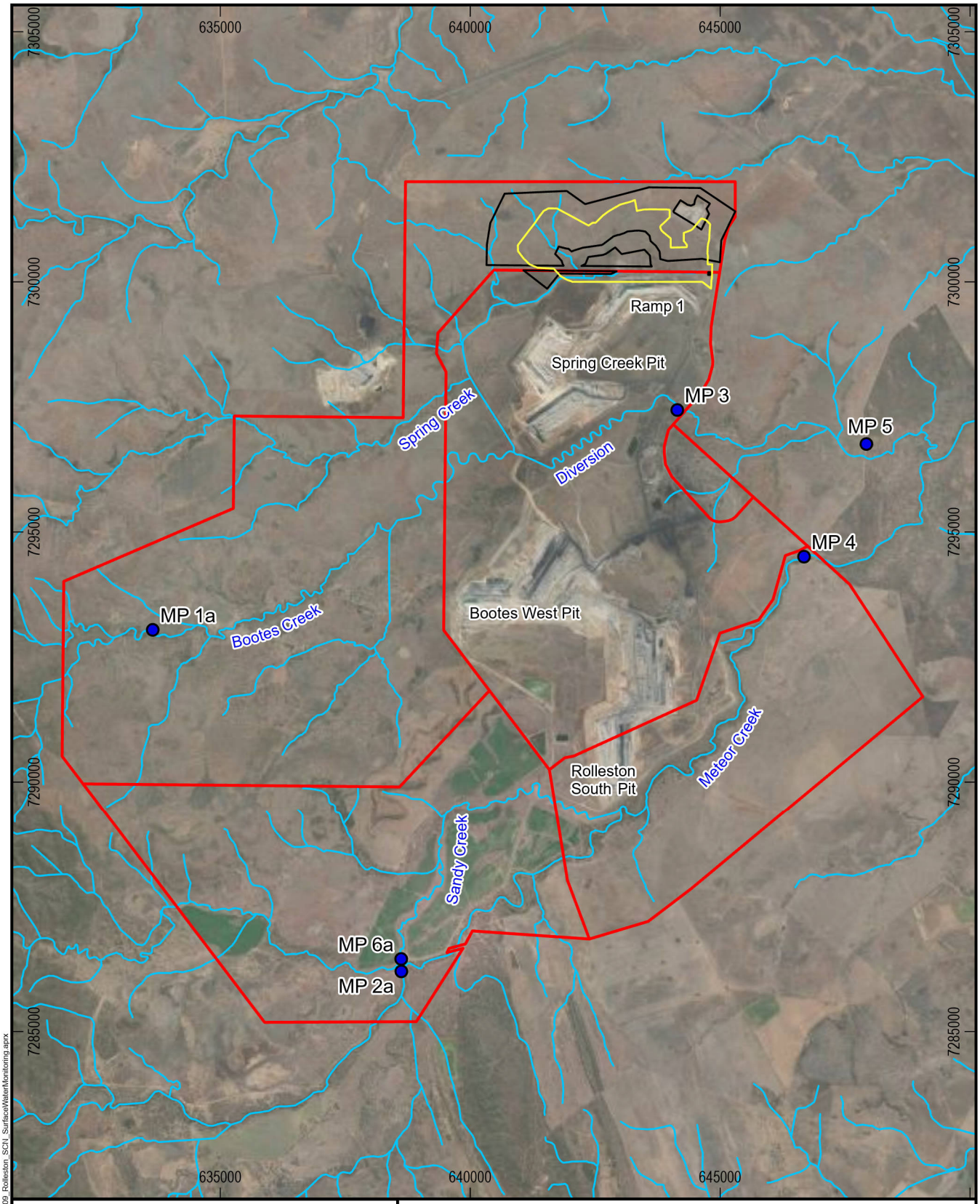
- Surface water quality during releases.
- Creek bed sediments.
- Biological condition (Aquatic macroinvertebrates).
- Stream flow hydrology; and
- Stream bank stability.

Monitoring locations for the above items are given in **Table 8** below with locations shown in **Figure 5**. The REMP also outlines the frequency, analytes, and data capture requirements for each of the required monitoring efforts.

Table 8 Receiving Water Monitoring Points

Monitoring Point	Receiving Waters Location	Easting (GDA2020)	Northing (GDA2020)
Upstream Monitoring (Background)			
MP 1a	Bootes Creek Upstream	633648	7293044
MP 2a	Meteor Creek Upstream	638622	7286202
MP 6a*	Sandy Creek Upstream	638619	7286450
Downstream Monitoring			
MP 3*	Bootes Creek Downstream	644142	7297439
MP 4	Meteor Creek Downstream	646678	7294507
MP 5	Bootes Creek Downstream	647926	7296759

*Not monitored as part of the REMP. Only monitored during release events.



Legend

- Surface Water Monitoring Locations
- Waterway
- ROC Mining Lease Boundaries
- SCNCP Project Area
- Project Pit

Source: State of Queensland (Department of Resources) 2022, Engeny 2023, Glencore 2023, METServe 2023, Earthstar Geographics.

Spring Creek North Continuation Project

Receiving Water Monitoring Points

0 1 2 4

Kilometers

Scale: 1:110,000 (A4)

21/03/2023

Datum: GDA2020
Projection: MGA55

FIGURE 5

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5.2.6 Current Surface Water Management

The existing Spring Creek mining area is the most northern mining pit at ROC. The pit receives inflows from rainfall runoff in addition to groundwater inflows. Existing water management infrastructure associated with Spring Creek mining area include:

- Pit dewatering - Pumps and pipelines to allow dewatering to the existing mine water system to supply site water demands, storage or release. The existing pit dewatering pump and pipeline are located along the pit highwall and can pump water into the mine water pipeline near Pit Water Dam (PWD) which can transfer at high capacity to all the key water storages.
- Clean catchment diversion drains and bunds - A series of excavated drains and bunds that redirect runoff upslope of the highwall towards the west into Spring Creek before flowing into Bootes Creek.

The current ROC water management system is described in the following section. A layout plan showing existing storages, pumps and drainage features are shown in **Figure 6** and the water management system schematic is shown in **Figure 7.**

The main components of the surface water management system are discussed in the following sub-sections.

5.2.6.1 Clean Water System

The existing ROC clean water management system includes clean water storages, groundwater dewatering bores, diversions, and flood protection levees/bunds. The overall purpose of the clean water management system is to:

- Divert clean runoff water from catchment areas to keep it separate from the mine water and sediment water systems.
- Supply raw water for potable demands (Naroo dam only).
- Supplement mine water demands.
- Advanced dewatering of underground aquifer/s to reduce groundwater ingress into mining pits.
- Levees provide operating mine pits with 0.1% AEP flood protection.

The clean water management system is described in the following sections.

5.2.6.2 Clean Water Storages

The existing ROC clean water storages are described in **Table 9.**

Table 9 ROC Clean Water Storages (Engeny, 2022)

Name	Storage Capacity (ML)	Description/Purpose
Naroo Dam	968	Naroo Dam is a catchment dam and is the preferred raw water supply on site. Subject to sufficient stored water, it is used for direct raw water supply to the water treatment plant (WTP) for potable water demands at the site and mine accommodation village. A bore water source (Irrigation Bore #2) is also connected to a header tank to supplement Naroo Dam supply if required. Water is pumped from Naroo Dam or the header tank to the WTP.

5.2.6.3 Bore Licences

The existing groundwater extraction bores and licences are described in **Appendix A – Section 4.3.1.2.**

5.2.6.4 Diversion and Flood Protection Levees

A full list of the existing creek diversions and flood protection levees across the ROC operation is provided in **Appendix A – Table 4.3**.

The diversions that have the potential to be affected by the proposed Project are described below in **Table 10**.

Table 10 Relevant ROC Diversions (Engeny, 2022)

Name	Description/Purpose
Spring Creek Diversion Drain	The Spring Creek Diversion drain was constructed to allow the advancement of Spring Creek Pit. The Spring Creek Diversion Drain includes an excavated drain heading south into Bootes Creek and a bund embankment to redirect flow into the drain and provide pit flood protection. The drain is approximately 60m wide.
Bootes Creek Diversion	The Bootes Creek Diversions (Stage 1 and 2) direct runoff from the Bootes catchment through the mine between the Spring Creek and Bootes West/Bootes Creek Pits. The Bootes Creek Diversions and associated levee protect Spring Creek and Bootes West Pits from a 1:1000 AEP flood. The Stage 2 Diversion is currently under construction with a planned completion in early 2023.

5.2.6.5 Mine Water Management

A water management system schematic for the existing ROC is presented in **Figure 7**. The mine water system contains numerous in-pit sumps, staging dams and larger storage dams for mine affected water. The mine water storages are summarised in **Appendix A – Table 4.4.**

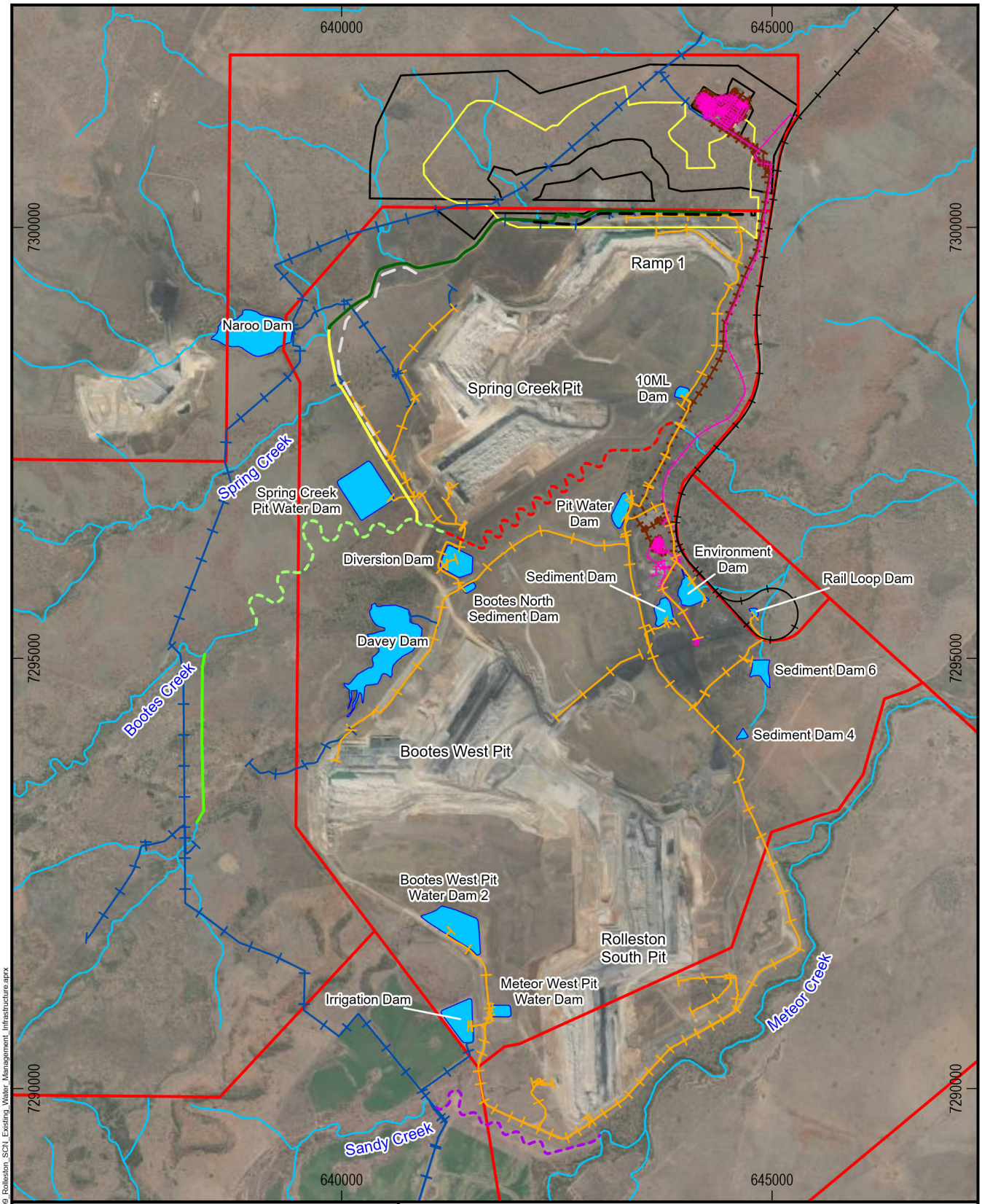
Mine water releases can be made to Bootes Creek and Meteor Creek (via Sandy Creek) in accordance with the flow triggers and water quality limits prescribed in the current ROC EA EPML00370013 (EA Table D3). Gravity releases are possible at Bootes West Pit Water Dam 2, Environment Dam, Sediment Dam 6, Diversion Dam, Irrigation Dam and Spring Creek Pit Water Dam (**Figure 6**). Pumped releases are possible from Pit Water Dam, Meteor West Pit Water Dam and the dams listed as gravity release sites, except for Rail Loop Dam.

Releases into Bootes Creek can be undertaken from the following dams (in order of priority), at a maximum combined rate of 5.0 m^3/s in receiving water high flow conditions.

- Environment Dam;
- Diversion Dam (unavailable from the beginning of 2023 until the end of 2024);
- Pit Water Dam (pumped release);
- Sediment Dam 6; and
- Spring Creek Dam.

Releases to Meteor Creek under gravity are currently from Irrigation Dam and Bootes West Pit Water Dam 2 to the maximum rate of 6.5 m^3/s.

The proposed Project will utilise the existing water management system, including an interconnecting pipe network with associated pumps which allow pit dewatering and mine affected water transfers between water storage structures across the site. The current pipeline route is shown in **Figure 6.**



Legend

- ROC Mining Lease Boundaries
- SCNCP Project Area
- Project Pit
- Dams
- Waterway
- Rail
- Spring Creek East Clean Water Diversion Bund
- Spring Creek North Clean Water Diversion Bund
- Bootes Creek Stage 1 Diversion
- Bootes Creek Stage 2 Diversion
- Sandy Creek Diversion
- Gibbs Gully Diversion
- Spring Creek Diversion Drain
- Spring Creek North Drain

Pipelines

- Clean
- Mine Affected
- Potable
- Sewage

Source: State of Queensland (Department of Resources) 2022, Engeny 2023, Glencore 2023, METServe 2023, Earthstar Geographics.

Path: S:\Projects\GC009_Rolleston\ArcGIS\Project_Files\Projects\GC009_Rolleston_SCN_Existing_Water_Management_Infrastructure.aprx

Spring Creek North Continuation Project

Existing Water Management Infrastructure

0 0.5 1 2

Kilometers

Scale: 1:64,000 (A4)

21/03/2023

Datum: GDA2020
Projection: MGA55

FIGURE 6

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5.2.6.6 Erosion and Sediment Control

Erosion and sediment are controlled onsite by all mine affected catchments draining internally to the mine water system with the use of sediment control structures. Internally draining catchments are managed through typical controls such as:

- Vegetation establishment;
- Rock protection;
- Sediment dams; and
- Pit sumps.

ROC minimises disturbed area catchments where possible to reduce the volume of water and sediment handled onsite. To date ROC has received certification for progressive rehabilitation of 581ha of rehabilitated land. Runoff from the certified rehabilitation currently drains to existing storages and sediment dams, however, if ROC enters a wetter period there is opportunity to freely drain some of these areas from site. The certified rehabilitation at ROC is summarised in **Appendix A-Table 4.6**.

5.2.6.7 Acid Mine Drainage

Existing water quality data shows that the site does not experience significant saline runoff from disturbed areas of pit and/or spoil. Previous work in the RCEP EIS (2013) and contaminant source studies have indicated that the Non-Acid Forming (NAF) to Potential Acid Forming (PAF) waste rock ratio is >20:1, with a net neutralising effect of any potential acid leachate (DEHP, 2015). No acidic drainage has been observed on site throughout the mine life.

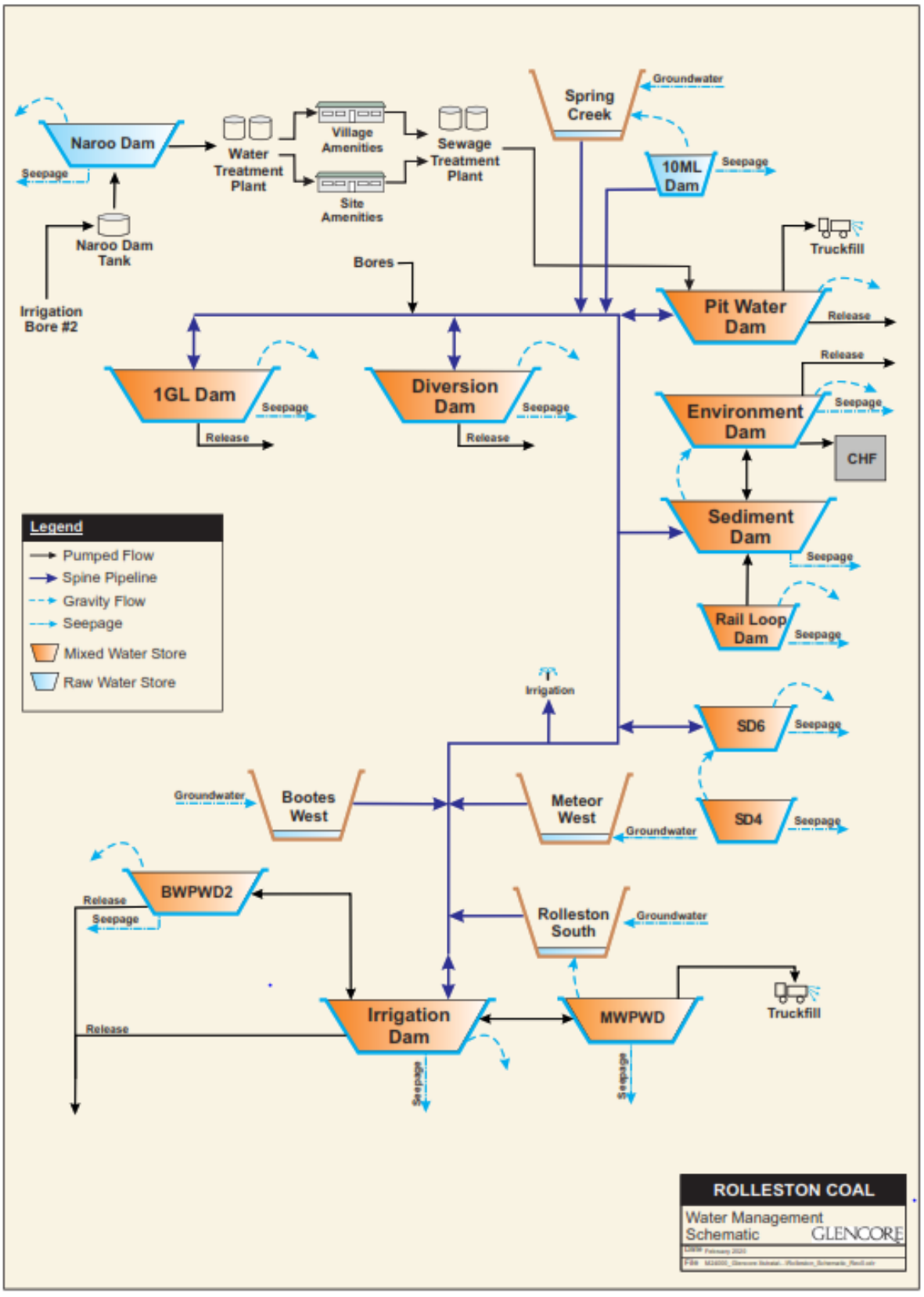


Figure 7 **Water Management Schematic**

5.2.7 Proposed Changes to Project Surface Water Management

The proposed water management strategy for the continuation of mining in the Project area includes:

- Clean Water Management - Construction of a new drain to direct clean runoff to the west, around the planned Project mining extent.; and
- Pit Dewatering – relocation and extension of the existing pit dewatering pipeline north of the planned Project mining extent.

5.2.7.1 Clean Water Management

The Project will intercept the existing Spring Creek pit clean water drain, requiring a new drain to be constructed to redirect overland flow from the northern natural catchment away from proposed operational areas. A single drain to capture residual natural surface runoff which would otherwise report to the Project area is proposed. The drain will redirect flow west around the Project footprint and through the Bootes Creek Diversion before flowing offsite to the east. The flow path is represented in **Figure 8,** along with the location of the current clean water drain.

The proposed drain locations are shown in **Appendix A - Figure 5.3** and a long section in **Appendix A - Figure 5.1**. The drain will be sized to convey the 0.1% AEP peak flow which are estimated to be 9.1m^3/s. Excavation of the drain is likely through rock, similar to the existing drain (refer **Appendix A – Figure 2.1**) and further armouring or protection is not expected to be required. The drain will aim to:

- Maximise reinstatement of natural catchment reporting to Spring Creek;
- Eliminate the risk of mixing of natural surface runoff with mine affected water; and
- Prevent potential ponding of water against highwall areas on the northern edge of the mine footprint.

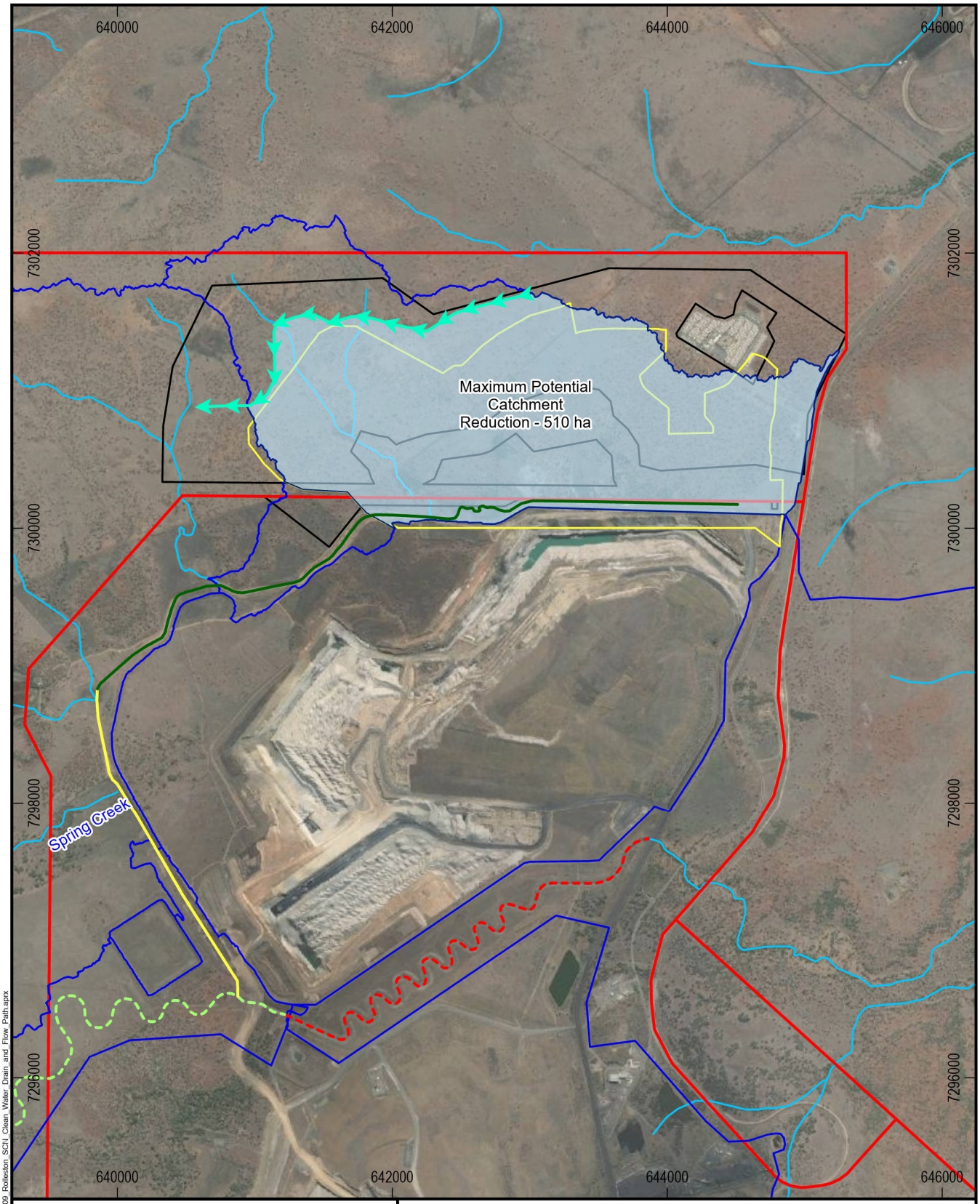
Based on the proposed drain alignment preliminary sizing of the drain for the expected 0,1% AEP peak flows is shown below in **Table 11.**

Table 11 Clean Water Drain Concept Design Details (Engeny, 2022)

Item	SCNP Clean Water Drain
Drain Length	2,329m
Longitudinal grade	0.2% at steepest section
0.1% AEP peak Flow	9.1m^3/s
Base Width	10m
Maximum flow depth	1.4m
Maximum flow velocity	0.65m/s at steepest section
Maximum bund height	3.5m

5.2.7.2 Pit Dewatering

The existing Ramp 1 catchment area is 311 ha. Following completion of mining in the Project area, the catchment is expected to increase to approximately 674 ha by the end of the final landform development (**Appendix A - Figure 5.2**), representing an increase of 363 ha. Realignment of the dewatering pipeline to facilitate mining in Spring Creek North Pit is required and the proposed alignment is shown in **Appendix A - Figure 5.3**. No other changes to pipe infrastructure are expected with the Project pit continuing to dewater via the spine pipeline.



