ILUKA

Balranald Mineral Sands Project

2023 Annual Review

(1 January 2023 to 31 December 2023)

ANNUAL REVIEW DETAILS

Details of the operations are summarised in Table 1 below.

Table 1: Annual Review

Name of operation	Balranald Mineral Sands Project
Name of operator	Iluka Resources Limited
Development consent / project approval #	SSD – 5285
Name of holder of development consent / project approval	Iluka Resources Limited
Mining Leases #	ML 1736 & ML 1855
Name of holder of mining lease	Iluka Resources Limited
Water licence #	WAL31101, WAL31102, WAL44602, WAL44970 & WAL 41857
Name of holder of water licence	Iluka Resources Limited
RMP start date	12 August 2022
RMP end date	Continuing
Annual Review start date	01 January 2023
Annual Review end date	31 December 2024

I, Brendan Isaacs, certify that this audit report is a true and accurate record of the compliance status of the Balranald Mineral Sands Project for the period 1st January – 31st December 2023 and that I am authorised to make this statement on behalf of Iluka Resources.

Name of authorised reporting officer	Brendan Isaacs
Title of authorised reporting officer	Senior Environmental Specialist
Signature of authorised reporting officer	
Date	22 March 2024

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1 STATEMENT OF COMPLIANCE

This report is the 2023 Annual Review for the Balranald Mineral Sands Project (the 'Balranald Project' or the 'Project') as required by Condition 4, Schedule 5 of State Significant Development Consent SSD-5285 granted under the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This report has been prepared using the *Annual Review Guideline Post-approval requirements for State significant mining developments* (DPE, October 2015).

A summary of the compliance status of the operation with the conditions of the relevant approvals is provided in Table 2.

Non-compliances are described in Table 3, noting that no non-compliance events occurred during the reporting period.

Table 2: Statement of compliance

Statutory approval	All conditions complied with
SSD Development consent (SSD-5285)	Yes
Mining Lease 1736	Yes
Mining Lease 1855	Yes
Environment Protection Licence 20795	Yes
EPBC Approval (2012/6509)	Yes

Table 3: Non-compliances

Relevant approval	Condition	Condition description	Compliance status	Comment	Where addressed in Annual Review
No non-compliances during the reporting period					

Compliance status key for Table 3

Risk level	Colour code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: • potential for serious environmental consequences, but is unlikely to occur; or • potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: • potential for moderate environmental consequences, but is unlikely to occur; or • potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

2 INTRODUCTION

2.1 Operations overview

Iluka have approval to develop a mineral sands mine in south-western New South Wales (NSW), known as the Balranald Mineral Sands Project (the Balranald Project). It includes construction, open-cut mining, primary processing, and rehabilitation of two linear mineral sand deposits, known as the West Balranald and Nepean deposits, located approximately 12 kilometres (km) and 66 km north-west of the town of Balranald, respectively. The Balranald Project also included undertaking an approved bulk sampling activity at the West Balranald deposit with the removal of up to 100,000 tonnes (t) of mineral ore to trial the use of underground mining methods.

Development consent (SSD-5285) was granted for the Balranald Project by a delegate of the NSW Minister for Planning under the EP&A Act on 5 April 2016 (herein referred to as the consent). Approval was also granted under the EPBC Act (EPBC 2012/6509) by a delegate of the Commonwealth Minister for the Environment on 6 January 2017 (herein referred to as the Commonwealth approval).

Iluka has undertaken some of the approved bulk sampling activity involving the extraction of the mineral ore from depth using trial underground mining technology within the approved disturbance area of the West Balranald deposit.

The underground mining trials were conducted as follows:

- Trial 1 (T1) proof of concept undertaken between February and May 2015;
- Trial 2 (T2) commerciality test undertaken between May to October 2016;
- Trial 3 (T3) commerciality test undertaken between June to November 2020; and
- Site placed into care & maintenance from 18 November 2020.

The outcome of the bulk sampling activity confirmed the effectiveness of the underground mining method, validated key elements of the mining unit design and have been used to help guide future life-of-mine (LOM) operational conditions and inform the potential suitability (commerciality and potential reduced environmental impacts) of underground mining as an alternative method for resource extraction.

On 21 December 2022, Iluka were granted approval to modify the consent (MOD1) to expand the underground mining trial which includes an additional area of disturbance to the approved Balranald Project area to enable primary processing of the ore into heavy mineral concentrate (HMC) and transport of HMC offsite for secondary processing at Iluka's facilities in Victoria and/or Western Australia (WA). Figure 3 shows the underground mining trial approved by the MOD1 Consolidated Consent.