Legend

- Waterway
- Spring Creek North Clean Water Drain
- Bootes Creek Stage 1 Diversion
- Bootes Creek Stage 2 Diversion
- Spring Creek Diversion Drain
- Spring Creek North Drain
- ROC Waterway Catchments
- Maximum Potential Catchment Reduction
- ROC Mining Lease Boundaries
- SCNCP Project Area
- Project Pit

Source: State of Queensland (Department of Resources) 2022, Engeny 2023, Glencore 2023, METServe 2023, Maxar.

Path: S:\Projects\GC009_Rolleston\ArcGIS\Project_Files\Projects\GC009_Rolleston_SCN_Clean_Water_Drain_and_Flow_Path.aprx

Spring Creek North Continuation Project

Proposed Clean Water Drain and Surface Water Flow Path

0 250 500 1,000

Meters

Scale: 1:40,000 (A4)

21/03/2023

Datum: GDA2020
Projection: MGA55

FIGURE 8

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5.2.8 Potential Impacts on Environmental Values

Capture of rainfall runoff within the disturbance area has the potential to reduce overland flow in the immediate vicinity of the Project. However, impacts to the natural streamflow of waterways are expected to be negligible beyond the immediate Project area for the following reasons:

- The maximum potential Bootes Creek catchment reduction over the Project life, as per **Appendix A – Figure 6.1** is 510 ha. This represents approximately 5% of the total catchment (95 km²), and less than 1% of the total Meteor Creek catchment at the confluence with Bootes Creek;
- There are no water users in the immediate vicinity of the Project that will be impacted by the change in local catchments.

Although impacts are expected to be negligible, implementation of the proposed clean water drain will minimise the extent of overland flow impact while facilitating improved safety conditions for mining in the Project area.

The Project will be internally draining and managed through the existing water management system via pit dewatering sumps. Therefore, no external surface water quality impacts on the immediate or downstream waterways are expected.

Flood impacts resulting from the Project are expected to be negligible given:

- Mining commences high in the landscape and progresses further uphill to the north-west, resulting in negligible external catchment;
- The Project is situated 30m in elevation above the Bootes Creek floodplain, towards the top of the local catchment and is approximately 4km from Bootes Creek itself.

Cumulative impacts associated with the Project area are considered negligible as the individual impacts associated with development of the Project are similar to the existing Ramp 1 in the Spring Creek Pit. Improved outcomes for surface water post closure are expected as the Project enables effective rehabilitation of the final void. The existing Ramp 1 void highwall is located immediately south of the existing mine lease boundary and cannot, without the inclusion of mining activities in the Project area, be battered back to a flatter grade to improve landform and drainage outcomes. The proposed final landform will see backfilling of the existing Ramp 1 void.

5.2.9 Sodium Levels Table D3

In addition to activities relating specifically to the SCNCP, ROC also seek to amend the trigger levels for sodium within EA Table D3 – Release contaminant trigger investigation levels. This amendment will apply to release trigger levels for all mine affected water dams across site.

An amendment to EPML00370013 was approved in October 2022, which updated the trigger limits for Sodium across ROC's surface water monitoring points. This included updates to sodium trigger levels within EA tables D3 (Release contaminant trigger levels) and D5 (Receiving waters contaminant trigger levels).

The current EA trigger levels stated within Table D5 were taken from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, 2000* (the guideline). Table 4.2.8 of the guideline states trigger values for prevention of foliar injury due to sodium in irrigation water. The most restrictive value of 115 mg/L for sodium sensitive plants was chosen as stakeholders downstream from the ROC may require the use of downstream waters for irrigation purposes.

However, an administrative error meant that the value for Table D5 – Receiving waters contaminant trigger levels (115 mg/L) was replicated in Table D3 – Release contaminant trigger levels.

ROC has undertaken monitoring of waters released from the various mine affected water dams across site since 2008, with sodium levels within these waters ranging from 4 mg/L to 539 mg/L, with an average across 676 sample events completed to date of 192 mg/L.

The current trigger limit imposed within EA Table D3 of 115mg/L represents the 22nd percentile of sample results to date, which is considered inadequate for the effective management of mine affected water on site. RCH propose that the trigger level for Sodium in EA Table D3 (**Table 4**) is raised to 300 mg/L. This value is derived from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, 2000*. Table 5.2.3 of the guideline states water quality guidelines for recreational purposes. Within Table 5.2.3 a value of 300 mg/L is given for Sodium.

Within the Australian Drinking Water Guideline (*Australian Drinking Water Guidelines 6, 2011, Version 3.8 Updated September 2022*), Table 10.6 – Guideline values for physical and chemical characteristics, does not provide a health-based value for sodium. The only guideline value is an aesthetic value for a taste threshold of 180 mg/L.

When compared to sample results for the ROC from 2008 through to 2022 (**Figure 9**), the value of 300 mg/L represents the 87th percentile of Sodium results. As such it is believed that this value is better representative of the water conditions within the ROC water storages.

As the trigger value for receiving waters (EA Table D5) will remain at 115 mg /L, it is not anticipated that the amendment to release trigger levels will have any impact on the downstream environment or downstream stakeholders. If any of the ROC's downstream monitoring points detect levels of Sodium above 115 mg/L, and the downstream level is higher than levels at the relevant upstream monitoring point, any releases will cease, and an investigation conducted as per EA condition D18.

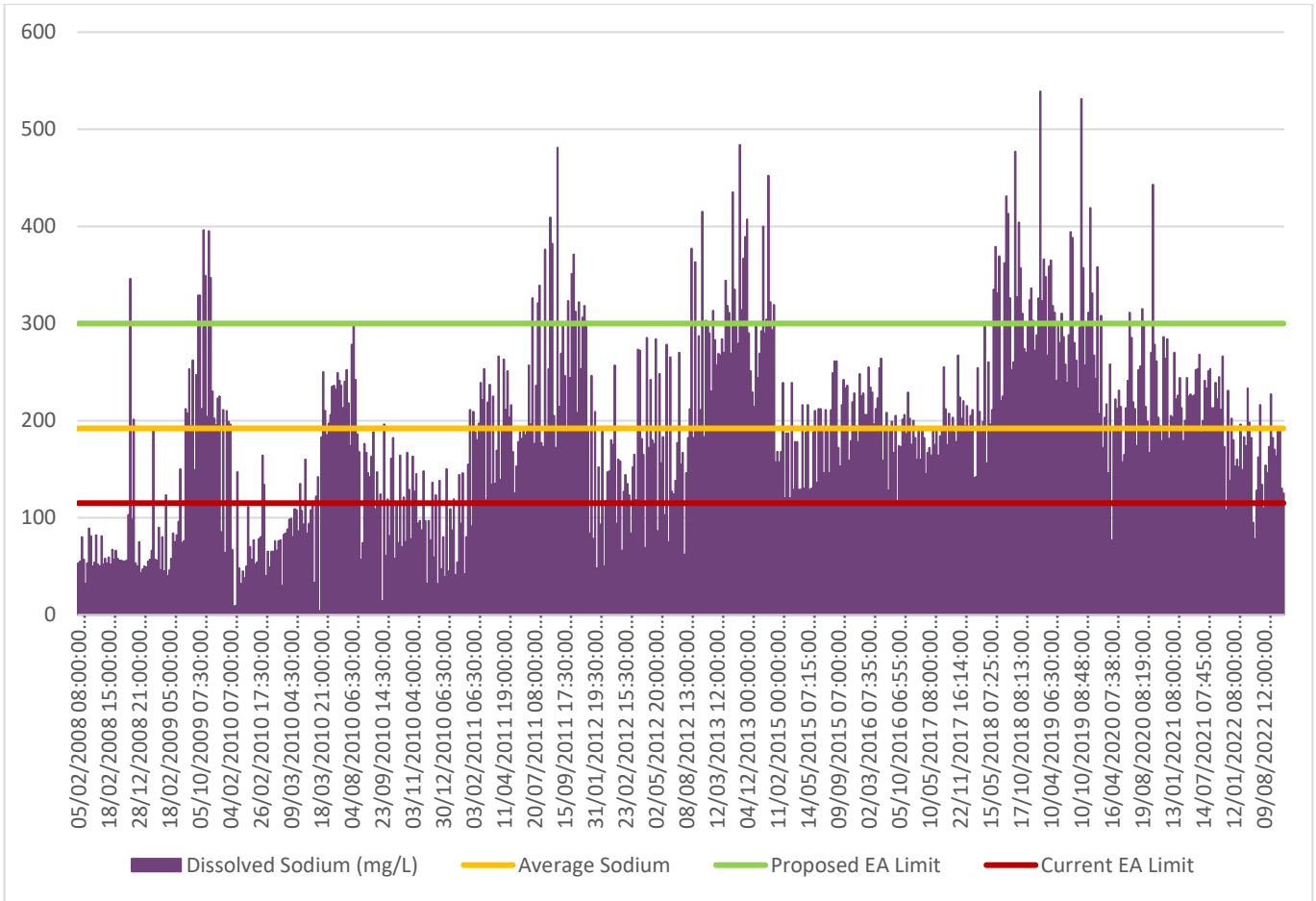


Figure 9 **ROC Surface Water Sample Results (Sodium) 2008 - 2022**

5.3 Groundwater

Umwelt Australia Pty Ltd (Umwelt) were engaged by RCH to undertake a groundwater assessment for the Project to support an amendment application for EA EPML00370013 and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

For the purposes of the groundwater assessment and modelling, the future ROC life of mine (LOM) plan was also included in the proposed mine plan, which includes:

- Within the previously approved disturbance extents, adjustments to pit footprint and mine plan for W1, W2, W3, W4, and Gibbs Gully Pit, that will be actively mined until the end of 2039;
- Slight adjustment to the Rolleston South Pit compared to the extent previously modelled by AGE (2014a), but consistent with the extent of mining in the Associated Water Licence (AWL) approval;
- In-pit and out of pit waste rock emplacements;
- Rehabilitation up to approximately 2046.

Available site data and publicly available information was collated to inform the current understanding of the conceptual groundwater model at the ROC. This included the current site geological model, recent bore census information, site monitoring data, installation of additional bores and site inspection. Based on the updated conceptual groundwater model, a MODFLOW-USG numerical model was developed. The model was informed by the inputs and design of previous modelling conducted at site by AGE (2014 and 2018).

The model was calibrated to match observed trends in groundwater levels, vertical heads, and mine inflows from 2002 to 2022. A transient predictive model was then run for a range of scenarios to represent the impacts for the previously modelled approved mine plan by AGE (2014), as well as the current ROC LOM plan and the Project. This has been undertaken to address an EA amendment application (refer **Appendix B, Section 1.4.2),** EPBC Act approval requirements (refer **Appendix B, Section 1.5**) and support amendment to the application to amend the associated water license (refer **Appendix B, Section 1.4.2**). The approved AWL mine plan (AGE 2018) was not remodelled, which more closely reflects the ROC plan. Therefore, the results presented by Umwelt are considered conservative estimates of predicted impacts due to the Project with regards to the AWL approval.

The key findings of the assessment were:

- During mining, inflows for the SCNCP Pit are predicted to peak in 2038 at 1,353 ML/year, with average inflows of 591 ML/year over the entire life of SCNCP Pit;
- Up to 755 ML/year is abstracted from Groundwater Unit 1 and up to 597 ML/year is abstracted from Groundwater Unit 2 over the life of the Project. No water is predicted to be abstracted from Quaternary alluvium in the SCNCP Pit area;
- Cumulative take for the Project plus current ROC LOM plan is a predicted to peak at about 1,919 ML/year in year 2025 for Groundwater Unit 1 (Alluvium) and 2,031 ML/year for Groundwater Unit 2 (Hardrock) in year 2029;
- Groundwater level drawdown within the alluvium and regolith due to the Project could extend approximately 5.5 km north and approximately 4 km east of the disturbance footprint. Results are generally consistent with previous predictions by AGE (2014a and 2018); with the exception of more extensive drawdown in the regolith north of SCNCP with the Project;
- Groundwater level drawdown and depressurisation in the Tertiary basalt due to the Project extends approximately 6 km north to north-west;
- Groundwater depressurisation within the Permian coal measures due to the Project could extend up to 11 km north and 13 km east of the disturbance extents. The extent of depressurisation is influenced by the extent of the coal measures and coal seam subcrop;
- Three existing landholder bores are predicted to recorded groundwater level drawdown of greater than 1 m due to the Project. These include one on Albinia Downs (AD09) and two in Albinia National Park (BH27 and NP03);

- Post mining, the SCNCP Pit is predicted to form a groundwater 'sink', with groundwater levels in the two main final voids (Void 7 and 8) predicted to recover to around 230 mAHD and 225 mAHD, respectively. Bootes Creek Pit and Spring Creek Pit are largely backfilled with current approved rehabilitation. Levels in Void 6 in Bootes Creek Pit is predicted to recover to around 225 mAHD. There is potential for localised seepage along the old alignment of Spring Creek from Spring Creek Pit; however, this varies dependent on assumptions in the recovery model design.

Monitoring will be conducted in accordance with the existing EA conditions, plus additional monitoring to address the key areas of potential impact. The existing site monitoring network will be expanded to include additional bores within the alluvium and a VWP. Once sufficient data has been collected from the proposed sites, site specific trigger levels will be established. As part of the program, trigger exceedances will be investigated, and management measures may be implemented as a result of the investigation.

The key findings outlined above are discussed in detail within this section. For the purposes of the groundwater assessment, the term 'Project site' encompasses the SCNCP. The term 'Study area' encompasses the Project (SCNCP), approved ROC operations and the surrounding region, which is captured within the groundwater model boundary.

5.3.1 Queensland Regulatory Framework

5.3.1.1 Water Regulation

The Queensland Water Act 2000 (Water Act) and subordinate Water Regulation 2016 are the primary legislation regulating groundwater resources in Queensland. The Water Act aims to ensure sustainable management and efficient use of water resources, with provisions covering approval requirements for water use and allocations.

The Water Act and Water Regulation 2016 are enacted under a framework of Water Plans (WPs). Water resources within the Project site are captured under the Water Plan (Fitzroy Basin) 2011, within the Highlands Groundwater Management Area and Comet River sub-basin. Surface water is within zone WQ1307 – Comet surface water, and groundwater is under groundwaters zone 13 and zone 25.

As part of the Project, RCH is proposing to exercise underground water rights for existing approved operations and the Project within MLs 70415 and 70307. Groundwater affected by the Project is within the Highlands Groundwater Management Area and Comet River sub-basin under the Water Plan (Fitzroy Basin) 2011. This relates to both Groundwater Unit 1 (containing aquifers of the Quaternary alluvium) and Groundwater Unit 2 (sub-artesian aquifers).

5.3.1.2 Environmental Authority

Under the Environmental Protection Act 1994 (EP Act), a groundwater impact assessment is required as part of the application to amend the Environmental Authority (EA) to undertake an environmentally relevant activity. Minimum reporting requirements for groundwater assessments are outlined within the EP Act Guideline Requirements for site-specific and amendment applications – underground water rights.

A summary of the guideline requirements and where they have been addressed within this report is provided in **Appendix B, Table 1.3**.

Groundwater assessment is also required to consider post closure conditions, as outlined in the Progressive Rehabilitation and Closure Plan (PRCP) guideline under the Mineral and Energy Resources (Financial Provisioning) Act 2018 (MERFP Act). There are a range of assessment requirements to inform the PRCP. These include conceptual modelling and numerical modelling of post closure groundwater conditions to predict post closure groundwater levels, flow pathways and interaction with key water resources. These requirements have been considered, and modelling results for post closure conditions are included within the assessment for incorporation into the forthcoming ROC PRCP.

5.3.2 Topography and Drainage

The topography of the Rolleston area consists of undulating hilly terrain associated with basaltic lava flows. Erosion has resulted in prominent escarpments which are drained by tributaries of the Comet River.

The highest relief in the Project site is about 280 metres above Australian Height Datum (mAHD) which is approximately 35 m to 40 m above the alluvial terraces of Meteor and Bootes creeks.

The Project site is located within the Comet River catchment in the Fitzroy Basin. Four creeks cross the ROC mining leases and these are from north to south, Spring Creek, Bootes Creek, Sandy Creek and Meteor Creek. Sandy Creek, Bootes Creek and Meteor Creek are defined as watercourses under the Water Act.

Within the Project site there is a minor drainage line that flows to the south to Spring Creek/ Bootes Creek. North of the Project area are Shannons Gully, Aldebaran Creek and two unnamed creeks that all flow in an easterly direction towards Meteor Creek. At distance to the south of the Project site are Peawaddy Creek and Yellowbelly Creek that flow to the east to Consuelo Creek/ Panorama Creek, which in turn flows into Comet River.

5.3.3 Geology

5.3.3.1 Regional Geology

Rolleston is located on the western edge of the Bowen Basin. The surface geology is dominated by Tertiary basalt across the site, with Quaternary alluvium localised along creeks (Meteor Creek and Bootes Creek). The Tertiary basalt and alluvium unconformably overlie the Permian aged Blackwater Group and underlying basement units (i.e., Black Alley Shale and Aldebaran Sandstone). The target coal bearing strata within the Study area is within the Permian aged Blackwater Group.

5.3.3.2 Local Geology

While regional geological mapping captures most key features within the Study area, updates to the geological understanding have been introduced based on site specific data. The available data for the site includes:

- Site geological model.
- Previous hydrogeological and geological studies conducted on site.
- Regional bores, including registered landholder bores where geology information is available and petroleum exploration holes/wells.
- Site visit conducted by Umwelt on 1 June 2022, to gain an on-ground understanding of the geology at site and discuss with the site geologists.
- Additional drilling and installation of nested monitoring bores by RCH near SCNCP in January 2023.

This site-specific data was reviewed and updates made to the local understanding of the geology for this assessment.

5.3.3.2.1 Quaternary Alluvium

Site drill holes and monitoring bores were utilised to refine the extent of the Quaternary alluvium present at site. The local extent of alluvium is greater than the regional mapped extent. Review of the drill logs indicates the Quaternary alluvium thickness can range between 1 m and 45 m, with an average thickness of around 22 m for Meteor Creek and around 13 m for Spring Creek and Bootes Creek. The drill lithological logs indicate the alluvium has a heterogenous distribution and composition, but generally comprises:

- Soil and surficial clays up to around 12 m thick
- Sand and gravels up to 44 m thick.

Quaternary alluvium does not occur within the Project area.

5.3.3.2.2 Tertiary Basalt

At site the Tertiary basalt is around 20 m to 100 m thick, with localised areas of higher thickness at the northern end of SCNCP.

The site geological data indicates at least three distinct flow phases in the basalt, with marker ash bands and interflow sediments (i.e., clays and sandy clays) between phases (EES, 2013). The upper phases (TB1 and TB2) have an amygdaloidal texture, with cavities infilled within minerals (i.e., calcite), while the deepest phase (TB3) more reflects massive (refer **Appendix B, Figure 2.11**). The infilled cavities within the amygdaloidal basalt (TB1 or TB2) can be preferentially weathered where it occurs at surface.

Review of site geological drill logs also indicates the presence of a Tertiary clay/tuff unit that is recorded between 1m to 23m in thickness, around 4.5m thick on average. The clay unit is underlain by Tertiary basal sands and gravels that are recorded on site drill logs to be around 3m thick on average and ranges between 1m to 9m thick, where it is present. It is noted that the Tertiary basal sands are not present in all drill records. The site dewatering and abstraction bores (refer **Appendix B, Figure 2.10**) are largely constructed to target these basal sands.

5.3.3.2.3 Permian Coal Measures

ROC targets the economic coal seams within the Upper Permian Blackwater Group, which unconformably underlies the Tertiary basalt at site. The site geological model, developed based on site exploration data, shows the extent of the Permian coal measures differs slightly compared to regional mapping. The extent of the coal measures is influenced by the presence of the Springsure, Consuelo and Inderi anticlines.

The coal seams are interbedded with siltstone/mudstone and minor sandstone, which is referred to as overburden and interburden. During the site visit, the site geologists noted the presence of a heat affected contact zone where the Permian coal measures unconformably underlie the Tertiary basalt. This zone exhibits as a green siltstone unit overlying light grey siltstone/mudstone. Anecdotal information from site personnel indicates this unit is competent and hard with a low porosity; however, no site-specific hydraulic data was available at the time of reporting to provide confirmation.

The main coal seams at site are the X, A, B, C and D seams, as shown in the stratigraphic column in **Appendix B, Figure 2.8**. The X Seam (X1, X2) can be economic in places, but is generally a thin seam. The coal seams occur in various splits with an average thickness of around 3.5 m for A Seam and 2.5 m for B Seam. C Seam is less than 0.5 m thick and occurs within 3 m below B Seam. D Seam is the main economic coal seam at site, ranging between 0.7 m and 6.1 m thickness and 4.4 m thick on average.

The Blackwater Group conformably overlies the Black Alley Shale, which generally occurs 30 m below the D Seam. The Black Alley Shale conformably overlies the Peawaddy Formation, Catherine Sandstone, Ingelara Formation, Freitag Formation and Aldebaran Sandstone.

5.3.3.3 Structural Geology

The structural geology of the Study Area includes a series of generally north to south trending anticlines and synclines (folds), including the Springsure Anticline to the west, the Consuelo Anticline to the south and the Inderi Anticline to the north-east (refer **Appendix B, Figure 2.7**). The Blackwater Group Permian coal measures occur at outcrop along the anticline structures, and the Tertiary basalt is thickest within the syncline structures and largely absent at the hinge zone of the anticlines.

A large regional-scale fault is mapped to the distant east of the Study Area; however, no details on the fault type and properties are available. Minor faults have also been mapped across the Study Area, as shown in **Appendix B, Figure 2.7**.

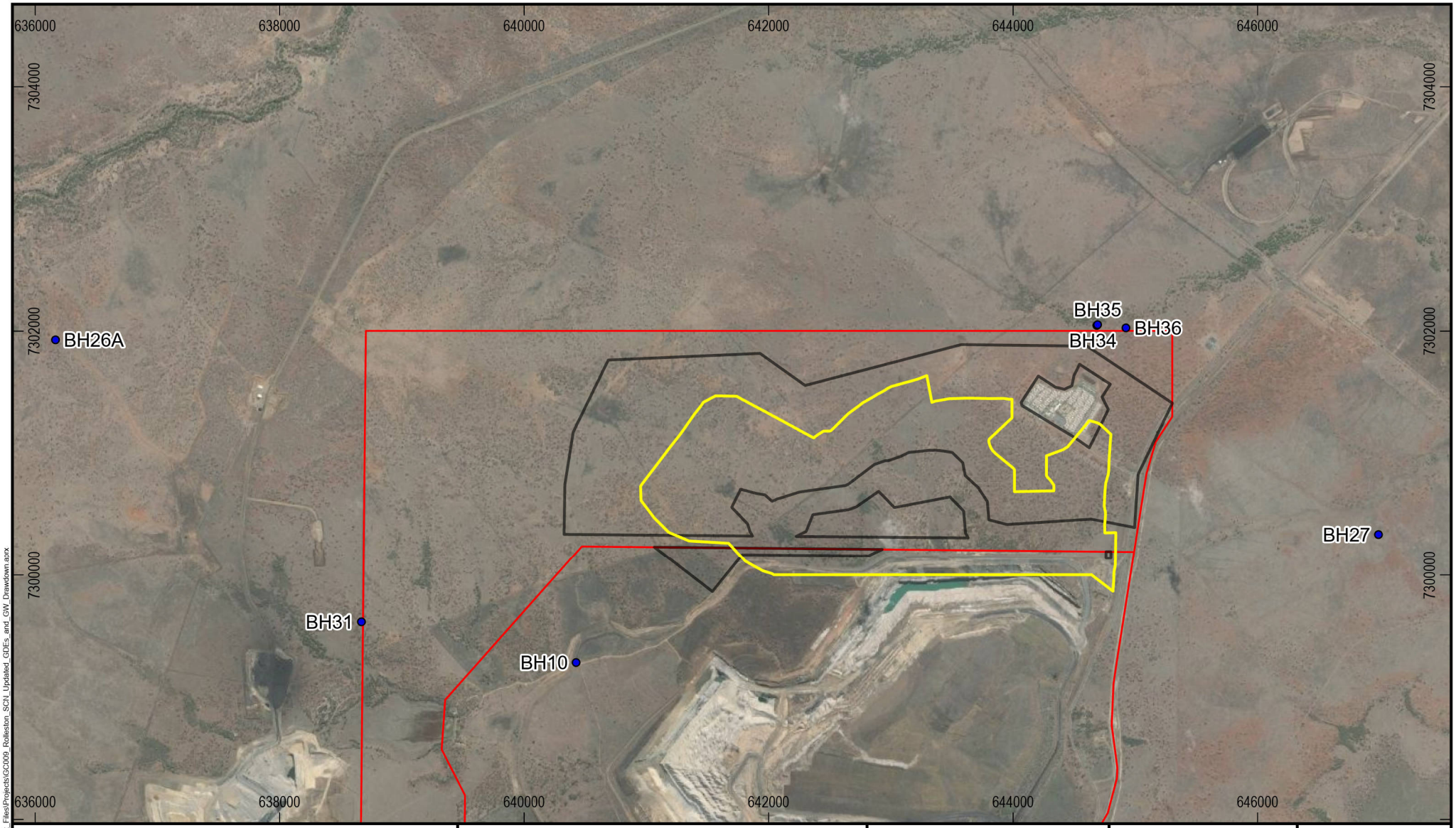
5.3.4 Hydrology

5.3.4.1 Groundwater Monitoring

Groundwater monitoring is conducted at site in accordance with requirements outlined in the AWL and EA. The location of the monitoring bore network within the immediate vicinity of the Project is shown in **Figure 10**, while the monitoring bore network across the wider ROC is presented in **Appendix B, Figure 3.1**. **Table 12 i**ncludes details on the bore status, use, construction details, and data availability.

The geology intersected by each bore has been reviewed against mapped geology, bore construction details and site drill hole information. Based on this, the geology for bores BH19, BH11and BH26 has been revised to the basement units, Catherine Sandstone and Black Alley Shale.

Three new monitoring bores (BH34 to BH36) were also recently installed by ROC in the Tertiary basalt to the north of the SCNCP. The bores were installed near each other at different depths to help characterise the degree of vertical connectivity within the Tertiary basalt. Data collection is still ongoing.



Legend

- Groundwater Monitoring Bores
- ROC Mining Lease Boundaries
- Spring Creek North Project Area
- Project Pit

Source: State of Queensland (Department of Resources) 2022, Glencore 2023, Umwelt 2023, METServe 2023, Maxar.

Spring Creek North Continuation Project

Groundwater Monitoring Network

0 0.5 1 1.5

Kilometers

Scale: 1:44,000 (A4)

28/04/2023

Datum: GDA2020
Projection: MGA55

FIGURE 10

GLENCORE

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\GC009_Rolleston\ArcGIS\Project_Files\Projects\GC009_Rolleston_SCN_Updated_GDEs_and_GW_Drawdown.aprx

Table 12 ROC Groundwater Monitoring Bores (Uwmelt, 2023)

Bored ID	Easting	Northing	Ground Elevation (mAHD)	Screened Geological Unit	Screen Depth (mBGL)	Status/Purpose	Monitoring Period
BH1	641654	7295517	256.18	Blackwater Group	47.5-67.5	Inactive	2003-2011
BH2	641646	7295546	253.18	Basalt	7-25	Inactive	2003-2011 (S)
BH5*	644475	7292615	236.57	Blackwater Group	32-40	Quarterly SWL	2003-2022
BH6*	644507	7292607	234.68	Basalt	6-23	Quarterly SWL and EA Compliance bore	2003-2022
BH7*	642691	7290062	236.57	Blackwater Group	36-90	Quarterly SWL	2003-2015 (S)
BH8*	642688	7290050	236.64	Alluvium	15-28	Quarterly SWL	2003-2019 (S)
BH9	638259	7295278	251.94	Basalt	65-80	Quarterly SWL	2003-2022 (S)
BH10	640425	7299283	239.36	Basalt	69-84	Quarterly SWL	2003-2022 (S)
BH11	644853	7297781	236.44	Permian coal measures/ basement†	49-59	Quarterly SWL and EA Compliance bore	2003-2022
BH12	645327	7295906	236.2	Basalt	39-40	Quarterly SWL and EA Compliance bore	2003-2022 (S)
BH13	636334	7295451	257.34	Basalt	5-12	Quarterly SWL	2014-2022
BH14	636331	7295446	257.82	Basalt	37-43	Quarterly SWL	2018-2022
BH15	634030	7291055	296.79	Basalt	54-57	Quarterly SWL and EA Reference bore	2016-2022
BH16	634030	7291055	296.9	Blackwater Group	123-129	Quarterly SWL	2018-2022
BH17	637931	7292303	258.11	Basalt	69-86	Quarterly SWL and EA Compliance bore	2016-2022
BH18	637935	7292299	258.29	Basalt	80-83	Quarterly SWL	2018-2022
BH19	640749	7288678	242.96	Catherine Sandstone†	17.4-23.4	Quarterly SWL	2012-2022 (L)
BH20	641490	7290115	239.83	Alluvium	17.4-20.4	Quarterly SWL	2012-2022
BH21	645030	7291360	235.5	Alluvium	16-22	Quarterly SWL	2016-2022
BH22	645034	7291360	235.54	Blackwater Group	74-80	Quarterly SWL	2018-2022
BH23	642150	728885	242.37	Alluvium	16-19	Quarterly SWL	2012-2022
BH24	648058	7289701	255.4	Basalt	27-34	Quarterly SWL and EA Compliance bore	2015-2022
BH25	639711	7287296	246.5	Alluvium	24-30	EA Reference bore	2017-2022 (L)
BH26	632960	7300527	267.5	Black Alley Shale†	27-30	Quarterly SWL	2015-2022 (L)
BH26A	636166	7301929	267.4	Basalt	51-54	Quarterly SWL and EA Reference bore	2016-2022 (L)
BH27	646989	7300335	242.3	Basalt	67-70	Quarterly SWL and EA Reference bore	2018-2022

Bored ID	Easting	Northing	Ground Elevation (mAHD)	Screened Geological Unit	Screen Depth (mBGL)	Status/Purpose	Monitoring Period
BH28	647197	7293901	228.4	Alluvium	16-22	Quarterly SWL and EA Compliance bore Landholder bore in use 280m to the west	2016-2022
BH29	649785	7290830	242.3	Basalt	30-46	Quarterly SWL (including Make Good monitoring) and EA Compliance bore Landholder bore in use 625m to the south-east	2015-2022
BH30**	647756	7294487	229.4	Alluvium	12-15	Quarterly SWL	2018 - 2020
BH31	638669	7299616	256.68	Basalt	21-27	Quarterly SWL and EA Reference bore	2017-2022
BH32	635754	7196950	277.30	Basalt	5-25	Quarterly SWL and EA Reference bore	2017-2022 (L)
BH33	647308	7292448	230.50	Alluvium	20-23	Quarterly SWL and EA Compliance bore Landholder bore use	2017-2022
BTD3	644180	7287666	290.50	Blackwater Group underlying Rewan	79-85	Quarterly SWL	2014-2022
BH34	644685	7302047	240.5	Basalt	9 – 13 (gravel 9-13)	Installed Jan 2023 SWL 7.5 mbgl Yield 1.3 L/s	-
BH35	644691	7302053	240.5	Basalt	42 – 48 (gravel 21 – 51)	Installed Jan 2023 SWL 9 mbgl Yield 0.093 L/s	-
BH36	644923	7302027	238.9	Basalt	86 – 92 (gravel 66 – 102)	Installed Jan 2023 SWL 10 mbgl Yield 1.83 L/s Potentially intersects Permian from 91-102m	-

Note: ^ Coordinates in GDA2020 Z55* bore mined out ** bore blocked/removed

(S) Stygofauna sampling conducted on bore in 2011 by ALS (L) Logger installed

† Geology revised from Blackwater Group, informed by review of mapped geology and bore construction details.

~ Ground Elevation based on DEM data

5.3.4.2 Hydraulic Properties

Site specific data has been collected at site from pumping tests and slug tests, as reported by AGE (2009) and AGE (2013). Test results show that the hydraulic conductivity for Meteor Creek alluvium can range between 2.2 x 10-1 m/day and 2.61 x 102 m/day, with the higher hydraulic conductivity associated with the gravels at Irrigation Bore 1. AGE (2009) also recorded a specific yield of between 0.00358 and 11.4 %.

The results for Tertiary basalt ranged between 7.6 x 10-2 m/day and 5 m/day, with the higher hydraulic conductivity recorded at shallow bore BH13 (5 – 12 m depth). This corresponds with observed geology at site, where amygdaloidal basalt is observed with infilled cavities (potentially calcite). Cavity mineralisation appears to preferentially weather out in the surface samples. The occurrence of the cavities decreases with depth and grades into more of a massive basalt, where groundwater occurrence is likely influenced more by fracturing and faulting.

Limited data is available for the Permian coal measures, with one bore recording a hydraulic conductivity of 1.6 x 10-1 m/day for coal (BH22) and around 1.7 x 10-2 m/day and 8.0 x 10-2 m/day for the shallow overburden (BH19). The heat affected contact zone is observed where the Permian coal measures unconformably underlie the Tertiary basalt, which exhibits as a green siltstone unit overlying light grey siltstone/mudstone. No site-specific hydraulic data is available for the overburden unit.

5.3.4.3 Groundwater Distribution, Flow, Recharge and Discharge

5.3.4.3.1 Quaternary Alluvium

Quaternary alluvium is localised around drainage lines and comprises heterogeneously distributed unconsolidated sediments to depths of up to 45 m. There are no monitoring bores within the Spring Creek or Bootes Creek alluvium within the Project area, due to the absence of alluvium within the area. Groundwater level data from across the ROC indicates the presence of groundwater in the alluvium, generally between 12 m to 18 m below ground. Alluvial groundwater conditions appear to be unconfined, with recharge from rainfall and streamflow.

There are a range of landholder bores intersecting the alluvium along Aldebaran Creek (refer **Appendix B, Section 3.5.1**), including Inderi bores (I02, I03, I04, I05 and I06), as well as Meteor Downs bores (MD14 and MD15). Bore census information from RCH indicates the presence of shallow groundwater in the alluvium, at a depth of around 10 m to 16 m. The available bore census information indicates groundwater from the alluvium is largely used for stock water supply. Further discussion on private groundwater use is included in **Appendix B, Section 3.5.1.**

Groundwater discharge from the alluvium to the incised creeks (baseflow contributions) has the potential to occur in localised areas following peak recharge events.

5.3.4.3.2 Tertiary Basalt

The Tertiary basalt is present across most of the Study area and includes three main flow events (TB1, TB2 and TB3). Groundwater occurrence in the basalt is largely associated with the amygdaloidal basalt in TB1 and TB2 and within the shallow weathered basalt. Recharge to the Tertiary basalts is predominantly derived from direct rainfall recharge, as well as potential downward seepage from alluvium (where present) and upward seepage from the underlying coal measures.

Following peak flood events in 2010, groundwater levels within the Tertiary basalt were recorded within 1.7 m to 24.4 m below ground level (mbgl). The shallow levels were recorded at BH5 (**Appendix B**, **Figure 3.1**), which intersects Tertiary basalt below the Meteor Creek alluvium. Over 2021 groundwater levels in the shallow Tertiary basalt ranged between 8.1 m to 18.7 mbgl, coinciding with a period of below average rainfall and progression of mining. In late 2022 the area experienced above average rainfall, therefore it is expected current groundwater levels have increased. BH34 was recently installed in January 2023 into the shallow weathered basalt and indicated the presence of groundwater at around 7.5 m deep. The bore was drilled following a period of above average rainfall at the site and is located near Unnamed Gully 1 (**Figure 10**)**.**

There are 20 monitoring bores at site targeting the Tertiary basalt to depths of between 15 m and 92 m. Groundwater levels in the Tertiary basalt have largely declined since around 2012, corresponding with a sustained period of below average rainfall. With above average rainfall in 2022, it is anticipated groundwater levels may rise.

Drawdown in the Tertiary basalt is expected around the active mine area, with a slightly steeper rate of decline for bores BH6 and BH10 that are within 1 km of dewatering bores and approximately 1 km of the mine area.

The majority of landholder bores are constructed in the Tertiary basalt, largely targeting the shallower amygdaloidal basalt in TB1 and TB2. The available bore census information indicates groundwater from the Tertiary basalt is largely used for stock water supply. Further discussion on private groundwater use is included in **Appendix B, Section 3.5.1**.

The interpolated depth to groundwater in the Tertiary basalt in most areas across the ROC is over 20m. However, there are some localised areas where groundwater is within 10m in the shallow weathered basalt. This includes the lower reach of the unnamed tributaries north of SCNCP and upper reach of Bootes Creek. Groundwater discharge from the Tertiary basalt to the incised creeks (baseflow contributions) has the potential to occur in localised areas following peak recharge events. Further discussion on groundwater surface water interactions is included in **Section 5.3.4.4**.

5.3.4.3.3 Permian Coal Measures

The Permian aged Blackwater Group is present across the Project site, and conformably overlies the basement units of Black Alley Shale to the Aldebaran Sandstone.

The Blackwater Group includes what is generally considered hydraulically 'tight' interburden sequences of mudstone, siltstone and minor sandstone. The coal seams (A, B, C and D) are the main groundwater bearing units, with groundwater occurrence and flow influenced by secondary porosity within the fractures and cleats. Groundwater recharge to the Blackwater Group includes rainfall recharge where it occurs at outcrop along the Springsure Anticline, Consuelo Anticline and Inderi Anticline, as well as downward seepage where it unconformably underlies the Quaternary alluvium and Tertiary basalt.

The highest groundwater heads are recorded to the west in the Black Alley Shale for BH26 and in the Blackwater Group for BH16, indicating a general gradient of flow towards the east. The available groundwater trends show a subdued response to climate trends, with a rise in heads with above average rainfall in 2011, followed by a general decline in heads since 2012 with a period of below average rainfall.

The trends also show influence from active mining. Groundwater heads are lowest within the immediate mine area, reflecting depressurisation in response to mining. Interpolated groundwater heads and flow within the Permian coal measures are presented in **Appendix B, Figure 3.10**, which shows the localised depressurisation around the active mine area.

5.3.4.4 Groundwater Surface Water Interactions

The surface water-groundwater interaction has been assessed by comparing observed stage height at site surface water stream gauges and nearby groundwater level observations in the alluvium and basalt. The locations of the creek water stage recording stations are shown in **Figure 5**. The details of these monitoring points are given in **Table 8**.

Groundwater monitoring points BH28 and BH30 are both screened in alluvium, 750m and 1400m from station MP4 (331902), respectively. Groundwater levels in BH28 and BH30 follow the same trend indicating hydraulic connectivity between these points. Groundwater levels have been recorded 13 m below the creek level, which indicates potential losing conditions. Groundwater levels in the alluvium could temporarily rise and contribute baseflow to Meteor Creek in response to peak rainfall events; however, there is limited temporal groundwater data available for the sites.

As Tertiary basalt outcrops in the region, bores screened in basalt were also chosen to analyse potential surface water-groundwater interaction. Bores BH11 and BH9 are 777 m and 1,600 m from stations MP3 (331900) and MP1 (331901), respectively. Bore BH11 is constructed across Tertiary basalt and Permian coal measures, so is not an ideal fit, but is the closest available bore. Groundwater levels at BH9 have remained around 10 m below the creek level at MP1, and levels at BH11 have remained around 10 m below the creek level at MP3. The shallowest groundwater levels recorded have been around 7 m below surface for BH9, and around 9 m below surface for BH11. Groundwater levels in the Tertiary basalt could temporarily rise and contribute baseflow to Bootes Creek in response to peak rainfall events; however, there is limited temporal groundwater data available for the sites.

5.3.5 Baseline Water Quality

5.3.5.1 Water Type

The anion-cation balance for ROC monitoring bores is shown on the Piper diagram in **Figure 11**, which shows the main water types. Approximate groupings of water type for the three main water sources is shown in **Figure 11**. This includes Mg-HCO_3 type water for the alluvium and Na-HCO_3-K type water for the Permian. Groundwater in the Tertiary basalt exhibits a mixed water type, with a high proportion of HCO_3 but generally no dominant cations. It is noted that BH15 records highly variable water quality, which appears to be unique to this bore and may relate to sampling methodology or the condition of the bore.

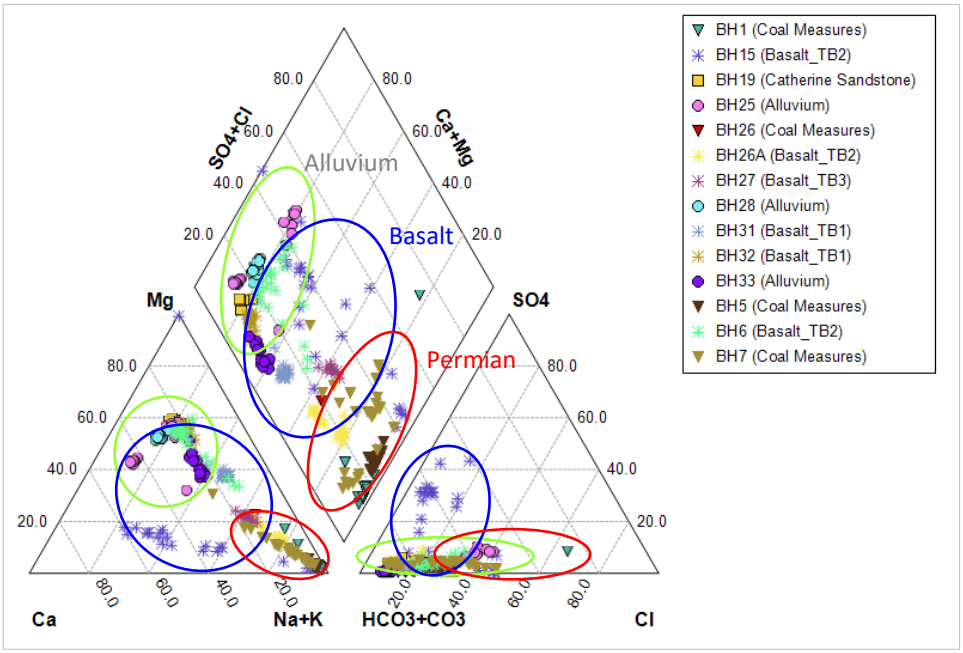


Figure 11 Piper Diagram of ROC Bores (Umwelt, 2023)

5.3.5.2 Salinity

Water quality data from ROC bores provides useful information on the beneficial use of groundwater associated with the major stratigraphic units. Salinity is a key constraint to water management and groundwater use and can be described by total dissolved solid (TDS) concentrations.

Figure 12 presents the salinity as total dissolved solids (TDS) for the main groundwater sources and surface water from the Comet River.

The graph shows that water within the Comet River is largely fresh with an average TDS of 215 mg/L, ranging between 12 mg/L and 607 mg/L. Water within the alluvium is generally fresh to brackish with an average TDS of 489 mg/L, ranging between 34 mg/L and 1,101 mg/L. Water within the Tertiary basalt is also fresh to brackish with an average TDS of 717 mg/L, ranging between 132 mg/L to 1,830 mg/L. One bore within the basalt (BH24) indicates moderately saline groundwater conditions, or potentially non-representative data.

Water within the Permian coal measures are fresh to brackish with an average TDS of 797 mg/L, ranging between 206 mg/L and 1,490 mg/L. The fresh water quality readings for the Permian include two results for BH7 in 2010 of up to 266 mg/L following the peak flood event. BH7 was located within the current footprint of Meteor South Pit, and shows the influence of recharge to the coal measures following flood events. The fresh water quality was also recorded from 2013 to 2015 for BH19. BH19 is a shallow bore (23.4 m deep) and likely intersects the Catherine Sandstone at subcrop beneath Meteor Creek alluvium. There is potential for downward seepage/recharge to the basement unit from alluvium. The results may also reflect the bore construction and potential mixing between units in the bore.

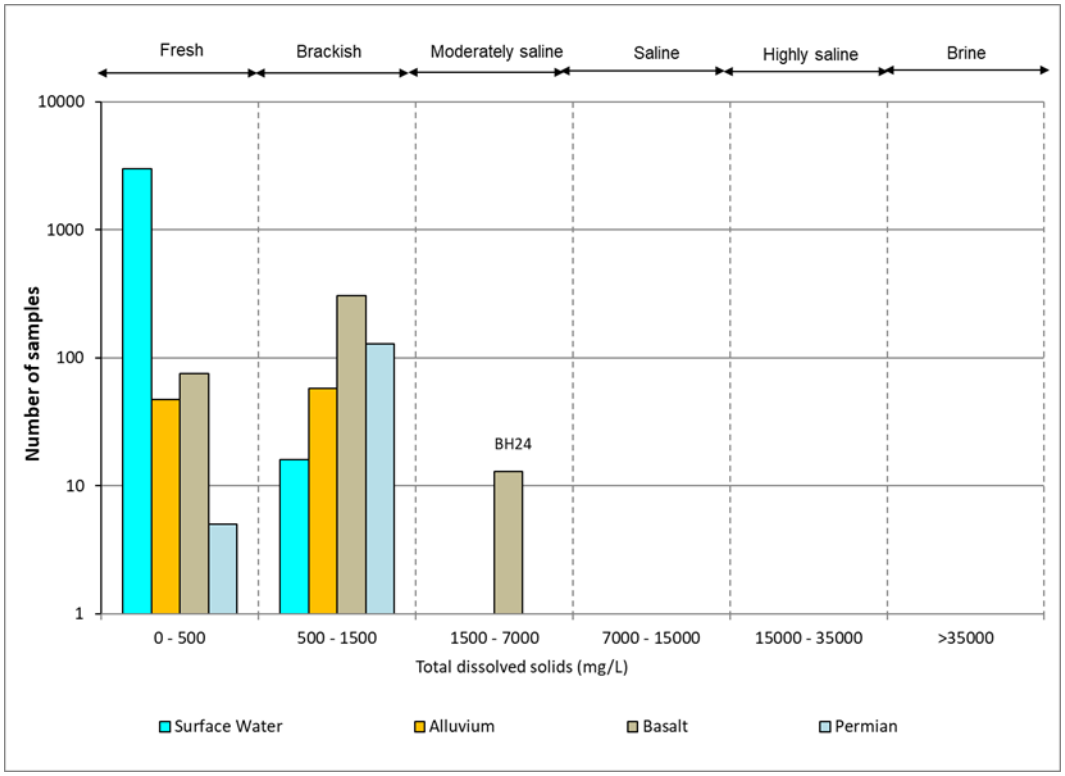


Figure 12 FAO (2013) Salinity Ranking by Unit (Umwelt, 2023

5.3.5.3 Beneficial Groundwater Use

The Project site falls within the Highlands Groundwater Management Area (GMA) in the Comet Subarea zone 13 and zone 25 of the Fitzroy Basin under the Water Plan (Fitzroy Basin) 2011. Groundwater at the Project site includes alluvial groundwater under GMA Groundwater Unit 1 (containing aquifers of the Quaternary alluvium) and Groundwater Unit 2 (sub-artesian aquifers).

The management objective of the Water Plan (Fitzroy Basin) 2011 is to maintain the 20th, 50th and 80th percentiles water quality results in order to preserve or enhance groundwater quality for its recognised uses. In the case of the Comet Sub-area groundwaters, these values include aquatic ecosystems, irrigation, farm supply/ use, stock watering, primary recreation, drinking water as well as being of cultural and spiritual value. Review of the registered bores in the region (refer **Appendix B, Section 3.5.1**) highlights groundwater in the Study area is largely used for stock water supply, with some used for domestic water supply and fire suppression.

In order to understand the groundwater resources within the Study Area, available water quality data has been compared to the:

- Fitzroy Basin Zone 25 Groundwater Quality Objectives (WQO) for deep and shallow water (<30 m), and Zone 13 WQO for deep water;
- Australian Drinking Water Guidelines (ADWG) (NHMRC 2011);
- ANZECC (2000) guidelines for fresh-water aquatic ecosystems and stock water supply.

A summary of the available ROC site groundwater quality data is presented in **Appendix B, Table 3.4**, grouped by groundwater source. Surface water quality data for Comet River is also presented, based on government monitoring data (station 130506A). As shown in **Appendix B, Table 3.4** groundwater in the Quaternary alluvium, Tertiary basalt and Permian coal measures all exhibit neutral water quality on average, ranging between 6.4 and 7.8. Based on the available water quality data, all groundwater sources are not considered suitable for drinking water, due to elevated metals. All groundwater sources are also not considered suitable for fresh-water aquatic ecosystems due to elevated EC and metals.

Groundwater in the Quaternary alluvium, Tertiary basalt and Permian coal measures is generally suitable for stock water supply on average. However, it is noted that total aluminium concentrations can exceed the guideline levels for all groundwater sources. The Quaternary alluvium and Tertiary basalt also recorded isolated readings of elevated chromium.

5.3.6 Numerical Groundwater Model

Numerical groundwater modelling was undertaken by Umwelt to assess the impact of the proposed Project, and approved operations on the groundwater regime. The objectives of the modelling are to:

- Determine the spatial change of groundwater levels with time.
- Predict the extent and area of influence of dewatering around the Project site.
- Estimate the potential changes in regional groundwater flow directions and report the potential impacts on landholder water supply bores.
- Quantify the direct groundwater inflows to the mine workings, and indirect change in groundwater conditions in connected water sources.
- Identify the potential impacts on GDEs and private landholder bores, where the mitigation of groundwater impacts may be required.
- Assess the cumulative impacts associated with approved and surrounding mining.
- Predict change in groundwater conditions post-closure, and identify areas of potential impact, where mitigation measures may be required.

Details on the setup and assumptions are presented in **Appendix B, Section 4,** with the full document referenced within **Appendix B, Appendix B – Rolleston Coal Operations Numerical Groundwater Model.**

5.3.7 Groundwater Impact Assessment

5.3.7.1 Predicted Inflows to SCNCP Pit

The total annual volumes of groundwater predicted to be intercepted by the SCNCP Pit is shown in **Figure 13**. This total volume includes water removed in rock material with mining, as well as water evaporated from the pit surface. It is therefore an over-estimate of water that could report to the site water balance.

As shown in **Figure 14** the inflows for the SCNCP Pit are predicted to peak in 2038 at 1,353 ML/year, with average inflows of 591 ML/year over the entire life of SCNCP Pit.

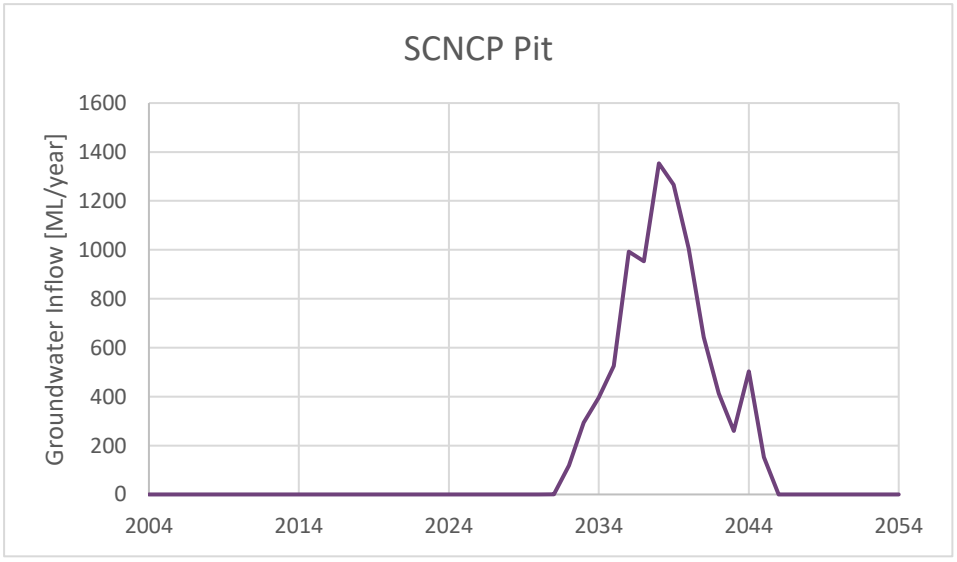


Figure 13 Predicted Groundwater Inflows – SCNCP Pit (Umwelt, 2023)

The predicted inflows by groundwater source were also extracted by assigning drain inflows by layer, to separate contribution by layers representing the Water Plan (Fitzroy Basin) 2011 groundwater zones, being:

- Groundwater Unit 1 (containing aquifers of the Tertiary Basalt); and
- Groundwater Unit 2 (Permian aquifers).

Figure 14 shows the predicted interception of groundwater for the SCNCP mine plan. The results indicate that for the SCNCP, up to 755 ML/year is abstracted from Groundwater Unit 1 and up to 597 ML/year is abstracted from Groundwater Unit 2 over the life of the Project. No water is predicted to be abstracted from Quaternary alluvium in the SCNCP Pit area.

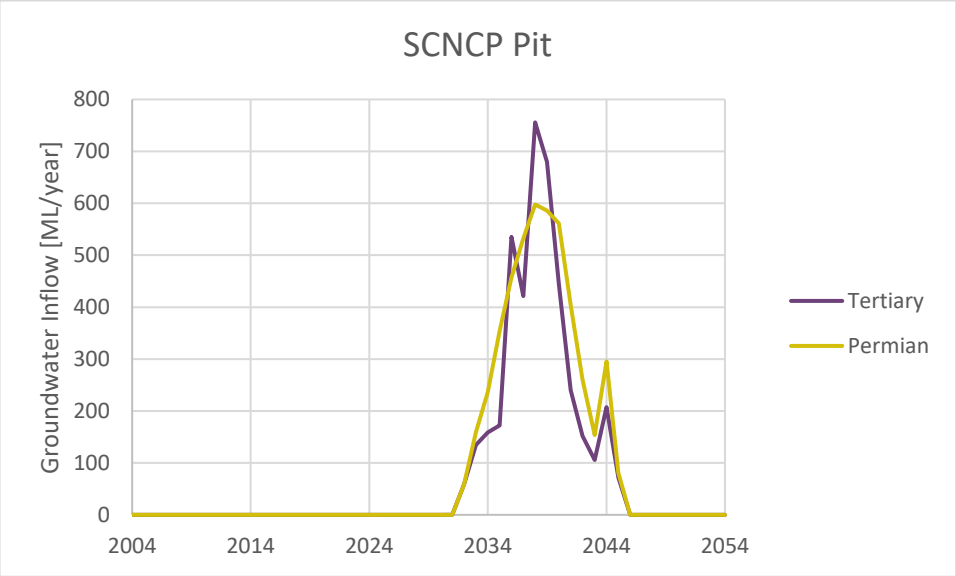


Figure 14 Predicted Groundwater Inflows by Unit for SCNCP (Umwelt, 2023)

5.3.7.2 Predicted Drawdown

Excavation with mining involves dewatering (advance and in-pit), excavation of rock material with entrained water, as well as exposure of the pit face to evaporation. This results in reduction in groundwater levels within the surrounding stratigraphy, with drawdown in unconfined units (i.e. alluvium/regolith) and depressurisation in confined units (i.e. Tertiary basalt and Permian coal measures). Depressurisation and drawdown is greatest at the working coal-face, and gradually reduces with distance from the mine.

Maximum drawdown due to the Project is obtained by comparing the difference in groundwater head predicted for the Proposed model scenario (Project plus ROC LOM plan) and groundwater head predicted for the Approved model scenario at all times. The predicted maximum incremental drawdown due to the Project and for the cumulative Proposed model scenario are presented for model layers representing the unconsolidated (layers 1 and 2), Tertiary basalt (layers 3, 4 and 5), deepest mined seam (layer 11) and Aldebaran Sandstone basement (layer 13). The figures have been zoomed in to show the Project area incremental drawdown. The figures also show the location of private bores (not on Glencore owned land) targeting groundwater in the relevant unit/layer.

Appendix B, Figure 5.5 shows the maximum drawdown due to the Project within the regolith (layer 1 and layer 2 combined) where the unit is predicted to be saturated. As shown in **Appendix B**, **Figure 5.5**, drawdown higher than 1 m in the regolith for the Project only and Proposed model scenario extends approximately 5.5 km north of the disturbance footprint, which is approximately 3.5 km further than was previously predicted by AGE (2018). The increase in drawdown extent is due to the inclusion of SCNCP Pit, as well as potential influence of the model updates. The extent of drawdown to the west is limited by the subcrop extent of the coal seam, consistent with predictions by AGE (2018).

There are no landholder bores targeting the alluvium or regolith within the predicted extent of drawdown due to the Project.

Appendix B, Figures 5.6 to **5.8** show the maximum depressurisation due to the Project within Tertiary basalt (layer 3, layer 4 and layer 5).

As shown in the figures, depressurisation higher than 1 m in the Tertiary basalt can extend approximately 6 km north to north-west. Additional landholder bores occur within the extent of maximum depressurisation due to the Project, which is further discussed in **Appendix B, Section 5.6.1**.

The extent of cumulative drawdown for the Proposed model scenario to the west and east is similar to predictions by AGE (2014) and AGE (2018). It is predicted that depressurisation in the basalt could extend up to around 5.5 km south-west of W1, beyond the extent previously predicted by AGE (2014) and AGE (2018).

Appendix B, Figure 5.9 shows the maximum depressurisation due to the Project within D Seam (layer 11). As shown in **Appendix B, Figure 5.9**, depressurisation higher than 1 m in the D Seam for the Project can extend up to 11 km north and 13 km to the east of the disturbance extents.

This is further north and east than was previously predicted by AGE (2014) and AGE (2018). The difference would relate to inclusion of the SCNCP Pit, plus also a range of updates to the model. Additional landholder bores occur within the extent of maximum depressurisation due to the Project, which is further discussed in **Appendix B, Section 5.6.1**.

Appendix B, Figure 5.10 shows the maximum depressurisation due to the Project within Aldebaran Sandstone basement (layer 13). As shown, depressurisation higher than 1 m in layer 13 for the Project can extend up to 12 km north and 16 km to the east of the disturbance extents. Maximum depressurisation due to the Project occurs in SCNCP Pit with up to ~7 m decline in head in its northern areas.

5.3.7.3 Proportion of Impact Due to Project

Due to the history of mining at the site, the predicted incremental drawdown due to the Project includes drawdown in areas where groundwater levels are impacted by the approved future operations. To help illustrate the actual incremental impacts due to the Project, the proportion of drawdown due to the Project has been calculated. This has been calculated using the incremental drawdown of the Proposed model scenario divided by the total maximum drawdown for the Proposed model scenario to produce a percentage contribution. To focus on the Project site, the drawdown figures have been zoomed to the Project site.

The percentage contribution of drawdown and depressurisation due to the Project is shown in **Appendix B, Figure 5.11** for the unconsolidated (layer 1 and 2), **Appendix B, Figure 5.12** for the Tertiary basalt (layer 4) and **Appendix B, Figure 5.13** for the D Seam (layer 11).

The figures show the Project contributes the majority (> 50 %) of drawdown and depressurisation around the SCNCP Pit.

5.3.8 Post Closure Groundwater Conditions

The post closure recovery period extends from around 2046 to 3039. Quarterly stress periods are included until 2050, followed by annual stress periods to 2060. The stress period length increases from 10 years until 2190 and 50 years until 3039. The predictive model was set up with average climatic and stream conditions.

Within the SCNCP Pit two main groundwater sinks form in two proposed voids (Void 7 and 8) within the final landform at around 230 mAHD and 225 mAHD, respectively. There are also two small void areas where the final landform surface dips down, which are Void 9 and 10. The location of these voids are shown in **Appendix B, Figures 5.20** and **5.21**

Post closure, under the basecase scenario the SCNCP Pit is predicted to form a groundwater ‘sink’ with groundwater flow from the Permian and Tertiary basalt towards the voids. Under this design there is no predicted seepage.

Based on the current ROC LOM final landform design there is an area of potential seepage at Spring Creek Pit. Budget zones were set up to quantify groundwater flux between the mine area and alluvium. The outputs are presented for the Approved model scenario in **Appendix B, Figure 5.22** and the Proposed model scenario in **Appendix B, Figure 5.23**. The alluvium was divided into two areas, Alluvium Zone 1 near Void 6 and Alluvium Zone 2 to the north (refer **Appendix B, Figure 5.24**).

The graphs show that the main area of potential seepage is from the mine area towards Alluvium Zone 2 to the south-west. Up to 8.4 ML/year of water is predicted to seep in this area for both the Proposed and Approved model scenarios. The Project is not resulting in any additional impacts in this area compared to the approved design, and it is understood rehabilitation of Spring Creek Pit has been largely completed and approved by the regulator.

5.3.9 Potential Impacts on Groundwater Users

The predicted drawdown at existing landholder bores near SCNCP Pit on land not owned by Glencore is shown in **Appendix B, Table 5.3**. The Table presents the predicted drawdown for the Approved scenario (AGE 2014 mine plan design), the Proposed model scenario (SCNCP Pit plus current ROC LOM). The Project only contribution to the cumulative drawdown is included for bores near SCNCP Pit. Maximum drawdown at the bores is generally predicted to occur around 2045 for the Approved model scenario and 2047 for the Proposed model scenario.

The Project is predicted to contribute incremental additional drawdown of greater than 1 m at four bores:

- **RN132929** on the Inderi property. Coordinates for the bore are approximately 3 km north of SCNCP, along Unnamed 2. The bore was apparently drilled in 2002, was originally referred to as Pocket Bore and was constructed to 48.5 m deep within the Tertiary basalt. RCH have confirmed with the landholder that this bore does not exist.
- **AD09** on the Albinia Downs property. Located approximately 2.7 km north-east of SCNCP. A basalt bore constructed to 58.56 m depth into Tertiary basalt. It is understood the windmill has been disconnected and the bore has not been used over the last 10 years, which corresponds with a period of below average rainfall. Approximately 5.99 m of drawdown is predicted for AD09, of which the Project contributes 2.17 m of drawdown. Based on the 2022 measured water level of 17.99 mbgl, the predicted drawdown is unlikely to adversely impact the pumpable capacity of the bore if it were to be put in use.
- **NP03** and **BH27** within Albinia National Park. BH27 is constructed to 70 m depth in Tertiary basalt and is used as a site reference monitoring bore and is not currently in use for water supply. Bore NP03 is a shallow (19 m deep) bore in the Tertiary basalt that is not currently in use. Groundwater levels were recently measured in 2022 near the base of the bore, at around 18.13 mbgl. Therefore, the predictions for the Approved and Proposed model scenarios would both result in groundwater levels being maintained below the base of the bore. The predictions are similar to previous predictions by AGE (2018), of up to 5 m drawdown at NP02. A Make Good Agreement is currently in place for Albinia National Park in accordance with requirements outlined in Associated Water Licence 618770 issued 31 March 2022.

5.3.10 Potential Impacts on Water Quality

5.3.10.1 Waste Rock Emplacement

The Project mine plan includes both out of pit and in-pit waste rock emplacements. As discussed in **Section 5.9**, characterisation of the waste rock material by EES (2013) indicated relatively neutral to alkaline pH between 6.7 to 9.5 and an EC of between 394 to 1,670 µS/cm. Some of the roof and floor materials were identified as PAF or PAF-UC, with potential release of metals (Al, As, Cr, Cu, Fe, Mo, Se, V and Zn). The average leachate metals concentrations are generally lower than average concentrations for aluminium and copper recorded in the groundwaters (refer **Appendix B Section 3.4.3**). Exceptions to this are arsenic and molybdenum, which are higher compared to average groundwater quality for all sources recorded at site. Chromium is also higher than average concentrations for Tertiary basalt and Permian coal measures.

There is potential for seepage to be produced from out of pit waste rock emplacements, particularly following peak rainfall and flood events. Surface water management measures will be put in place, including sediment dams and diversion drains to contain runoff on site.

There is also potential for interaction with groundwater with recharge through out of pit waste rock emplacement areas and in-pit emplacement where it is in direct contact with Quaternary alluvium and Tertiary basalt. As identified in **Section 5.3.8**, an area has been identified with potential outflow from the Spring Creek Pit to alluvium in Bootes Creek. It is estimated up to 8.4 ML/year of water from the backfilled pit may enter the alluvial groundwater system. There is limited data on the groundwater conditions and depth of alluvium in this localised area, therefore further work will be undertaken to refine predictions and the final landform design in this area to minimise potential for impacts to alluvial water quality.

5.3.10.2 Final Voids

- As discussed in **Section 5.3.8**, the Proposed final landform for the SCNCP Pit includes two main groundwater voids that will act as a sink and maintain levels below 225 mAHD to 230 mAHD.
- There is one small void in the current Spring Creek Pit with levels at around 225 mAHD. This acts as a partial sink; however, some outflow is possible from Spring Creek to the alluvium in this area as noted above. Under the scenario analysis, only one case (Case 11 K+ Tertiary) indicated a potentially higher pit lake level at around 230 mAHD. All other scenarios predicted pit lake levels at or below the base case level.

Water quality within the final voids will change over time with groundwater inflows, spoil recharge and evaporative processes. However, as discussed in **Section 5.3.5**, unlike other areas in the Bowen Basin, groundwater within the Study area is generally of good quality, with fresh to brackish salinity. The periodic recharge events associated with La Niña episodes would also contribute fresh water.

5.3.11 Monitoring and Mitigation Measures

5.3.11.1 Groundwater Monitoring Network

Ongoing groundwater monitoring will be conducted at site in accordance with the existing groundwater monitoring program outlined within the EA. Additional monitoring locations are also proposed to be installed to provide additional baseline data to characterise the groundwater regime. However, the finalised locations and construction for any proposed sites will be dependent on land accessibility, ground conditions and safety considerations.

It is also proposed that ongoing monitoring of existing geotechnical holes in spoil be conducted to help inform and refine assumptions on recovery within spoil. Over time these locations will be removed and (if required) additional locations installed as part of rehabilitation and mine closure activities.

The proposed monitoring network and program is outlined in **Appendix B, Table 6.1** and locations shown in **Appendix B, Figure 6.1**. This includes indicative locations for proposed future bores/vibrating wire piezometer. The actual location of the proposed sites would be dependent on land accessibility through ground-truthing.

5.3.11.2 Monitoring Approach

Groundwater quality monitoring will continue to be undertaken on a quarterly basis for existing bores, and is proposed to be undertaken bi-monthly (every two months) for a 12 month period for all newly installed bores, as outlined in **Appendix B, Table 6.1**.

The monitoring includes manual reading of the groundwater levels, download of logger data for bores equipped with loggers. As well as measurement of field parameters of EC and pH. Field samples will be collected for submission to a NATA accredited laboratory for analysis of:

- Physio-chemical indicators (field pH, field EC, TDS, temperature and total suspended solids (TSS).
- Major Ions (calcium, fluoride, magnesium, potassium, sodium, chloride, sulphate), hardness and ionic balance (total anions/cations).
- Total alkalinity as CaCO3, HCO3, CO3.
- Total and dissolved metals: (Ag, Al, As, B, Cd, Cr, Cu, Fe, Hg, Pb, Mn, Mo, Ni, Se, V and Zn).

5.3.11.3 Trigger Criteria Approach

Groundwater monitoring criteria will be used to enable early detection of changes in groundwater conditions beyond those predicted. This includes changes for existing approved operations and the Project.

Groundwater triggers for the existing monitoring program were updated in 2019 in consultation with DES. The trigger limits were based on the 95th percentile of baseline data (where available).

Where insufficient data was available, an interim trigger limit was assigned based on the Comet River Sub-basin Zone 13 shallow aquifer 80th percentile groundwater quality objective.

Trigger values are currently defined for pH, EC, calcium, sulphate, dissolved metals (Al, As, Cd, Cr, Cu, Pb, Mo, Ni, Se, Zn), fluoride and hydrocarbons (TPH C6 – C9 and TPH C10-C36). The triggers are currently defined as grouped triggers for alluvium and Tertiary basalt bores. Differences in water quality between the sources is noted in **Section 5.3.5**. Therefore, it is proposed that separate triggers be established for the alluvium and Tertiary basalt, based on the 95th percentile of baseline data for the existing site monitoring network in the EA.

Any updates to the groundwater quality trigger levels would be undertaken in line with the Department of Science, Information Technology and Innovation (DSITIA) guideline on "Using monitoring data to assess groundwater quality and potential environmental impacts" (DSITI, 2017). As per the DSITI (2017) guidelines, the triggers will be established in consideration of the Water Plan (Fitzroy Basin) 2011 WQOs, ANZECC (2000) criteria and site-specific conditions. Trigger criteria will be established for each groundwater unit potentially impacted by the Project, being the Quaternary alluvium and Tertiary basalt.

All site monitoring bores are located within the zone of predicted groundwater level change due to the Project. Therefore, changes in groundwater levels at the site bores will be compared to predicted groundwater trends to evaluate any deviations from the predicted trends.

It is assumed the triggers would be established based on the existing data and monitoring network only. The proposed additional bore locations (refer **Appendix B, Section 6.1.1**), once installed, will provide further information to help characterise the groundwater regime for future assessments and reviews.

Review of groundwater level and quality trends will be conducted by a suitably qualified person, and provided to the regulator on request as per the current EA requirements. The review will assess the change in groundwater level and quality, compared to historical trends and impact assessment predictions. The review will discuss any groundwater trigger exceedances or where trends show potential for environmental harm. Any exceedances of groundwater trigger criteria will be reported to the administering authority as per the conditions and timeframes stated within the Environmental Authority. Reporting will also be undertaken in accordance with the AWL conditions.

5.3.11.4 Groundwater Model Review

A new numerical groundwater model was developed for the Project and replicates actual mine progression to 2022. The model includes a scenario representing the current ROC LOM plan and the Project, referred to as the Proposed model scenario. Review of the model fit will be undertaken on a three yearly basis, including review of observed to modelled groundwater levels and trends, mine inflows, and mine progression. If required based on the review findings, the model will be updated to align to observed trends.

5.4 Terrestrial Ecology

Ecological surveys have been undertaken within ML's 70415, 70307, 70416 and 70458 for various ROC approval processes, with detailed ecological surveys undertaken throughout the Project area to assist development of the RCEP EIS in 2015.

A gap analysis was undertaken by Eco Logical Australia (ELA) in 2021 to determine any additional studies required to support this EA amendment for the Project. Gaps in the database and literature review including data age limitations, changes to site conditions, new threatened species listings and habitat quality assessments were identified. To address these gaps, ELA were engaged to undertake an ecological field assessment, provided in **Figure 15.** The scope of works for the ecological field assessment included:

- Validation of the extent and condition of Regional Ecosystems (REs) within the Project area;
- Confirmation of the presence/absence of Threatened Ecological Communities (TECs), species, and associated habitat; and
- Collection of habitat quality data in accordance with the *Guide to Determining Terrestrial Habitat Quality* (version 1.3) (DES, 2020) for use in offsets calculations.

A desktop assessment of the Protected Matters Search Tool (PMST) report (50km buffer), Matter of State Environmental Significance (MSES) report, and WildNet report (50km buffer) was conducted to provide contemporary listing status of species within the Project area.

Additional field studies were then undertaken by suitably qualified ecologists in November 2021, with a second field study undertaken in March 2022. The field studies verified RE extent and condition within the Project area, undertook targeted flora and fauna surveys, and collected habitat quality data in accordance with the *Habitat Assessment Guide* (DES,2020). The second field survey undertook additional BioCondition and habitat quality assessments to meet the recommended survey effort outlined in the *BioConditon: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Assessment Manual* (Eyre *et al*, 2015).

Following the Ecological Field Assessment (ELA, 2022), a Significant Impact Assessment (SIA) was conducted by E2M in late 2022 to determine whether the Project is likely to have a significant residual impact on terrestrial fauna and flora listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or *Nature Conservation Act 1992* (NC Act).

5.4.1 5.4.1 Proposed Impact

In order to facilitate the Project, RCH will require the clearing of all land and flora species within the Project area (592.2 ha). As such all ecological values listed in **Section 5.4** will be impacted.

5.4.2 Environmental Values

Desktop surveys identified a total of seven TECs, 21 threatened flora species, and 36 threatened fauna species (21 birds, seven mammals and eight reptiles) listed under the *Nature Conservation Act 1992* (NC Act) and/or the EPBC Act. Of these, only one TEC, seven flora species and eight fauna species were identified as likely or having potential to occur within the study area based on habitat requirements, distributions and known records within the study area (**Table 13**).

Table 13 Summary of Threatened Ecological Communities and Species (ELA, 2021)

Scientific name	Common name	NC Act	EPBC Act	Likelihood of occurrence
Natural Grasslands TEC	-	-	Endangered	Confirmed
Aristida annua	-	Vulnerable	Vulnerable	Potential
Cyperus clarus	-	Vulnerable	-	Likely
Dichanthium setosum	Bluegrass	-	Vulnerable	Potential
Dichanthium queenslandicum	King bluegrass	Vulnerable	Endangered	Known
Digitaria porrecta	Finger panic-grass	Near threatened	-	Likely
Marsdenia brevifolia	-	Vulnerable	Vulnerable	Likely
Trioncinia retroflexa	-	Endangered	-	Likely
Phascolarctos cinereus	Koala	Vulnerable	Endangered	Potential
Tachyglossus aculeatus	Short-beaked echidna	Special Least	-	Likely
Apus pacific us	Fork-tailed swift	Special Least	Migratory	Likely
Falco hypoleucos	Grey falcon	Vulnerable	Vulnerable	Potential
Geophaps scripta scripta	Squatter pigeon	Vulnerable	Vulnerable	Likely
Hirundapus caudacutus	White-throated needletail	Vulnerable	Vulnerable	Potential
Acanthophis antarcticus	Common death adder	Vulnerable	-	Potential
Egernia rugoso	Yakka skink	Vulnerable	Vulnerable	Potential

5.4.3 Regional Ecosystems

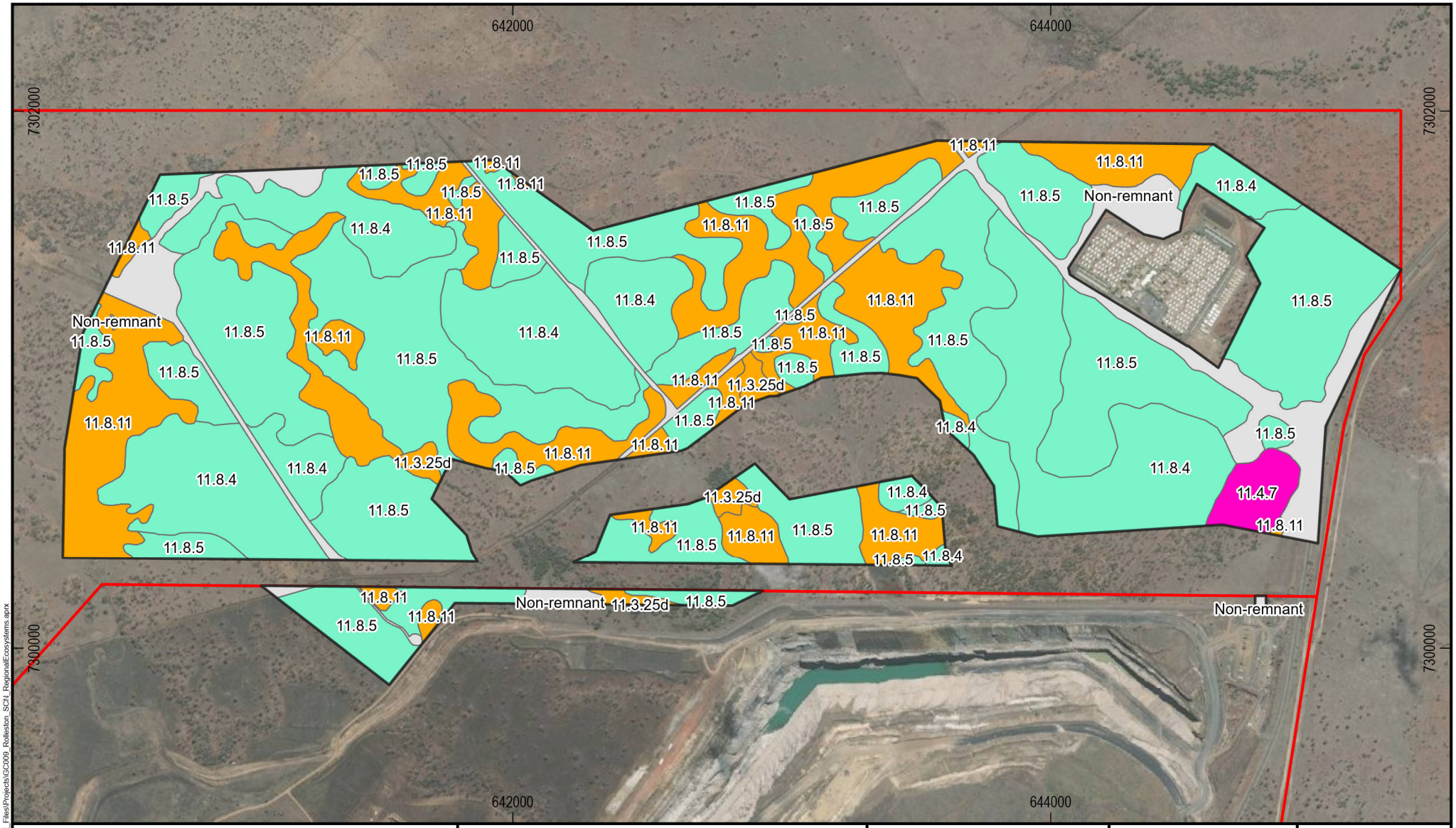
Ground-truthing of vegetation communities was undertaken within the study area to update DES and RCEP mapping conducted prior to the approval of the 2015 EIS. Specific updates addressed composition (RE type) and spatial extent of RE boundaries. Additionally, an endangered RE (Biodiversity status), RE 11.4.7 was ground-truthed occurring in the south-east of the study area. This RE was confirmed by the Queensland Herbarium. The ground-truthing resulted in the majority of the study area (92.7%) being mapped as remnant vegetation, and approximately 43.3 ha (7.3%) mapped as non-remnant or cleared vegetation associated with current mine infrastructure and roads.

Ground-truthing resolved mixed polygons identified in the 2015 RCEP EIS, which was an accepted practice during previous survey periods, but are no longer accepted under current guidelines. Additionally, some REs previously mapped were no longer accurate due to changes to RE definitions and were renamed to align with current RE definitions (i.e. RE 11.8.11a has changed to 11.3.25d). Ground-truthed REs within the Project area are described in **Table 14** and presented in **Figure 15.**

Table 14 Regional Ecosystems within the Project Area (ELA, 2021)

Regional Ecosystem	Condition	Short Description	BD Status	VMA status	Area (ha)
11.4.7	Remnant	*Eucalyptus populnea with Acacia harpophylla and/or Casuarina cristata* open forest to woodland on Cainozoic clay plains.	Endangered	Of Concern	7.0
11.8.5	Remnant	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	No concern at present	Least Concern	272.2
11.8.11	Remnant	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	Of Concern	Of Concern	124.1
11.3.25d	Remnant	*Melaleuca bracteata* woodland to open forest	Of concern	Least concern	5.7
11.8.4	Remnant	*Eucalyptus melanophloia* woodland to open woodland on Cainozoic igneous rocks	No concern at present	Least Concern	139.8
Non-remnant		Non-remnant areas consisted of mining infrastructure including roads, communications towers, tower pads, and soil stockpiles.			43.3

*Vegetation Management Act, 1999 (VMA) *Biodiversity (BD)



Legend

- ROC Mining Lease Boundaries
- SCNCP Project Area
- Ground-Truthed Regional Ecosystems
- Biodiversity Status
- Endangered
- Non-remnant
- No concern at present
- Of concern

Source: Glencore 2022, METServe 2023, Maxar. Regional ecosystem dataset produced by Ecological Australia (2022).

Path: S:\Projects\GC009_Rolleston\ArcGIS\Project_Files\Projects\GC009_Rolleston_SCN_RegionalEcosystems.aprx

Spring Creek North Continuation Project

Ground-Truthed Regional Ecosystems

0 200 400 600

Meters

Scale: 1:20,000 (A4)

28/04/2023

Datum: GDA2020
Projection: MGA55

FIGURE 15

GLENCORE

METSERVE
Mining & Energy Technical Services Pty Ltd

5.4.4 Habitat Types

A total of four habitat types (excluding non-remnant areas) were identified within the Project area, these include:

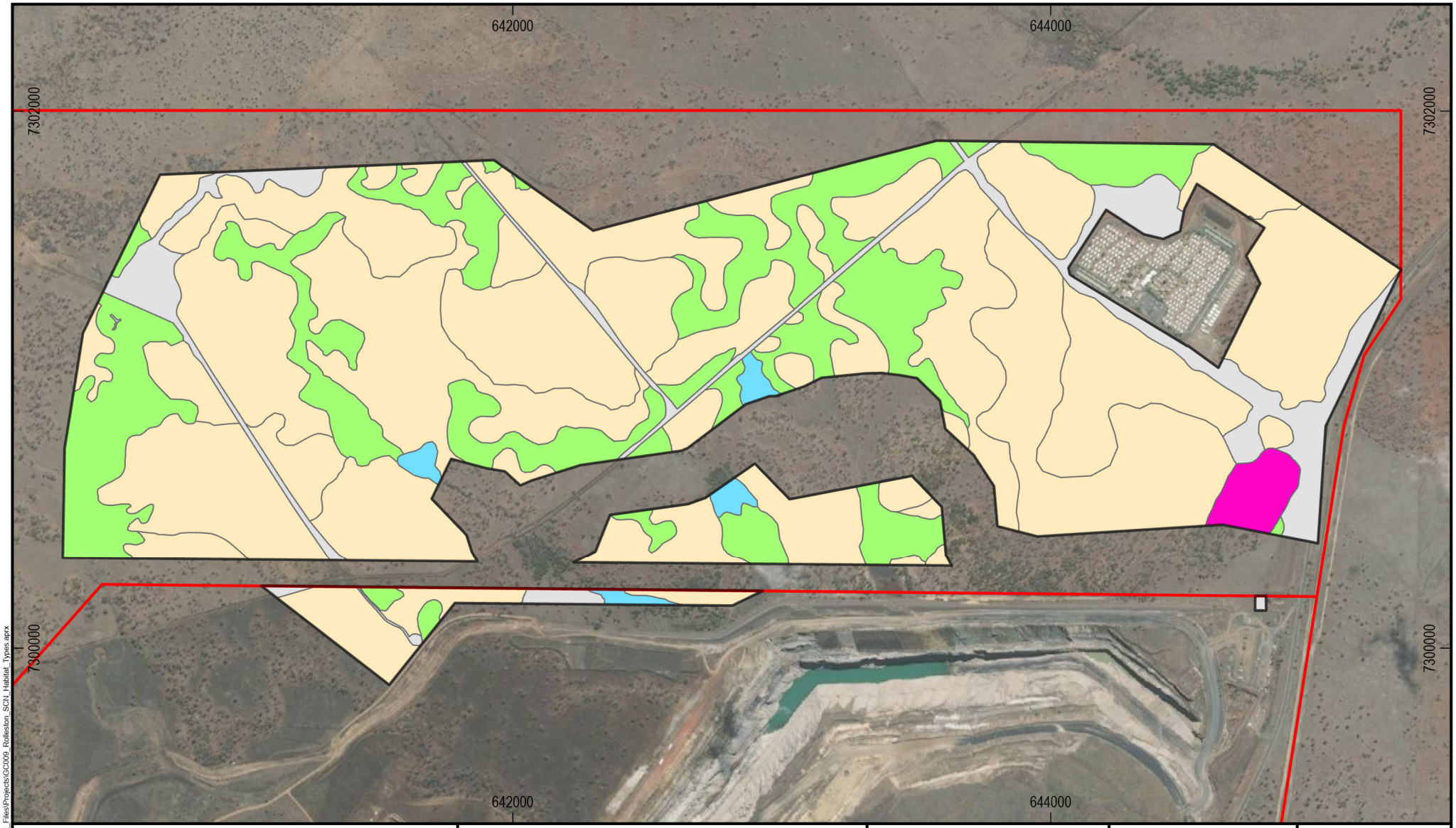
- Black tea-tree closed woodland fringing drainage lines;
- Eucalypt woodland on tertiary to early-quaternary clay deposits;
- Natural grasslands; and
- Open woodland to open forest on igneous or sedimentary substrate.

These habitats provide a range of foraging and dispersal habitats for a variety of native fauna species. A summary of the habitat types including values and associated REs are described in **Table 15** and displayed in **Figure 16.**

Table 15 Habitat Types within Project Area (ELA, 2021)

Habitat Type	Associated REs	Field Description and Associated Values	Area (ha)
Black tea-tree closed woodland fringing drainage lines	11.3.25d	This habitat type is found fringing minor waterways and is characterized by a black tea-tree dominated low closed woodland. Vegetation in this habitat type was in remnant condition. Koala may use this habitat type for shelter habitat given its proximity to eucalyptus, however, it would be a marginal habitat due to the fragmented nature and lack of *Eucalyptus* spp. Squatter pigeons may use this habitat for breeding, foraging and dispersal given the presence of seasonal waterbodies and native perennial grasses present. This habitat may provide perching habitat for the white-throated needletail and fork- tailed swift, which may fly over the study area. This habitat is also potential habitat for grey flacon perching and hunting as this species preys upon small ground-dwelling birds, small mammals and reptiles which are likely to use this area as well.	5.7
Eucalypt woodland on clay deposits	11.4.7	This RE occurred on level to gently undulating plains with a sedimentary substrate (clay to fine sandy soils). This habitat type is characterized by poplar box dominating the canopy cover with a denser subcanopy consisting of brigalow. Vegetation in this habitat type was in remnant condition. Koala may utilize this habitat for foraging and dispersal due to the presence of poplar box, a known food tree. Squatter pigeons are likely to use this area for foraging and dispersal habitat with native perennial grasses present. However, due to the presence of buffel grass (a listed threatened species under the Conservation advice), it is unlikely to be best quality. The white-throated needle tail and fork tailed swift may fly over this habitat as temporary visitors whilst in Australia. This habitat may provide potential habitat for grey falcon perching and hunting due to the presence of prey species such as small ground-dwelling birds, small mammals and reptiles. This habitat type may contain the following flora species which all occur on basalt soils: *Marsdenia brevifolia*,king bluegrass, *Cyperus clarus*.	7.0
Open woodland to open forest on igneous or	11.8.4 & 11.8.5	This habitat is characterized by Eucalyptus spp. (silver-leaved ironbark and mountain coolabah) dominated open woodlands to open forests occurring on igneous or sedimentary soils. Vegetation within this habitat type was in	412.1

Habitat Type	Associated REs	Field Description and Associated Values	Area (ha)
sedimentary substrate		remnant condition. This habitat type has a sparse canopy cover and low abundance of tree hollows, all of which were small (<20cm). This habitat type may provide foraging habitat for Koala, with the presence of two food tree species (mountain coolabah and silver-leaved ironbark). Squatter pigeons are likely to use this area for foraging and dispersal habitat due to its native perennial grass cover and open ground layer. This habitat type may provide potential dispersal habitat for yakka skink and common death adder in areas with thick groundcover and leaf litter. White-throated needletails and fork-tailed swifts will likely use this habitat as fly-over habitat. Grey flacons and may use this habitat for hunting as the sparse canopy trees allow it to ambush prey form above. This habitat type may contain the following flora species which all occur on basalt soils: *Marsdenia brevifolia*, king bluegrass, *Cyperus clarus*.	
Natural grassland	11.8.11	This habitat type occurred on basalt plains and hills and is characterized by a perennial grass dominated groundcover with sparse to no trees. The dominant perennial grass species were *Panicum decompositum* (native millet) and/or feathertop wire-grass. The grassland habitat occurs in association with moderate to deep cracking soils. Vegetation within this habitat type was in remnant condition. The white-throated needletail and fork-tailed swift may fly over this habitat as temporary visitors whilst in Australia during non-breeding season but are unlikely to used it for perching, roosting or foraging given the treeless natural. This habitat type may provide grey flacons with hunting habitat where they can prey upon ground dwelling birds, small mammals and reptiles. This habitat type may contain the following flora species which all occur in basalt grasslands: *Trioncinia retroflexa*, finger panic grass, king bluegrass, bluegrass, *Cyperus clarus* and *Arisitida annua*.	124.1



Legend

- ROC Mining Lease Boundaries
- SCNCP Project Area

Habitat Types

- Black tea-tree closed woodland fringing drainage lines
- Eucalypt woodland on clay deposits
- Natural grassland on Cainozoic igneous soils
- Open woodland to open forest on igneous or sedimentary rocks
- Non-remnant

Source: Glencore 2022, METServe 2023, Maxar. Habitat type dataset produced by Ecological Australia (2022).

Spring Creek North Continuation Project

Habitat Types

0 200 400 600

Meters

Scale: 1:20,000 (A4)

28/04/2023

Datum: GDA2020
Projection: MGA55

FIGURE 16

GLENCORE

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\GC009_Rolleston\ArcGIS\Project_Files\Projects\GC009_Rolleston_SCN_Habitat_Types.aprx

5.4.5 General Flora and Fauna Observations

An array of flora and fauna species were observed throughout the field survey which are common throughout the region (**Appendix C - Figure 3** and **Figure 7**).

Fauna observations were largely confined to observations of diurnal birds, with 31 species recorded, however, two macropods (*Macropus giganteus* [eastern grey kangaroo] and *Macropus parryi* [whiptail wallaby]), two amphibian (*Litoria caerulea* [green tree frog], *Litoria rubella* [desert tree frog]) and one reptile (*Pogona barbata* [bearded dragon]) were also recorded. No threatened flora or fauna species were recorded.

A total of 99 flora species were observed throughout the study area. The dominant tree species consisted of *Eucalyptus* spp., either mountain coolabah or silver-leaved iron bark and to a lesser extent, poplar box within the woodlands and black tea-tree in closed woodlands fringing drainage line habitat. Shrubs were scarcely recorded throughout the study area. The majority of groundcover species were native grasses, including white spear grass, feathertop wire-grass, black speargrass, *Thellungia advena* (Coolabah grass) and *Themeda triandra* (kangaroo grass). Multiple groundcover species were common across the study area including *Achyranthes aspera* (chaff flower).

5.4.6 Weeds

A total of 11 exotic flora species were recorded within the Project area. Of these, two species are listed as Category 3 restricted matters under the *Biosecurity Act 2014* and are Weeds of National Significance (WoNS), which prohibits their sale, trade or spread. These restricted weeds are:

- *Opuntia stricta* (Prickly Pear); and
- *Parthenium hysterophorus* (Parthenium).

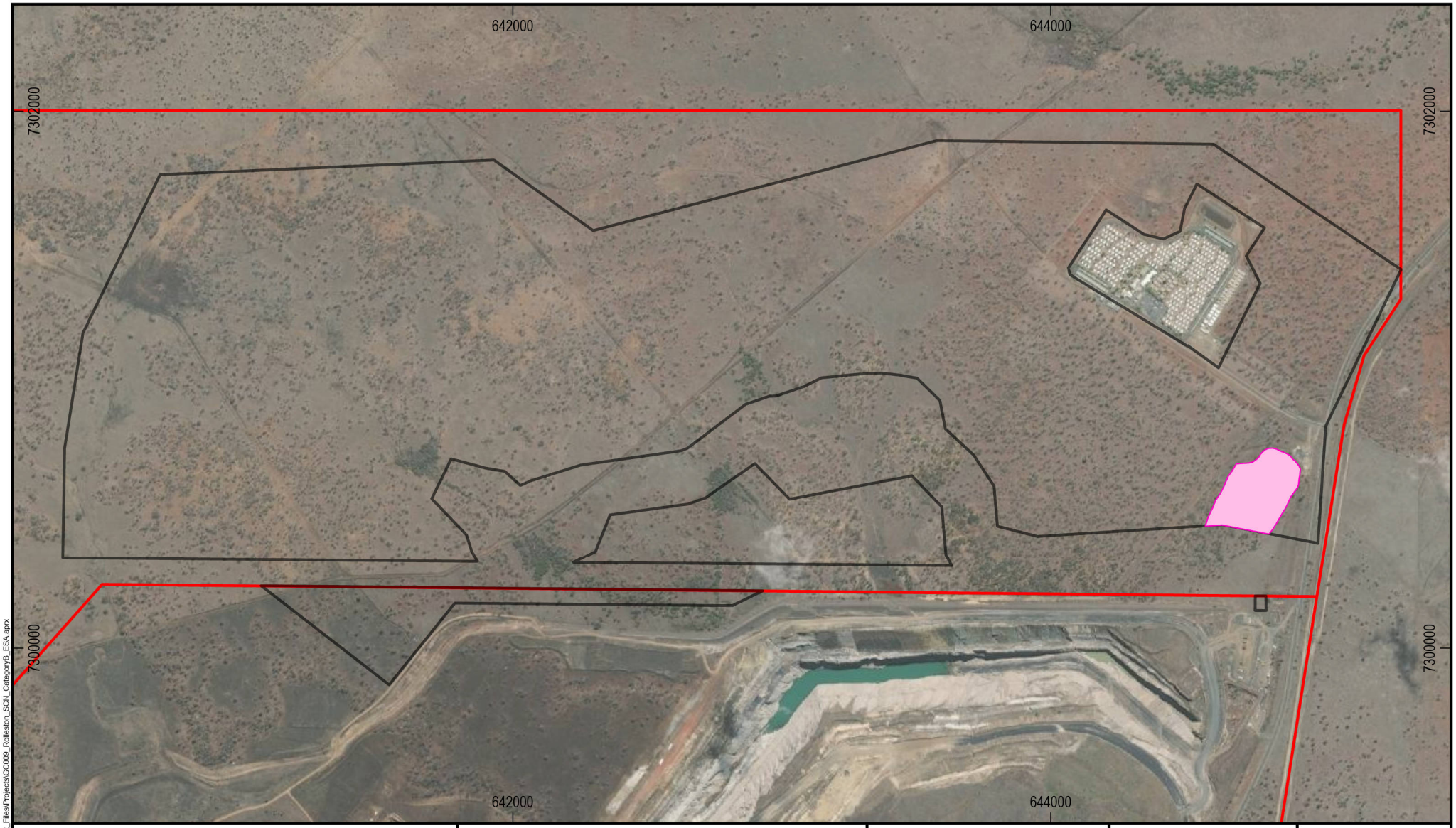
These Category 3 weeds will be managed within the Project area as per the existing ROC Weed Management Plan.

Additionally, non-native pasture grasses such as buffel grass and red natal grass were identified within the study area. These species are not listed under the *Biosecurity Act 2014* or as a WoNS.

5.4.7 Environmentally Sensitive Areas

Under the Environmental Protection Regulation 2019, REs with an endangered biodiversity status as defined in the UN-REDD Programme are classified as Category B ESAs (Queensland Herbarium, 2010). RE 11.4.7 which has an Endangered Biodiversity status, was identified within the study area, and therefore comprises Category B ESA. A total of 7.0 ha of Category B ESA was ground-truthed within the study area **(Figure 17**).

No Category A or Category C ESAs were identified within the study area.



Legend

- ROC Mining Lease Boundaries
- SCNCP Project Area

Category B ESA

- 11.4.7

Source: Glencore 2022, METServe 2023, Maxar. Regional ecosystem dataset produced by Ecological Australia (2022).

Path: S:\Projects\GC0099_Rolleston\ArcGIS\Project_Files\Projects\GC0099_Rolleston_SCN_CategoryB_ESA.aprx

Spring Creek North Continuation Project

Category B Environmentally Sensitive Area

0 200 400 600

Meters

Scale: 1:20,000 (A4)

28/04/2023

Datum: GDA2020
Projection: MGA55

FIGURE 17

GLENCORE

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5.4.8 Threatened Flora Species

Table 16 shows the threatened flora species listed under the NC Act that are likely or have potential to occur within the study area, as informed by the likelihood assessment and field survey. The area of potential habitat within the Project area, the associated RE and the BioCondition score for the habitat are shown below.

Table 16 Threatened Flora Species (ELA, 2021)

Scientific name	Common name	NC Act	Likelihood of occurrence	Area (ha)	Associated RE	BioCondition Scores
Aristida annua	-	Vulnerable	Potential	124.1	11.8.11	0.77
Cyperus clarus	-	Vulnerable	Potential	536.2	11.8.4	0.57
					11.8.5	0.77
					11.8.11	0.77
Dichanthium queenslandicum	King bluegrass	Vulnerable	Potential	536.2	11.8.4	0.57
					11.8.5	0.77
					11.8.11	0.77
Digitaria porrect	Finger panic-grass	Near threatened	Likely	124.1	11.8.11	0.77
Marsdenia brevifolia	-	Vulnerable	Potential	536.2	11.8.4	0.57
					11.8.5	0.77
					11.8.11	0.77
Trioncinia retroflexa	Belyando Cobbler's Pegs	Endangered	Likely	124.1	11.8.11	0.77

5.4.8.1 Aristida Annua

No direct observations of *Aristida annua* were recorded during the November 2021 or March 2022 surveys. However, there have been four records within 50 km of the study area (Atlas of Living Australia [ALA], 2021).

This species is an annual tufted grass which occurs on black clay soils, basalt soils and disturbed landscapes. This species has also been known to occur within the Natural Grasslands TEC. Within the Project area a total of 124.1ha was mapped as potential habitat, identified as RE 11.8.11 (**Figure 15**).

5.4.8.2 Cyperus Clarus

No direct observations of *Cyperus clarus* were recorded during the November 2021 or March 2022 surveys. However, *Cyperus clarus* was recorded in March 2022 within the potential offset area to the west of the Project area, on Meteor Downs property.

Cyperus clarus is a slender tufted perennial species which occurs within grasslands and open woodlands on basalt soils. Within the Project area a total of 536.2 ha was mapped as potential habitat, identified as RE 11.8.4, 11.8.5 and 11.8.11 (**Figure 15**).

*5.4.8.3 Dichanthium Queenslandicum (*King Bluegrass)

No direct observations of king bluegrass were recorded during the November 2021 or March 2022 surveys. However, there have been 16 records within 50 km of the Project area and four records within 1 km (ALA, 2021). Additionally, king bluegrass was recorded as a small population on Meteor Downs in March 2022.

This species is known to occur as a component of Natural Grasslands TEC and is associated with other species of bluegrasses. This species and the associated Natural Grasslands TEC occurs on fine grained soils, typically cracking clays on basaltic or fine-grained sedimentary rocks, on flat or gently undulating rises, within areas which have relatively high summer rainfall. Within the Project area a total of 536.2 ha was mapped as potential habitat, identified as RE 11.8.4, 11.8.5 and 11.8.11 (**Figure 15**).

5.4.8.4 *Digitaria Porrecta (*Finger Panic-Grass*)*

No direct observations of finger panic-grass were recorded during the November 2021 or March 2022 surveys. However, there are 11 known records within 50 km of the Project area, and four records within 1 km (ALA, 2021). A seed head was observed at the site offices and another seed head was observed within Meteor Downs during a separate field survey in March 2022, indicating finger panic grass may be present nearby.

This species is known to occur within tussock grasslands and open woodland of poplar box or forest red gum. Preferring heavy textured soils, typically cracking clays. Within the Project area a total of 124.1 ha was mapped as potential habitat, identified as RE 11.8.11 (**Figure 15)**.

5.4.8.5 *Marsdenia Brevifolia*

No direct observations of *Marsdenia brevifolia* were recorded during the November 2021 or March 2022 surveys. However, there are 11 known records within 50 km of the Project area (ALA, 2021).

This species is known to occur within woodlands dominated by red bloodwood and *Eucalyptus crebra*, with dense kangaroo grass understorey on basaltic substrate. Kangaroo grass was recorded within the Project area in RE 11.8.5 which has a mountain coolabah and silver-leaved ironbark canopy cover. Within the Project area a total of 536.2 ha was mapped as potential habitat, identified as RE 11.8.4, 11.8.5 and 11.8.11 **(Figure 15**).

5.4.8.6 *Trioncinia Retroflexa*

No direct observations of *Trioncinia retroflexa* were recorded during the November 2021 and March 2022 surveys. However, there are six known records within 50 km of the Project area (ALA, 2021).

This species is known to occur within dark brown or black cracking clay soils. It is also known to occur within grasslands. Within the Project area a total of 124.1 ha was mapped as potential habitat, identified as RE 11.8.11 **(Figure 15**).

5.4.9 Threatened Fauna Species

No detection of threatened fauna species occurred within Project area during field surveys. Suitable habitat for threatened fauna was identified through habitat suitability assessments. **Table 17** shows the threatened fauna species listed under the NC Act that are likely or have potential to occur within the Project area, as informed by the likelihood assessment and field survey. The area of potential habitat within the Project area and habitat quality score are also shown below.

Table 17 Threatened Fauna Species (ELA, 2021)

Scientific name	Common name	NC Act	Likelihood of occurrence	Area (ha)	Habitat Quality Score [1]
Phascolarctos cinereus	Koala	Vulnerable	Potential	424.8	6.43
Geophaps scripta scripta	Squatter pigeon	Vulnerable	Likely	424.8	5.91
Falco hypoleucos	Grey falcon	Vulnerable	Potential	548.8	2.61
Hirundapus caudacutus	White-throated	Vulnerable	Potential	592.2	NA
Acanthophis antarcticus	Common death adder	Vulnerable	Potential	419.1	2.76
Egernia rugoso	Yakka skink	Vulnerable	Potential	146.9	2.54

[1]Habitat quality assessment was not applicable for the white-throated needletail as it is an aerial species.

5.4.9.1 *Phascolarctos Cinereus (*Koala)

No direct observations of the koala were recorded during the November 2021 or March 2022 surveys. However, there are more than 40 known records within 50 km of the Project area including along Meteor Creek which flows through the southern Rolleston ML (109801) (ALA, 2021).

Koala are arboreal marsupials whose diet comprises mainly of Eucalyptus and/or Corymbia leaves of several preferred species (Australian Koala Foundation, 2015; Youngenthob et al., 2021).

This species is more commonly encountered in habitats dominated by eucalypt forests along watercourses, however, all vegetation communities dominated by eucalypts provide suitable habitat. Within the Project area, locally important koala trees, silver-leaved ironbark and mountain coolabah (The Australian National University, 2021), were recorded. Locally important koala trees are characterised as trees which koalas regularly browse which could be considered a substantial portion of the koala diet.

Ancillary habitat trees which were also recorded within the Project area include brigalow and black tea-tree. Ancillary trees are defined as trees which are not necessarily food trees but provide important habitat for koalas (The Australian National University, 2021).

Within the Project area a total of 424.8 ha of potential habitat was mapped, present as Myrtaceae dominant vegetation communities including RE 11.3.25d, 11.4.7, 11.8.4 and 11.8.5 **(Figure 15**). This habitat may be used for breeding, foraging and dispersal, however, given the absence of eucalypt dominated riparian habitat, no refuge habitat was identified in the Project area. Refuge habitat is habitat which koalas can persist in hot and dry conditions where trees will retain enough moisture for koala survival.

Note that due to the lack of Eucalyptus trees within RE 11.3.25d, this RE is likely to only be used for dispersal to the surrounding areas with Eucalyptus trees present or shelter habitat.

*5.4.9.2 Geophaps Scripta Scripta (*Squatter Pigeon*)*

No direct observations of the squatter pigeon were recorded during the November 2021 or March 2022 surveys. However, there are 30 known records within 50 km of the Project area (ALA, 2021).

Squatter pigeons are ground-dwelling birds which predominantly forage on seeds from grasses, herbs and shrubs. Squatter pigeons tend to inhabit the grassy understorey of eucalypt woodlands and open grass areas including regrowth and modified areas such as paddocks, tracks and stock yards. Squatter pigeons require access to permanent waterbodies for drinking, either natural or man-made as long as there is bare-ground at the water's edge. The substrate within the squatter pigeon habitat is generally well draining soils such as gravel, sand or loam.

Within the Project area a total of 424.8 ha of potential habitat was mapped, identified as RE 11.3.25d, 11.4.7, 11.8.4 and 11.8.5 (**Figure 15**). This habitat has potential to be used for foraging and dispersal. As it is not within 1 km of a permanent water source it is unlikely to be breeding habitat.

*5.4.9.3 Falco Hypoleucos (*Grey Falcon*)*

No direct observations of the grey falcon were recorded during the November 2021 or March 2022 surveys. However, there have been two records within 50 km of the Project area (ALA, 2021).

This species generally occurs within arid and semi-arid Australia, however, it has been identified within open woodlands, stony plains, acacia shrublands, grasslands and along riparian vegetation.

A total of 548.8 ha of potential habitat was mapped within the Project area, identified as RE 11.3.25d, 11.4.7, 11.8.4, 11.8.5 and 11.8.11 (**Figure 15**). The species may be an occasional visitor to the area, due to the presence of potential foraging habitat. However, due to the lack of tall emerging trees with large stick nests of similar sized birds, it is unlikely that the Project area will provide grey falcon with breeding habitat.

*5.4.9.4 Hirundapus Caudacutus (*White-Throated Needletail*)*

No direct observations of the white-throated needletail were recorded during the November 2021 or March 2022 surveys. However, there are 13 known records within 50 km of the Project area (ALA, 2021).

This species is almost exclusively aerial when in Australia during non-breeding season (September to April). They often occur flying over open forest and rainforest habitat but have also been recorded over heathland and remnant vegetation. They only temporarily roost within dense foliage within canopy trees or in hollows.

Given their broad habitat use and aerial nature, a total of 592.2 ha of potential fly over habitat was mapped and includes the full Project area (**Figure 15**). This habitat would potentially be used as temporary roosting and perching habitat, and fly-over habitat.

5.4.9.5 Acanthopis Antarcticus (Common Death Adder)

No direct observations of the common death adder were recorded during the November 2021 or March 2022 surveys. However, there are known records within 50 km of the Project area (ALA, 2021).

This species inhabits a wide variety of habitats ranging from grasslands to woodlands, heaths, rainforests and wet sclerophyll forests (DES Species Profile - *Acanthopis antarcticus* [Common Death Adder], 2021). The main habitat requirement for this species is the presence of microhabitat features such as leaf litter and debris within woodland, shrubland and grasslands where they can shelter and ambush prey species.

Potential dispersal and foraging habitat was present in areas with thick ground cover vegetation and deep leaf litter. Within the Project area a total of 419.1 ha of potential habitat was mapped, identified as RE 11.4.7, 11.8.4, 11.8.5 and 11.8.11 (**Figure 15**).

*5.4.9.6 Egernia Rugosa (*Yakka Skink*)*

No direct observations of the yakka skink were recorded during the November 2021 or March 2022 surveys. However, there is a single known record within 50 km of the Project area (ALA, 2021).

The yakka skink inhabits dry eucalypt and acacia woodlands and open woodlands. They can be found in cavities, between and under rocks, logs, tree stumps or abandoned animal burrows.

Within the Project area a total of 146.9 ha of potential habitat was mapped, identified as RE 11.4.7 and 11.8.4 (**Figure 15**) where potential fallen hollow logs occur in which they can shelter.

5.4.10 Special Least Concern

Table 18 shows the special least concern fauna species listed under the NC Act that are likely or have potential to occur within the Project area, as informed by the likelihood assessment and field survey. The area of potential habitat within the Project area is shown below.

Table 18 Special Least Concern Fauna Species (ELA, 2021)

Scientific name	Common name	NC Act	Likelihood of occurrence	Area (ha)
Apus pacificus	Fork-tailed swift	SL	Likely	592.2
Tachyglossus aculeatus	Short-beaked echidna	SL	Likely	548.9

*5.4.10.1 Apus Pacificus (*Fork-tailed Swift*)*

No direct observations of the fork-tailed swift were recorded during the November 2021 or March 2022 surveys. However, there have been five records within 50 km of the Project area (ALA, 2021).

The fork-tailed swift is almost exclusively aerial when in Australia and occurs over a variety of habitat types from rainforest to semi-arid areas. Therefore, habitat for this species has been mapped across all remnant vegetation where they may forage above the habitat and occasionally perch on exposed branches.

Within the Project area a total of 592.2 ha of potential habitat was mapped across the full Project area (**Figure 15**). This habitat would potentially be used as temporary roosting and perching habitat, as well as fly-over habitat.

*5.4.10.2 Tachyglossus Aculeatus (*Short-beaked Echidna*)*

No direct observations of the short-beaked echidna were recorded during the November 2021 or March 2022 surveys (ELA, 2021). However, this species has been recorded within 50 km of the Project area (ALA, 2021) and it is a wide-ranging and common species.

Short-beaked echidnas are monotremes which feed upon termites. They use their snouts to break apart termite mounds and logs. They are found throughout Australia and occupy the majority of habitat types throughout their range. Given this broad habitat capability, there is potential for the species to use all of the habitat types mapped within the Project area, a total of 548.9 ha.

5.4.11 Matters of State Environmental Significance

MSES, as defined in Schedule 2 of the *Environmental Offsets Regulation 2014*, were assessed within the Project area (**Table 19**).

Table 19 Matters of State Environmental Significance (ELA, 2021)

MSES	Presence within Project Area

Regulated Vegetation
• Prescribed REs that are endangered RE.
• Prescribed REs that are of concern RE.
• Prescribed REs that:
  ○ intersect with an area shown as a wetland on the vegetation management wetlands map; or
  ○ an area of essential habitat on the essential habitat map for an animal that is endangered wildlife or vulnerable wildlife or a plant that is endangered wildlife or vulnerable wildlife.
• A prescribed RE is a MSES, for a prescribed activity mentioned in schedule 1, item 7(e), if the ecosystem is an area of essential habitat on the essential habitat map for an animal that is near threatened wildlife or a plant that is near threatened wildlife.
• A prescribed regional ecosystem to the extent that the ecosystem is located within a defined distance from the defining
	Present as:
	• Prescribed REs that are endangered (7.0 ha);
	• prescribed REs that are of concern (129.8 ha);
	• prescribed REs that intersect with an area of essential habitat on the essential habitat map (15.4 ha); and
	• Prescribed REs within a defined distance from the defining banks of a relevant watercourse (20.5 ha).
	
	(Not present as REs that intersect an area shown as a wetland on the vegetation management wetlands map).

Connectivity Areas	Present as 548.9 ha of remnant vegetation within the Project area

Wetlands and Watercourses
• a wetland:
  ○ in a wetland protection area
  ○ of high ecological significance shown on the map of Queensland wetland environmental values.
• a wetland or watercourse in high ecological value waters.
	Not present

Designated precinct in a strategic environmental area	Not present
Protected wildlife habitat	Present as potential habitat for the following endangered, vulnerable, and special least concern (non-migratory species) under the NC Act: • *Aristida annua* (124.1 ha);

MSES	Presence within Project Area
	• *Cyperus clarus* (536.2 ha); • king bluegrass (536.2 ha); • *Marsdenia brevifolia* (536.2 ha); • *Trioncinia retroflexa* (124.1 ha); • koala (424.8 ha); • short-beaked echidna (548.9 ha); • squatter pigeon (424.8ha); • grey falcon (548.8 ha); • white-throated needletail (592.2 ha);
Protected areas	Not present
Highly protected zones of State marine parks	Not present
Fish habitat areas	Not present
Waterway providing for fish passage	Not present
Marine plants	Not present
Legally secured offset areas	Not present

5.4.12 Matters of National Environmental Significance (MNES)

5.4.12.1 Threatened Ecological Communities

One TEC was confirmed (Natural Grasslands TEC) during the field survey. A total area of 124.1 ha met key diagnostic characteristics and condition thresholds for the TEC outlined in the Commonwealth Listing Advice (DEWHA, 2008). The key diagnostic thresholds included having a sparse or absent tree canopy cover and presence of indicator species. Given the presence of rainfall preceding the survey, grasses were in good condition and easily identifiable to species level due to the presence of seed heads. The indicator species for the Natural Grassland TEC identified during the November 2021 field survey included Queensland bluegrass, feathertop wiregrass, white speargrass, Queensland bluegrass, native millet and coolabah grass. The areas identified as Natural Grasslands TEC within the Project area meet the condition thresholds to be classified as best quality TEC.

5.4.12.2 Threatened Flora

Table 20 presents the threatened flora species listed under the EPBC Act that are likely or have potential to occur within the Project area, as informed by the likelihood and field surveys. The area of potential habitat within the Project area are also shown below.

Table 20 Commonwealth Threatened Flora Habitat (ELA, 2021)

Scientific name	Common name	EPBC Act Status	Likelihood of occurrence	Area (ha)	Associated RE
Aristida annua	-	Vulnerable	Potential	124.1	11.8.11
Dichanthium setosum	Bluegrass	Vulnerable	Potential	124.1	11.8.11
Dichanthium queenslandicum	King bluegrass	Endangered	Known	5536.2	11.8.4
					11.8.5
					11.8.11
Marsdenia brevifolia	-	Vulnerable	Likely	536.2	11.8.4
					11.8.5
					11.8.11

Three of these species are listed under the NC Act and therefore are discussed **in Sections 5.4.8.1** to **5.4.8.5**. The additional species is discussed below.

5.4.12.3 Dichanthium Setosum (*Bluegrass*)

No direct observation of bluegrass was recorded during either of the surveys. However, seven records have been identified within 50 km of the Project area, three of which are within 1 km (ALA, 2021).

Bluegrass occurs within areas of cleared woodland, grassy roadside remnant vegetation and heavily disturbed pasture. This species tends to grow on heavy basaltic black soils and red-brown loams with clay subsoils. Species which were recorded within the Project area which bluegrass often grows in association with includes silver-leaved ironbark and kangaroo grass.

A total of 124.1 ha of potential habitat was mapped within the Project area, identified as RE 11.8.11 (**Figure 15)**.

5.4.12.4 Threatened and Migratory Fauna

Table 21 shows the threatened fauna species listed under the EPBC Act that are likely or have potential to occur within the Project area, as informed by the likelihood and field survey. The area of potential habitat within the Project area is shown below.

Table 21 Commonwealth Threatened and Migratory Fauna Habitat and Extent (ELA, 2021)

Scientific name	Common name	EPBC Act Listing	Likelihood of occurrence	Area (ha)
Phascolarctos cinereus	Koala	Endangered	Potential	424.8
Geophaps scripta scripta	Squatter pigeon	Vulnerable	Likely	424.8
Falco hypoleucos	Grey falcon	Vulnerable	Potential	548.8
Hirundapus caudacutus	White-throated needletail	Vulnerable	Potential	592.2
Apus pacificus	Fork-tailed swift	Migratory	Likely	592.2
Egernia rugoso	Yakka skink	Vulnerable	Potential	146.9

All of these species are also listed under the NC Act, and therefore are discussed in **Sections 5.4.9.1** to **5.4.9.6**.

5.4.13 Significance of Impact Assessment

E2M was commissioned to prepare a Significant Impact Assessment (SIA) for MNES and MSES relating to terrestrial ecology for the Project (E2M, 2023). The aim of this assessment was to determine whether activities relating to the Project are likely to have a significant impact on MNES and MSES identified within the Project area. Works undertaken by E2M for this SIA included:

- A desktop assessment to identify MNES and MSES likely to occur within the Study area (see **Appendix D - Sections 3 and 4**)
- Field surveys to assess the suitability of habitat for MNES and MSES and document the presence of MNES and MSES on site (**see Appendix D - Sections 3 and 5**)
- An assessment of potential Project impacts on MNES and MSES (see **Appendix D - Section 6**); and
- An assessment of residual impacts on MNES and MSES in accordance with Commonwealth and State legislation and guidelines (see **Appendix D - Section 7**).

A SIA was completed for each of the MNES likely to occur within the Project area in accordance with applicable *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) guidelines. The likelihood of a 'significant residual impact' to MSES was assessed using the Queensland Environmental Offsets Policy: Significant Residual Impact Guideline (DEHP, 2014) (SRI Guideline). MSES that were assessed under the EPBC Act Guidelines (species also listed under the EPBC Act), were not assessed under the Queensland Guideline, in accordance with the *Environmental Offsets Act 2014* (QLD).

The SIA determined that the Project is likely to have a significant impact on MNES and MSES occurring within the Study area (as summarised in **Table 22**).

Table 22 Summary of SIA for MNES and MSES occurring within the Project area (E2M, 2023)

Environmental Matter	Status	Anticipated Significant Impact	Habitat within the Project Area (ha)
MNES			
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Likely	124.1
King bluegrass *Dichanthium queenslandicum*	Endangered	Potential	536.2
Koala	Endangered	Potential	424.8
MSES			
Protected Habitat (NC Act)			
Cyperus clarus	Vulnerable	Potential	536.2
Belyando cobbler's pegs *Trioncinia retroflexa*	Endangered	Likely	124.1
Regulated Vegetation (VM Act)			
Prescribed RE 11.4.7	Endangered	Likely	7.0
Prescribed RE 11.8.11	Of concern	Likely	124.1
Prescribed REs within a defined distance from the defining banks of a relevant watercourse	N/A	Likely	20.5

5.4.14 Offset Requirements

5.4.14.1 Commonwealth Government Requirements

MNES are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Significant impacts to MNES must be compensated through the delivery of environmental offsets in accordance with the EPBC Act Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012). This policy states that an environmental offset must "deliver an overall conservation outcome that improves or maintains the viability of the protected matter as compared to what is likely to have occurred under the status quo".

Approval for a project under the EPBC Act requires that environmental offsets and the associated Offset Area Management Plan are approved by the Minister for the Environment, and legally secured, prior to the commencement of any disturbance to MNES.

5.4.14.2 Queensland Government Requirements

Significant impacts to prescribed environmental matters must be offset in accordance *with the Environmental Offsets Regulation 2014*. Prescribed environmental matters include MNES protected by the EPBC Act, as well as some matters of state and local environmental significance. Matters of state environmental significance that are prescribed environmental matters are listed in Schedule 2 of the Environmental Offsets Regulation 2014. This regulation also prescribes the Queensland Environmental Offsets Policy version 1.9, which clarifies how environmental offsets should be delivered in Queensland.

As stated in section 1.1.3 of the *Queensland Environmental Offsets Policy version 1.9*, state governments can only impose an offset condition in relation to a prescribed activity if the same or substantially the same impact and the same or substantially the same matter has not been subject to assessment under a Commonwealth Act. Offsets are therefore only required under the Queensland framework in the following two instances:

- When the prescribed environmental matters that experience significant residual impacts are not MNES; and/or
- When the Commonwealth Government decided that the activity was not a controlled action, yet residual impacts to a matter of both state and national environmental significance qualify as significant under Queensland definitions (as defined within the *Queensland Environmental Offsets Policy Significant Residual Impact Guideline*: DEHP 2014).

5.4.14.3 ROC Offset Requirements

Due to the likelihood of the above impacts, the Project will be referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW), and Department of Environment and Science (DES) for consideration under the EPBC Act and *Environmental Offsets Act 2014* (QLD) respectively. It is likely that approval for the project will be conditional on the provision of offsets in accordance with the EPBC Act and/or the Queensland framework.

An offset proposal will be developed for all matters identified as likely to experience a significant residual impact (**Table 22**).

Further discussion of the significance of these impacts under the respective guideline criteria is provided in the Significant Impact Assessment (E2M, 2023) (**Appendix B**).

5.4.15 Mitigation Measures

RCH has a number of management plans to mitigate and manage the impacts to flora and fauna on site as a result of existing ROC operations. These plans will be updated to include the Project area and any additional threatened species identified through the various ecological assessments undertaken to support this EA amendment.

5.5 Aquatic Ecology

As discussed in **Section 5.2**, the surface water environment within and surrounding the Project footprint consists of 1st order drainage lines with no sustained flows. There are no dams or permanent water bodies within the Project area. As such the only aquatic values that may be impacted by the Project are Groundwater Dependent Ecosystems (GDEs), and therefore, that is the focus of this section.

5.5.1 Local Aquifers

Umwelt (2023) developed a calibrated, numerical groundwater model of all relevant aquifers within the SCNCP and wider ROC. This was based on a range of data sources, including an on-site groundwater monitoring network and groundwater assessments from nearby mines, and has been conducted in accordance with the *Australian Groundwater Modelling Guidelines* (Barnett et al., 2012), the MDBC *Groundwater Flow Modelling Guideline* (MDBC, 2001) and the IESC *Explanatory Note for Uncertainty Analysis* (IESC, 2018). More information on the groundwater model is available in **Section 5.3.6.**

There are three environmentally relevant hydrogeological units present within the Rolleston area likely to be impacted by mining activities. These hydrogeological units are associated with Quaternary alluvium, Tertiary basalt, and Blackwater Group sediments, as summarised below:

- Quaternary Alluvium: Alluvial sediments can be separated into near-surface low-permeability clayey sediments and higher-yielding coarse sand and gravel, which occur at the base of the unit. The alluvium is recharged by rainfall, and potentially streamflow when the creeks are flowing. Alluvial groundwater discharge includes downward seepage and potential localised baseflow contributions following peak rainfall events. Alluvial groundwater flow generally follows topography, with a general gradient to the east towards Comet River.

  Due to the presence of only small drainage lines within the Project footprint and surrounding area, Quaternary alluvium is not found within the area predicted to be impacted by the SCNCP.

- Tertiary Basalt: Groundwater within Tertiary basalt is a fractured rock aquifer, with a low permeability basal clay/tuff and, in some localised areas, basal sands and gravels. Recharge to the Tertiary basalts is predominantly derived from direct rainfall recharge, as well as potential downward seepage from alluvium

(where present) and upward seepage from the underlying coal measures. Groundwater discharge includes downward seepage and potential localised baseflow contributions following peak rainfall events.

The Tertiary basalt is present across most of the Project area, with the depth to groundwater usually over 20m. However, there are some localised areas where groundwater is within 10 m in the shallow weathered basalt. This includes the lower reach of the unnamed tributaries north of SCNCP. Groundwater discharge from the Tertiary basalt to the incised creeks (baseflow contributions) has the potential to occur in localised areas following peak recharge events.

- Permian Coal Measures: The coal seams of the Blackwater Group are generally regarded as the main water bearing horizons within the Permian units. Blackwater Group interburden and overburden sediments are very low yielding. Recharge to Blackwater Group sediments is likely to occur from direct rainfall recharge in outcrop/subcrop areas and potentially from downward seepage from overlying stratigraphy. There is also potential for upward seepage from underlying units, including the Aldebaran Sandstone, where gradients enable flow. Groundwater levels within close vicinity to open-cut pits are impacted by mining activities and likely to become further depressurised as mining progresses. However, the groundwater response is influenced by the structural geology (i.e. extent of the Blackwater Group).

  The Permian aged Blackwater Group is present across the Project site, and conformably overlies the basement units of Black Alley Shale to the Aldebaran Sandstone. The Blackwater Group includes what is generally considered hydraulically 'tight' interburden sequences of mudstone, siltstone and minor sandstone. The coal seams (A, B, C and D) are the main groundwater bearing units, with groundwater occurrence and flow influenced by secondary porosity within the fractures and cleats. Groundwater recharge to the Blackwater Group includes rainfall recharge where it occurs at outcrop along the Springsure Anticline, Consuelo Anticline and Inderi Anticline, as well as downward seepage where it unconformably underlies the Quaternary alluvium and Tertiary basalt.

5.5.2 Groundwater Quality

Groundwater quality across the ROC is covered in detail in **Section 5.3.5**. Water quality data from the ROC groundwater monitoring network provides useful information on the potential use of groundwater by flora and/or fauna. Salinity is a key constraint to groundwater use by regional ecosystems and can be described by total dissolved solid (TDS) concentrations.

Water within the alluvium is generally fresh to brackish with an average TDS of 489 mg/L, ranging between 34 mg/L and 1,101 mg/L. Water within the Tertiary basalt is also fresh to brackish with an average TDS of 717 mg/L, ranging between 132 mg/L to 1,830 mg/L. One bore within the basalt (BH24) indicates moderately saline groundwater conditions, or potentially non-representative data. Water within the Permian coal measures are fresh to brackish with an average TDS of 797 mg/L, ranging between 206 mg/L and 1,490 mg/L.

The potential GDEs found within the Project area are dominated by *Melaleuca bracteatea* (11.3.3a and 11.3.25d) which is a salt-tolerant species as per the Salinity Management Handbook, Second Edition (DERM 2021) and is likely to be able to utilise the fresh to brackish groundwater found within the Tertiary basalt through the Project area.

5.5.3 Groundwater- Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecosystems that require access to groundwater on a permanent or intermittent basis to meet some or all of their water requirements to maintain their communities of plants and animals, ecological processes, and ecosystem services (Richardson et al., 2011). GDEs can be grouped into three categories in Queensland, based on their type of groundwater reliance:

- Aquatic GDEs are dependent on the surface expression of groundwater and rely on groundwater after it has been discharged to the surface i.e., groundwater-fed wetland systems (swamps, lakes and rivers);
- Terrestrial GDEs are dependent on the subsurface expression of groundwater and access subsurface groundwater to meet all or some of its water requirements i.e., terrestrial vegetation with typically deep-rooted trees; and

- Subterranean GDEs occur within caves and aquifers. Cave GDEs occur in caves which have some degree of groundwater connectivity. Aquifer GDEs typically occur within the intergranular void space, rock fractures and solution cavities. Aquatic animals that live in groundwater are referred to as stygofauna.

The Commonwealth Government has established the National Atlas of Groundwater Dependent Ecosystems (the GDE Atlas), based on the current knowledge of GDEs across Australia. The GDE Atlas (BOM 2018) shows known and potential GDEs and is considered the most comprehensive inventory of the location and characteristics of GDEs in Australia. GDEs as mapped within the GDE Atlas, are shown in **Appendix B, Figures 3.17 and 3.18**.

5.5.3.1 Terrestrial Ecosystems

The GDE Atlas mapping for Terrestrial ecosystems shows potential terrestrial groundwater dependent ecosystems (TGDEs) reliant on groundwater that may be impacted as a result of the Project. These are shown in **Appendix B, Figure 3.17** and include:

- High-potential GDEs as riparian vegetation along Unnamed 1 near McQueen's Bore, and along Unnamed 2.
- Moderate-potential GDEs along creeks and drainage lines, including Unnamed 1 and Unnamed 2.
- Low-potential GDEs localised along creeks and drainage lines across the site and surrounds.

A full description of all REs present throughout the Project area is included in **Section 5.4.3**. Only one RE within the project area (11.3.25d: *Melaleuca bracteata* closed woodland fringing drainage lines) is likely to be accessing groundwater within the Project area.

Another potential GDE identified through regional RE mapping is RE 11.3.3a, *Melaleuca bracteata* woodland on alluvial plains. While no ecological surveys have taken place to ground truth these areas outside of the Project footprint, this RE correlates with other riparian areas within the wider ROC which were surveyed as part of the 2013 EIS.

5.5.3.2 Wetlands and Springs

A review of the GDE Atlas mapping for Aquatic ecosystems indicates the potential GDEs reliant on the surface expression of groundwater that may be impacted as a result of the Project. These are shown in **Appendix B, Figure 3.18** and include:

- High-potential GDEs in localised sections of Unnamed 1 and Unnamed 2.
- Moderate-potential GDEs along most creeks and tributaries, as well as a palustrine wetland of high environmental significance (HES) mapped within the Albinia National Park (HES feature ID 91774).

The (former) Department of Natural Resources and Mines' mapping of groundwater-dependent ecosystem springs – Queensland (published 28 April 2020) indicates there are no springs within the Project area. The closest mapped springs are located over 60 km east within the Expedition State Forest.

Drainage features throughout the Project area are ephemeral and flow only at periods of high rainfall. During the supporting studies for the 2013 EIS, FRC Environmental conducted aquatic ecology investigations throughout the area, with one survey site located within the Project area. This site was dry in late wet season (April 2010) and therefore was not able to be surveyed for aquatic fauna. It is expected that due to the infrequent surface flows and depth to groundwater in the area, Aquatic GDE's are likely to be present infrequently and only during extreme rainfall events. As such any Aquatic GDEs in the area surrounding the SCNCP are likely to have low ecological value.

5.5.3.3 Stygofauna

Stygofauna surveys were undertaken in 2011 and 2014 within 18 groundwater monitoring sites across the wider ROC. Results showed the presence of stygofauna communities in four of the 18 locations. Of these, stygofauna were detected in two alluvial bores BH8 (GOB-4B and GPB-4A) and four basalt bores (BH2, BH12, GOB-1C and GOB-3B). Fauna included:

- Class Annelida, Order Oligachaeta and Family Naididae at BH8 (GOB-4B), BH12 and GOB-3B
- Class Crustacea, Order Copepoda, Family Cyclopoida at BH8 (GPB-4A) and GOB-1C

- Class Crustacea, Order Copepoda, Family Harpacticoida at GOB-1C
- Class Crustacea, Order Syncaridae, Family Parabathynellidae at BH2 and GOB-1C, with the highest abundance (24 specimens) at GOB-1C.

Of the bores sampled, the closest bores occupied with Stygofauna to the SCNCP were BH2 and BH12 (**Appendix B, Figure 3.1**). Both BH2 and BH12 are located over 2km away from the Project site, while BH8 is located nearly 5km south.

5.5.4 Project Impacts on GDEs

Potential GDEs in and near the Project site include riparian vegetation (terrestrial GDEs) and aquatic GDEs associated with drainage lines "Unnamed 1" and "Unnamed 2" reporting to Meteor Creek, and a HES wetland within Albinia National Park. As discussed in **Appendix B, Section 5.5.6,** Stygofauna have been identified in samples collected from the Tertiary basalt across the wider ROC, however not within 2km of the Project site. Terrestrial and aquatic GDEs utilise groundwater within the Tertiary basalt, where the depth to groundwater was recorded (throughout 2022) between 8.3m to 16.4 mbgl. However, historical data indicates potential for near-surface groundwater levels and baseflow contributions from the Tertiary basalt following peak recharge events. During recent (early 2023) drilling following above-average rainfall, groundwater levels were recorded within 7.5 mbgl in the shallow weathered Tertiary basalt along Unnamed 1. As noted in **Section 5.3.10.2**, these peak recharge events generally coincide with a La Niña episode, which can occur every two to seven years on average.

Groundwater models developed by Umwelt investigated the likely scale of groundwater drawdown as a result of the Project. Models were based on long-term average quarterly rainfall, and do not capture peak recharge events, or sustained drought periods. Instead, they are intended to convey pre- and post-mining average groundwater conditions.

The groundwater levels predicted by the pre-mining, approved mining, and proposed mining (inclusive of the SCNCP) modelled scenarios were estimated at selected points near mapped potential GDEs. Predicted groundwater drawdown levels at GDEs within the predicted drawdown zone of the Project are shown in **Table 23 .**

Table 23 Predicted Drawdown at impacted GDEs

GDE	Depth to Groundwater			
	Pre-mining (m)	Approved (m)	Proposed (m)	Change from approved to proposed (m)
Unnamed 1 High Potential TGDE	8.35	29.31	67.17	37.86
Unnamed 2 GES (US)	6.23	12.94	24.04	11.10
Unnamed 1 GES (US)	7.11	11.29	12.62	1.33
Unnamed 1 GES (DS)	8.14	10.23	10.75	0.52
Unnamed 2 GES (DS)	8.37	9.45	9.73	0.28
Albinia NP HES	3.64	4.28	4.36	0.08
Aldebaran Creek High Potential TGDE – east	7.36	7.45	7.49	0.04
Aldebaran Creek High Potential TGDE – west	8.13	8.14	8.14	0.00

As per **Table 23** , of the eight potential GDEs mapped within the drawdown extent of the Project, only three are anticipated to experience drawdown exceeding 1m. The location of these GDEs relative to the Project, and the total projected (Proposed) groundwater drawdowns are shown in **Figure 18**.

For vegetation to access groundwater in the sub-surface, the roots must be able to reach the capillary zone above the water table and the water quality of groundwater must be adequate. To assess and map potential terrestrial groundwater-dependent ecosystems across the survey area, the following data sources were considered:

- National Atlas of Groundwater Dependent Ecosystems version 2.0 (BOM 2018);
- Published literature on root depths and groundwater usage among local vegetation types;

- Depth-to-groundwater mapping of the Project area (provided by Umwelt); and
- Groundwater quality (Umwelt, 2023).

There has been much recent worldwide research into groundwater-dependent ecosystems, combining tools such as stable isotope analysis, measurement of pre-dawn leaf water potential, and seasonal tracking of transpiration rates and "greenness" indices. One of the key findings of this research is that the use of groundwater by terrestrial vegetation depends greatly on the depth of this groundwater, and the influence of depth is largely consistent across continents and vegetation communities:

- In arid regions of China, groundwater up to 4–10m below the surface is used by vegetation (Jin *et al.* 2011; Lv *et al*. 2012; Liu *et al*. 2017);
- In California, groundwater up to a depth of 6–8m is used by vegetation (McLendon *et al*. 2008);
- Various studies in Australia have identified lower limits to the root extraction of groundwater of 7.5 m (Benyon *et al*. 2006), 5–11 m (O'Grady *et al*. 2006a), 8–10m (Robinson *et al*. 2006), and 9 m (Zolfaghar *et al*. 2017).

Where data is lacking, it is practical to use the widely adopted rule-of-thumb (e.g., Eamus *et al*. 2006a; Department of Natural Resources, Mines and Energy (DNRME) 2019a), that vegetation is likely to use groundwater up to a depth of 10m, may possibly use groundwater at depths of 10-20m, but is unlikely to access water deeper than 20m.

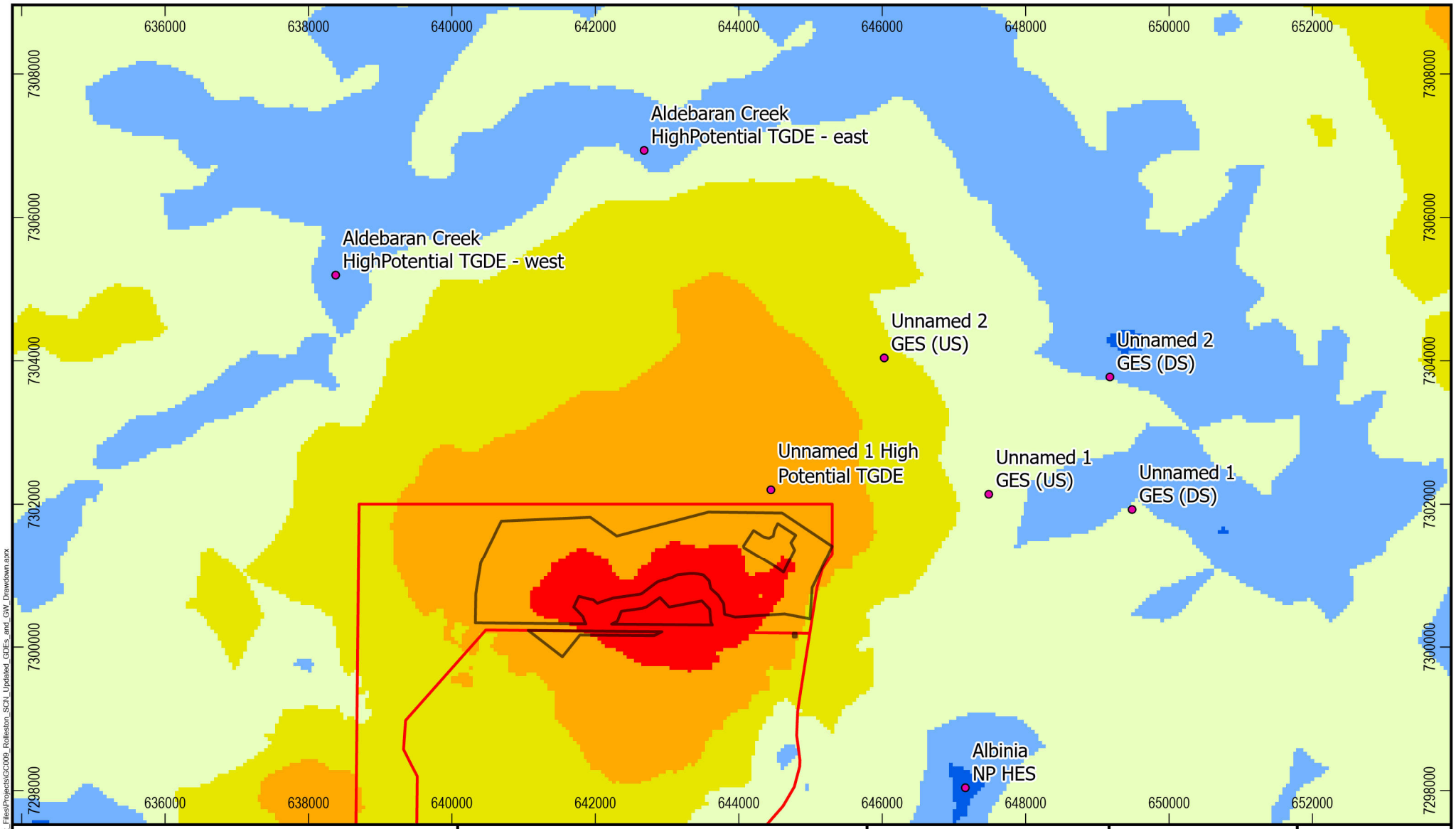
The three GDEs are all mapped as R.E 11.3.3a within the Queensland Globe regional ecosystem mapping layer. RE 11.3.3a is defined as *Melaleuca bracteata* woodland on alluvial plains. While no ecological surveys have taken place to ground truth these areas, this RE correlates with other riparian areas within the wider ROC which were surveyed as part of the 2013 EIS.

There are also several drainage lines (stream order 1) that flow from the north into the Project area. Ground truthing of the regional ecosystems in this area is discussed in **Section 5.4.3.** This ground truthing identified areas of 11.3.25d *Melaleuca bracteata* closed woodland fringing drainage lines, which was not included in the GDE Atlas mapping.

While no published studies have specifically investigated groundwater depths accessible to *M. bracteata*, other tropical Australian *Melaleuca* species are reliant on river water and/or shallow groundwater, up to 9 m deep (O'Grady et al., 2006a, 2006b). It is therefore possible that the three GDEs within the drawdown zone of the Project will already experience impacts from approved disturbance. This is especially true for the GDE labelled "Unnamed 1 High Potential TGDE", which is unlikely to survive the approved drawdown to 29m, which is below the root zone of most trees. Any further drawdown (as proposed) will therefore have no effect. The other two GDEs ("Unnamed 2 GES (US)" and "Unnamed 1 GES (US)") may withstand the currently approved drawdown without ill effect, as groundwater remains within 11-13m of ground level (near the extreme depth for roots to access). If these GDEs withstand the approved drawdown, it is likely that one of these GDEs ("Unnamed 1 GES (US)") will withstand the further minor proposed impact, as groundwater will remain within the same general window of 10-13m depth. For GDE "Unnamed 2 GES (US)", however, the proposed drawdown is significantly greater than the approved drawdown and impacts are considered highly likely as the groundwater will drop out of the root zone for most trees. However, review of the aerial imagery within Queensland Globe shows that the area around "Unnamed 2 GES (US)" has been heavily modified through cattle grazing and infrastructure associated with neighbouring mining operations. While it may exist as a depression with intermittent water ponding in the area, there appears to be little present in the way of remnant vegetation.

The predicted drawdown will persist until 2047, when groundwater levels will gradually recover back towards pre-mining conditions, which are reached by around 2060. The extended impact will likely result in the death of groundwater-dependent trees within "Unnamed 2 GES (US)" if present. The chief species affected (*Melaleuca bracteata*) has no special conservation significance. It is the most widespread species of *Melaleuca* in Australia, and is not a Koala food tree or an important habitat resource for other threatened species. As a dominant riparian species, it does play an ecological role in stabilising creek banks against erosion and is protected as a matter of state environmental significance as a "prescribed regional ecosystem located within a defined distance from the defining banks of a relevant watercourse", due to its value in stabilising the banks of local drainage lines.

Post closure groundwater levels throughout the area will recover higher than the currently approved mining scenario under the proposed SCNCP. This is due to differences in the final void designs, which are discussed in detail in **Appendix B, Section 5.5**. Without the SCNCP the approved final voids will be significantly deeper than the current Proposed final landform design.



Legend

- GDE Observations
- Spring Creek North Project Area
- ROC Mining Lease Boundaries

Depth to Groundwater (Proposed)

- 0-5 m
- 5-10 m
- 10-20 m
- 20-50 m
- 50-100 m
- >100 m

Source: State of Queensland (Department of Resources) 2022, Glencore 2023, METServe 2023, Umwelt 2023, Earthstar Geographics.

Spring Creek North Continuation Project

Depth to Groundwater (Proposed) in Relation to GDE Observations

0 1 2 3

Kilometers

Scale: 1:75,000 (A4)

28/04/2023

Datum: GDA2020
Projection: MGA55

FIGURE 18

GLENCORE

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\GC009_Rolleston\ArcGIS\Project_Files\Projects\GC009_Rolleston_SCN_Updated_GDEs_and_GW_Drawdown.aprx

5.6 Soils and Land Use

The RCEP Soil and Land Suitability Assessment (Palaris, 2013), completed as part of the RCEP EIS, assessed the environmental values and existing conditions, as well as detailing the potential impacts and mitigation measures required for the wider RCEP area. The wider RCEP study area included the proposed Project area within MLs 70307 and 70415.

No Strategic Cropping Land (SCL) was identified within the Project area during the Palaris field survey conducted between 2011 and 2013, or in subsequent desktop reviews. Soil types found within the Project area fall within the Oxford (Ox) and Waterford (Wa) land systems (Palaris, 2013) and are consistent with the soil types found across the currently approved ROC operation. The soil types are well understood and proven soil stripping, storage and placement methodologies are in place at ROC. As such, no changes to the approved and established soil management measures are required by the proposed amendment to EPML00370013.

The Project area was mapped as majority Class 2 and 3, with some smaller areas of Class 1 and 4 in terms of land suitability for grazing. The Project sits within an area identified as a Priority Agriculture Area (PAA). PAAs are areas of regional interest under the *Regional Planning Interest Act 2014* (RPI Act). PAAs are strategic areas, identified on a regional scale, that contain significant clusters of the region's high value intensive agricultural land uses. Within a PAA, high value intensive agricultural land uses are recognised as the priority land use over other proposed land uses. These uses are termed Priority Agricultural Land Uses (PALUs) and will be given priority in the consideration of applications for resource activities and regulated activities to ensure the continuation of the existing PALUs is not threatened.

It is acknowledged that not all land within a PAA is used as a PALU. This situation is recognised in the PAA Assessment Criteria. Within the RPI Act Statutory Guideline, PALUs in the Central Queensland regional plan are given as:

- Production from dryland agriculture and plantations;
- Production from irrigated agriculture and plantations;
- Intensive horticulture.

Schedule 2 of the *Regional Planning Interests Regulation 2014* (RPI Regulation), states that land or a property used for a PALU means the land or property has been used for a PALU for at least three years during the ten years immediately before an assessment application in relation to the land is made. The land within the Project area does not fulfil this criteria, and so no impacts to a PALU will occur as a result of the Project. The Project area was mapped by Palaris (2013) as majority Class 3 and 4 in terms of land suitability for dryland cropping, with some smaller areas of Class 2 and 5, however, it should be noted that the majority of the area is mapped as remnant vegetation, specifically eucalypts (see **Section 5.4**). The Soil and Land Use Assessment (Palaris, 2013) determined that the pre-mining land use of low intensity grazing could be restored throughout the Project area post-mining through effective rehabilitation.

5.7 Air Quality

The RCEP EIS Air Quality Impact Assessment (AECOM, 2013), assessed environmental values and the potential for the RCEP to affect air quality in the region. The Project will not increase the mine's production rate or extend the life of the mine. No change in the method of mining is proposed and the Project will utilise existing approved ROC infrastructure, with no additional supporting infrastructure relating to mine production required. No new sensitive receptors have been identified since the 2013 assessment, and the ROC will continue to implement the air quality management practices previously proposed and assessed. As such no amendments to the current trigger limits outlined in EPML00370013 are proposed. A summary of the RCEP assessment (AECOM, 2013) is provided below.

5.7.1 Environmental Values

Sensitive receptors within 15 km of the mine comprise seventeen dwellings, of which the closest is located 5.7 km from the Project **(Table 21).**

The Environmental Protection (Air) Policy 2019 establishes the environmental values of the air environment to be enhanced or protected in Queensland. These are:

- The qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems;
- The qualities of the air environment that are conducive to human health and wellbeing;
- The qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures, and other property; and
- The qualities of the air environment that are conducive to protecting agricultural use of the environment.

5.7.2 Potential Impacts on Environmental Values

The existing air environment of the ROC area was defined in terms of meteorology and climate, pollutant concentrations and the location of sensitive receptors. A site-specific emissions inventory was developed for three operational scenarios based on planned production data and fleet numbers. The impact of operations at the ROC was predicted using air dispersion modelling for the following pollutants of interest:

- Total suspended particulates (TSP);
- Particulate matter less than 10 µm in diameter (PM_{10});
- Particulate matter less than 2.5 µm in diameter ($PM_{2.5}$); and
- Dust deposition.

The RCEP EIS Air Quality Impact Assessment (AECOM, 2013), modelled impacts from three scenarios. Years 7, 12, and 16 of the RCEP. Of these three scenarios, years 7 and 12 (scenarios 1 and 2 respectively) addressed worst case operational years within the Spring Creek pit. As the Project is proposed as an extension to the Spring Creek pit, with no increase to the mine's production rate or LoM, along with no change in the method of mining, or the identification of any new sensitive receptors since the 2013 assessment, the AECOM 2013 assessment is considered to be fit for purpose.

The Project will decrease the distance to the Inderi homestead to 7.3 km, while the distance to the Glencore owned Meteor Downs homestead will remain 5.5km, however no significant impact is anticipated, and investigation trigger levels will remain the same at all receptors.

Table 24 shows a list of nominated sensitive receptors, with the approximate shortest distance from the approved RCEP (AECOM, 2013), vs approximate shortest distance from the proposed Project.

Table 24 Nominated Sensitive Receptors

Receptor	Direction from Project to homestead	Approx shortest distance from approved RCEP	Approx shortest distance from proposed Project	UTM Co-ordinates (mE, mN) Zone 55
Meteor Downs	NW	5.5 km	5.5 km	635124, 7302750
Albinia Downs	NE	5.8 km	5.7 km	650271, 7298160
Inderi	N	8.8 km	7.3 km	644889, 7308673
Croydon Hills	NW	9.5 km	10.6 km	630818, 7305673
Bottle Tree Downs	SE	6.8 km	14.4 km	650168, 7287015
Belmundi	NW	15.0	12.3 km	634426, 7312367
Maria Downs	NW	15.7	13.0	633990, 7312989
Myrtle Vale	NW	17.6	14.6	634474, 7314944
Canopus Park	N	14.5	10.4	638217, 7311895
Orana Downs	N	18.7	14.1	639828, 7315824
Wandana	N	18.7	14.0	640337, 7315780
Starlee	NE	17.5	12.0	656300, 736109
Karonga	N	15.0	9.9	643371, 7311792

Cambridge Downs	N	18.6	13.0	645299, 7314743
Maxmoor	NE	21.2	14.7	650490, 7315396
Carnarvan View	E	14.8	14.7	659268, 7297067
The Pocket	SE	10.3	14.3	655717, 7290964

Results of the air dispersion modelling (AECOM, 2013) are summarised as follows:

- No offsite impacts due to emissions from the ROC were predicted for TSP dust deposition and 24hr average $PM_{2.5}$ concentrations;
- Annual average $PM_{2.5}$ concentrations were predicted to exceed the ROC objectives at the Glencore owned Meteor Downs property; and
- Exceedances of the 24-hour PM_{10} ROC objective were predicted at Springwood Homestead and the two Glencore owned Mount Kelman and Meteor Downs properties.

The distance from the Project to all sensitive receptors identified within the RCEP assessment (AECOM,2013) have either increased or remained largely the same, and so no additional impacts are anticipated at any receptors not owned by Glencore.

5.7.3 Monitoring and Mitigation Measures

A number of existing mitigation strategies aimed at eliminating offsite PM_{10} impacts by reducing dust emissions from the ROC were identified. These strategies are based on the Air Quality Management Protocol (AQMP) (Xstrata Coal 2012) and include:

- A PM_{10} monitoring station is currently operated by ROC and is located to the south of the current operations;
- Maintain 80% dust control efficiency on primary haul roads via chemical stabilisation and/or watering;
- Rehabilitation of overburden dumps as soon as practical;
- Avoidance of dragline movements that cause high dust emissions — e.g. minimising dragline drop height;
- Water spraying system on Run of Mine (ROM) CHF transfers; and
- CHF variable height stackers onto product stockpiles

In addition to the above management and mitigation measures, the following requirements of the Aurizon Coal Dust Management Plan are already performed at the load out facility:

- Apply veneer suppressant to the surface of loaded coal wagons; and
- Load profiling to create a consistent surface of coal in each wagon.

RCH makes the below commitments for its ROC operations, and based on these, the potential for adverse air quality impacts due to the proposed Project is expected to be low:

- ROC air quality objectives stated within EPML00370013 will continue to be met at nominated sensitive receptors;
- ROC will continue to implement the existing Air Quality Management Plan; and
- The ROC will continue to implement the requirements of Aurizon's Coal Dust Management Plan (Aurizon 2010).

5.8 Noise and Vibration

The RCEP Noise Technical Report (AECOM, 2013), prepared as part of the RCEP EIS process, assessed the potential environmental noise impact of the expansion of the ROC operation. The Project will not increase the mine's production rate or extend the life of the mine. No change in the method of mining is proposed and the Project will utilise existing infrastructure approved under the current ROC operation, with no additional supporting infrastructure relating to mine

production required. An internal assessment has been undertaken to determine the impact of the Project on the ROC accommodation village. Any recommendations or mitigation measures proposed will be implemented to ensure any potential impact is minimised to the greatest possible extent.

No new sensitive receptors have been identified since the 2013 assessment, and the Project will continue to implement the noise and vibration management practices previously proposed and assessed. As such no changes are proposed to current trigger limits and monitoring locations outlined in EPML00370013. A summary of the RCEP assessment (AECOM, 2013) is provided below.

5.8.1 Environmental Values

Sensitive receptors within 15 km of the mine comprise seventeen dwellings, of which the closest is located 5.5km from the Project **(Table 24).**

The Queensland Environmental Protection (Noise) Policy 2019 establishes environmental values, states acoustic quality objectives for sensitive receptors and provides a framework for making decisions about the acoustic environment in Queensland.

Under this policy, the EVs to be enhanced or protected are:

- the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and
- the qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following-
    - sleep;
    - study or learn;
    - be involved in recreation, including relaxation and conversation; and
- the qualities of the acoustic environment that are conducive to protecting the amenity of the community.

5.8.2 Potential Impacts on Environmental Values

Documents considered in the RCEP assessment (AECOM, 2013) include:

- *Environmental Protection Act 1994*;
- Environmental Protection (Noise) Policy 2008 (EPP (Noise)). EHP (formerly the Department of Environment and Resource Management) guideline Planning for Noise Control (PFNC), dated August 2004;
- Draft Ecoaccess Guideline for the Assessment of Low Frequency Noise, dated November 2000The World Health Organization Guidelines for Community Noise, dated April 1999 EnHealth Council document The health effects of environmental noise – other than hearing loss, dated May 2004;
- Australia Standard AS 2670.2:1990 Evaluation of human exposure to whole-body vibration – Part 2: continuous and shock-induced vibration in buildings (1 to 80 Hz) German Standard DIN4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on Structures;
- Department of Transport and Main Roads document Road Traffic Noise Management: Code of Practice 2008; and
- Queensland Rail Code of Practice – Railway Noise Management Version 2 dated November 2007.

The above legislation, guidelines, policies and standards were reviewed to develop criteria that preserve the amenity of the surrounding areas and protects the health and wellbeing of nearby residents.

The EnHealth Council document references the WHO document which outlines guideline values for community noise intended to reduce the likelihood of adverse health effects. The EPP (Noise) outlines acoustic quality objectives intended to

enhance or preserve the health, wellbeing and other environmental values over the long term. On this basis, criteria have been proposed to protect the amenity of surrounding areas, as well as the health and wellbeing of nearby residents.

As the proposed operation of the mine will be operational 24 hours a day, the most stringent criterion of 35 dB(A) LAeq(1h) for the hours between 10pm and 7am was used at receptors to assess the operational noise impact associated with mining activities of the ROC operation.

Noise emission was modelled for Years 7 and 14 of the currently approved mine operation. These two scenarios were deemed to represent the typical worst-case locations of mobile mine plant for noise emission to surrounding receptors. Environmental noise emission from the mine was also assessed under a typical worst case meteorological condition of Meteorological Category 5, assuming F-class stability with calm conditions. Of these two scenarios, Year 7 addressed the worst-case operational scenario within the Spring Creek pit. As the Project is an extension to the Spring Creek pit, with no increase to the mine's production rate or LoM, along with no change in the method of mining, or the identification of any new sensitive receptors since the 2013 assessment, the AECOM 2013 assessment is considered fit for purpose.

The operation of the ROC in Year 7 was modelled to produce noise levels of up to 35 dB(A) LAeq(1h) at the most affected receptor (Springwood Homestead).

The predicted noise level at all other receptors is below 35 dB(A) LAeq(1h). Accordingly, the predicted mine noise impact at receptors is considered to comply with the nominated noise criteria provided ROC continue to implement the control strategies currently being used, as documented in the ROC Noise Management Plan (version 5), for the Project.

5.8.2.1 Low Frequency Noise

The noise impact at all sensitive receptors was found to meet the requirements of the screening test in the Ecoaccess *Assessment of Low Frequency Noise in 2004*(AECOM, 2013). Accordingly, the Project is not forecast to have a significant low frequency noise impact at any sensitive receptor.

5.8.2.2 Rail Noise and Vibration

There is no increase anticipated in rail traffic volumes as a result of the Project. As such the Project is not expected to increase the noise or vibration levels at receptors adjacent to the Blackwater System.

5.8.2.3 Road Traffic Noise and Vibration

There is no increase anticipated in road traffic volumes or noise levels as a result of the Project. As such, the Project is also not expected to increase road traffic noise levels on the Dawson Highway.

5.8.2.4 Operational Vibration

A literature review was performed to inform the assessment of vibration generated by general mining operations (excluding blasting). The vibration impact was assessed against the criteria recommended in the following standards:

- Australia Standard AS 2670.2:1990 Evaluation of human exposure to whole-body vibration – Part 2: continuous and shock-induced vibration in buildings (1 to 80 Hz);
- German Standard DIN4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on Structures.

As the nearest sensitive receptor is further than five kilometres away, the vibration levels generated by general mine operations are forecast to be imperceptible at the closest receptor, regardless of the duration and frequency of the vibrations generated. Accordingly, operational vibration impact from the Project is also considered to comply with the nominated vibration criteria.

5.8.2.5 Construction Noise and Vibration

The Project is proposed as an extension to existing operations at the ROC, and as such will make use of existing infrastructure to support operations. Some additional infrastructure, and upgrades to certain facilities, will be required to support existing infrastructure at the mine.

On this basis, construction noise and vibration were considered to be similar to or less than noise emitted during operational phases.

As such, noise and vibration impacts associated with the Project are expected to comply with relevant criteria for the protection of environmental values at nearby sensitive receptors.

5.8.3 Mitigation Measures

Construction and operation of the Project have the potential to impact on the local noise environment. Management is proposed via a combination of practices that aim to avoid, minimise, mitigate, or compensate effects on the natural environment. As an extension of an operating mine, the Project will incorporate a number of existing practices that have proven to be effective.

5.8.3.1 Existing Measures

A number of ROC operational procedures outline steps to manage emissions from the ROC. This is discussed below.

5.8.3.2 Acoustic Control

The assessment of operational noise impacts found that noise emission from the ROC at nearby receptors is forecast to comply with nominated noise criteria. These forecasts are based on the continuation of current leading mining practices undertaken at the ROC. These include:

- All equipment to be regularly maintained;
- Mining operations and construction to be undertaken using equipment with noise levels comparable to or less than those listed in Chapter 3 of the EIS.

5.8.3.3 Complaints Management

Existing operations at ROC operate under an Environmental Authority that requires that noise monitoring be undertaken when requested by the administering authority to investigate any complaint of noise nuisance. This practice will continue for the life of the Project. Complaints will be recorded in the site complaints/incidents register.

5.9 Waste Geochemistry

The RCEP Waste Geochemistry Assessment Report (Environmental Earth Sciences (EES), 2013), was prepared as part of the RCEP EIS process and assessed the geochemical characteristics of the overburden and interburden over the wider ROC operation. The predominant lithologies within the Project footprint align with those found across the ROC operation, and as such the proposed amendment will not change the operation and implementation of waste management practices previously proposed and assessed. A summary of the previous assessment is provided below.

5.9.1 Environmental Values

There are no specific environmental values assigned with waste geochemistry. The environmental values associated with surface water and groundwaters are relevant.

The objectives of the geochemical waste characterisation of the RCEP project were to evaluate:

- the chemical and physical properties of the waste rock, subsoil and coal seams;
- the potential for acid, neutral or saline drainage from mineral waste rock generated by RCEP operations; and
- the potential quality of leachate from mined waste (overburden, interburden and crushing waste).

The above objectives were achieved by the selection and subsequent analysis of 122 (plus 6 QA/QC) samples representative of waste material to be generated by the operation (roof, floor and overburden including soil), different lithological units and spatially distributed.

5.9.2 Potential Impacts on Environmental Values

The 2013 assessment report found that overburden and interburden would form the majority of waste produced during the ROC's operational phase, in terms of volume. The mine waste characterisation study (EES, 2013) concluded that waste materials generated from the ROC would likely be non-acid forming (NAF). The net acid-generating potential (NAGP) was found to be low for interburden material and non-existent for overburden material and soil.

All samples analysed displayed a zero to low acid generating potential with total Sulphur less than 2%. Based on the data collected for this study, it is believed that overburden material is likely to have a negligible acid forming capacity with mild acid-buffering characteristics. In addition, the overburden material was classified as sodic and dispersive with low salinity levels. Trace metal/metalloid enrichment was found in some samples with soluble concentrations of a number of elements in exceedance of release and/or on-site storage triggers. However, the management of surface water which may contact overburden would be contained and managed as discussed in the ROC Water Management Plan (WMP).

A number of samples recorded element concentrations above their average crustal abundance (EES, 2013). Elevated concentrations were recorded for arsenic, bismuth, antimony and zinc (in overburden samples); arsenic, bismuth, silver and antimony (in roof and floor samples) and selenium (in all domains i.e. overburden, roof/floor/interburden, soil and coal samples). It has also been noted that the applicable release contaminant guidelines generally refer to the LOR for ICPMS and/or generic ANZECC/ARMCANZ (2000) trigger values for most elements and thus may be overly conservative particularly considering the mine is within a naturally mineralised area.

Based on these results, the risk of potential impact on the quality of surface runoff and groundwater from mining waste materials associated with the Project is predicted to be low. The results of the kinetic leach column tests for samples taken across the ROC supported the results of the water extracts; namely, that the concentration of metals/metalloids in the leachate is low and typically below the laboratory limit of reporting. The concentrations of all metals/metalloids were below the applied water quality guideline criteria for aquatic freshwater ecosystems (95% species protection level) (ANZECC & ARMCANZ, 2000).

Overall, surface runoff and seepage from the overburden/interburden material is expected to be pH neutral to slightly alkaline and have a low level of salinity.

5.9.3 Mitigation Measures

As mentioned above, data indicates that there would be excess ANC available for acid neutralisation and furthermore, it is likely that any leachate generated from the waste rock is alkaline. As such, co-disposal of near seam and interburden material and overburden within a waste rock enclosure is likely to be an acceptable practise.

Testing also suggests that material is both sodic and dispersive (but not saline) and thus suitable measures must be implemented to prevent excessive erosion and potential sedimentation impact in nearby streams. Vegetation development for rehabilitation purposes could also be challenging due to the sodic and dispersive characteristics of the material and will require the placement of a layer of suitable topsoil overlying sodic material.

Proposed mitigation measures:

- Ensure a comprehensive surface water monitoring plan is in place and that it targets the contaminants of potential concern identified within this study; and
- Incorporate sediment and erosion control planning for the Project area within the ROC WMP

5.10 Traffic

The RCEP Transport Assessment Report (AECOM, 2013), provided as part of the RCEP EIS process, assessed environmental values and existing conditions and detailed the potential impacts and mitigation measures.

The Project will not require an increase in staff or the construction of any additional infrastructure beyond a single 66kV powerline. There is no change to the volume or type of traffic in the area anticipated as a result of the Project. As such, the

proposed amendment will not change the operation and implementation of transport management practices previously proposed and assessed.

5.11 Waste

Current EA conditions within EPML00370013 provide the minimum requirements for managing waste at the ROC. The proposed amendment will not change the operation and implementation of waste management previously proposed and approved. A summary of the previous assessment is provided below. ROC maintains a Waste Management Plan, which addresses the following:

- A description of the activities that may generate waste;
- Waste management control strategies, including:
  - The types and amounts of wastes generated by the activities;
  - Segregation of the wastes;
  - Storage of the wastes;
  - Storage of the wastes, transport of the wastes; and
  - Monitoring and reporting matters concerning the wastes;
- How the waste will be dealt with in accordance with the waste management hierarchy (that is, avoid, reuse, recycling, energy recovery, disposal);
- The hazardous characteristics of the wastes generated including disposal procedures for hazardous wastes; and
- Procedures for dealing with accidents, spills and other incidents; the indicators or other criteria on which the performance of the waste management program will be assessed; and staff training.

5.11.1 Environmental Values

The environmental values to be enhanced or protected through waste management at the ROC include the following:

- The life, health and wellbeing of people;
- The diversity of ecological processes and associated ecosystems; and
- Land use capability, having regard to economic considerations.

5.11.2 Potential Impacts on Environmental Values

The risk of impact to environmental values with respect to waste at the Project is anticipated to be insignificant. The waste streams identified include:

- General waste (benign construction waste, wood, food scraps etc.);
- Recyclable waste (paper, cans, glass etc.).

5.11.3 Mitigation Measures

The types of waste and quantity of waste generated at the Project will not increase as a result of the proposed amendment.

All waste will be managed in accordance with the existing Waste Management Plan.

5.12 Indigenous Cultural Heritage

Cultural Heritage Management Plans (CHMPs) have been developed to avoid, minimise or mitigate impacts on indigenous cultural heritage as a result of operations at ROC. The CHMP's have been developed and approved under the *Aboriginal Cultural Heritage Act 2003* (Qld).

Potential impacts of the Project would be managed in accordance with two approved CHMPs. They are the:

- *Cultural Heritage Management Plan – Rolleston Mine 2003* (as amended in 2011); and
- *Rolleston Coal Expansion Project – Cultural Heritage Management Plan 2013*.

Cultural Heritage Management Plan – Rolleston Mine 2003 was developed in 2003 and amended in 2011, and addresses any work conducted under the Project within ML70307.

Rolleston Coal Expansion Project – Cultural Heritage Management Plan 2013 was agreed in 2013 and approved by DATSIMA in 2013. This second plan provides for activities conducted under the Project on ML70415 (as well as wider ROC operations across ML's 701416, 70418 and 70458).

Both plans have been developed in consultation with the relevant Aboriginal Parties to each the above two agreements and outline the relevant actions to avoid, minimise or mitigate impacts on cultural heritage.

Such measures include additional survey and monitoring by the recognised Aboriginal Parties. These plans would form the basis for management and would enable impacts on indigenous heritage to be managed in a suitable and timely manner.

5.13 Non-Indigenous Cultural Heritage

The RCEP Non-Indigenous Assessment Report (AECOM, 2013), provided as part of the RCEP EIS process, assessed issues of cultural heritage significance.

Based on the assessment, there is one known historic (non-Indigenous) historically identified place within the proposed Project footprint. Archaeological deposits in the Project area are most likely to be associated with working and living areas, and a review of archival sources has identified a hut and yards complex within the Project Site that may preserve archaeological information related to both work and domestic contexts. Site inspections did not identify these structures above ground, however records of their existence or use may be present below ground. An assessment of impacts on historic 'huts' and 'yards' has been undertaken that considered the risk of a significant impact. Places containing potentially important archaeological deposits are protected under the *Queensland Heritage Act 1992* (QH Act), and there are penalties for interfering with (such as damaging, destroying, disturbing, exposing or moving) such discoveries (Sections 88 to 90).

An inspection was undertaken, but the sites were unable to be located. The available information is poorly documented and archaeological material may not exist in the area. A process has been identified to stop work and recover material should it be found. Based on the above, the Project is not considered likely to cause a significant impact on known cultural heritage.

The sensitivity of the archaeological deposits across the Project area would vary on a case-by-case basis. However, for the purposes of this assessment it is considered that archaeological deposits found would be of local or perhaps state importance and would therefore be considered to have a 'Moderate' sensitivity rating. RCH will proceed with the Project, subject to the "new finds" procedures, in compliance with Part 9 of the QH Act.

While attempts to visually locate these areas have not been successful, the potential remains for material of cultural significance to be present. Existing processes exist to 'stop works' in the event of uncovering a suspected potential cultural heritage item/s. These include:

- Work ceasing in the immediate area and the local site secured;
- The identified material or site would not be removed or disturbed further (barriers or temporary fences may be erected as a buffer around the find if required);
- Notification to Environment & Community manager (or delegate) who would commence an investigation;
- In accordance with the QH Act (Sections 88-90), DES would be informed using the form Reporting a Discovery that can be found at the following link: http://www.ehp.qld.gov.au/heritage/archaeology/making-a-discovery.html
- DES would determine the significance and future management of the find (DERM 2011b). This may involve the clearance of the site for development, recording and excavation, or protection.

5.14 Social

The RCEP Social Baseline Report (AECOM, 2013), provided as part of the RCEP application, assessed environmental values and existing conditions and detailed the potential impacts and mitigation measures.

The Project will not require any changes to workforce numbers, or any changes to workforce accommodation, and so therefore increase demands on social infrastructure in the surrounding communities are unlikely to be experienced.

As such the ROC will continue to operate and implement social impact management practices previously proposed and assessed. This includes regular consultation with stakeholders via the already established Community Reference Group.

6 Closure and Progressive Rehabilitation and Closure Plan

RCH has developed a Rehabilitation Management Plan (version 9.0) for its ROC operations, with the aim of returning the site to a healthy and sustainable ecosystem capable of similar land use as the surrounding landscape (i.e., extensive grazing).

The objectives of the rehabilitation program are to provide:

- A stable, self-sustaining, safe and non-polluting environment;
- An environment/ landscape that is free from liabilities for future stakeholders; and
- The identified post-mining land use within each rehabilitation domain.

Upon approval of the proposed Project, the Rehabilitation Management Plan (Glencore Coal Assets Australia (GCAA), 2020) will be updated to include the strategy for the rehabilitation of the Project area. Although disturbance of land cannot be avoided, residual impacts are considered to be minor and not significant following implementation of the rehabilitation strategy throughout the life of the mine and acceptable in terms of this EA amendment application.

In addition, specific criteria for final landform and residual voids are required to meet relinquishment standards at the completion of post-mining rehabilitation. The criteria have been developed in accordance with post-mining landform design upon cessation of mining activities.

The Project will be included in the ROC Progressive Rehabilitation and Closure Plan (PRCP). RCH has been issued a transition notice by the Department and is required to submit a PRCP to the Department by April 2024. Ramp 1, within the existing Spring Creek Pit mining area, has been mined out leaving a highwall that cannot be battered down without extending the slope outside of the current approval limit and into the Project footprint. The proposed Project allows for the pit to be extended north, and the existing Ramp 1 void to be filled. A buffer has been included in the project area to facilitate the battering of the Project area final highwall to an acceptable grade that would support the final land use (i.e., grazing) and not require the final landform to be classified as a Non-Use Management Area (NUMA).

Appendix A
Surface Water Assessment

A.1 Surface Water Assessment

Appendix B
Groundwater Assessment

B.1 Groundwater Assessment

Appendix C

Terrestrial Ecology Assessment

C.1 Terrestrial Ecology Assessment

Appendix D

Significant Impact Assessment

D.1 Significant Impact Assessment

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