2.2 Environmental management responsibilities

Table 4 provides the details of the Iluka personnel with environmental management responsibilities during the reporting period.

Table 4: Environmental management responsibilities

Name	Role	Contact details
Philip Lazzari	Project Manager	Philip.Lazzari@iluka.com
Dave Wright	Operations Manager	Dave.Wright@iluka.com
Nick Travers	Principal Environmental Approvals	Nick.Travers@iluka.com
Brendan Isaacs	Senior Environmental Specialist	Brendan.Isaacs@iluka.com

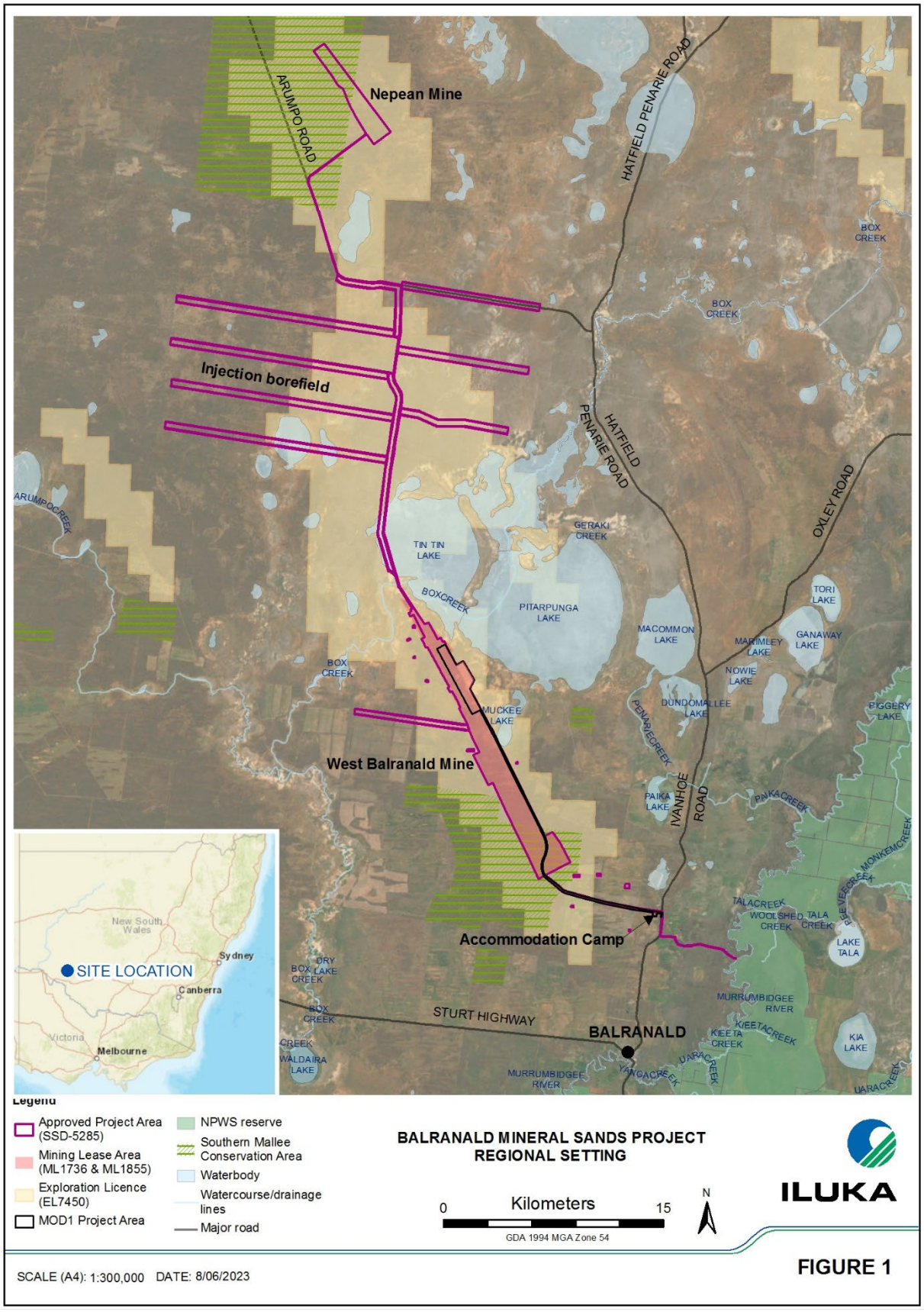

Figure 1: Project location and activity area

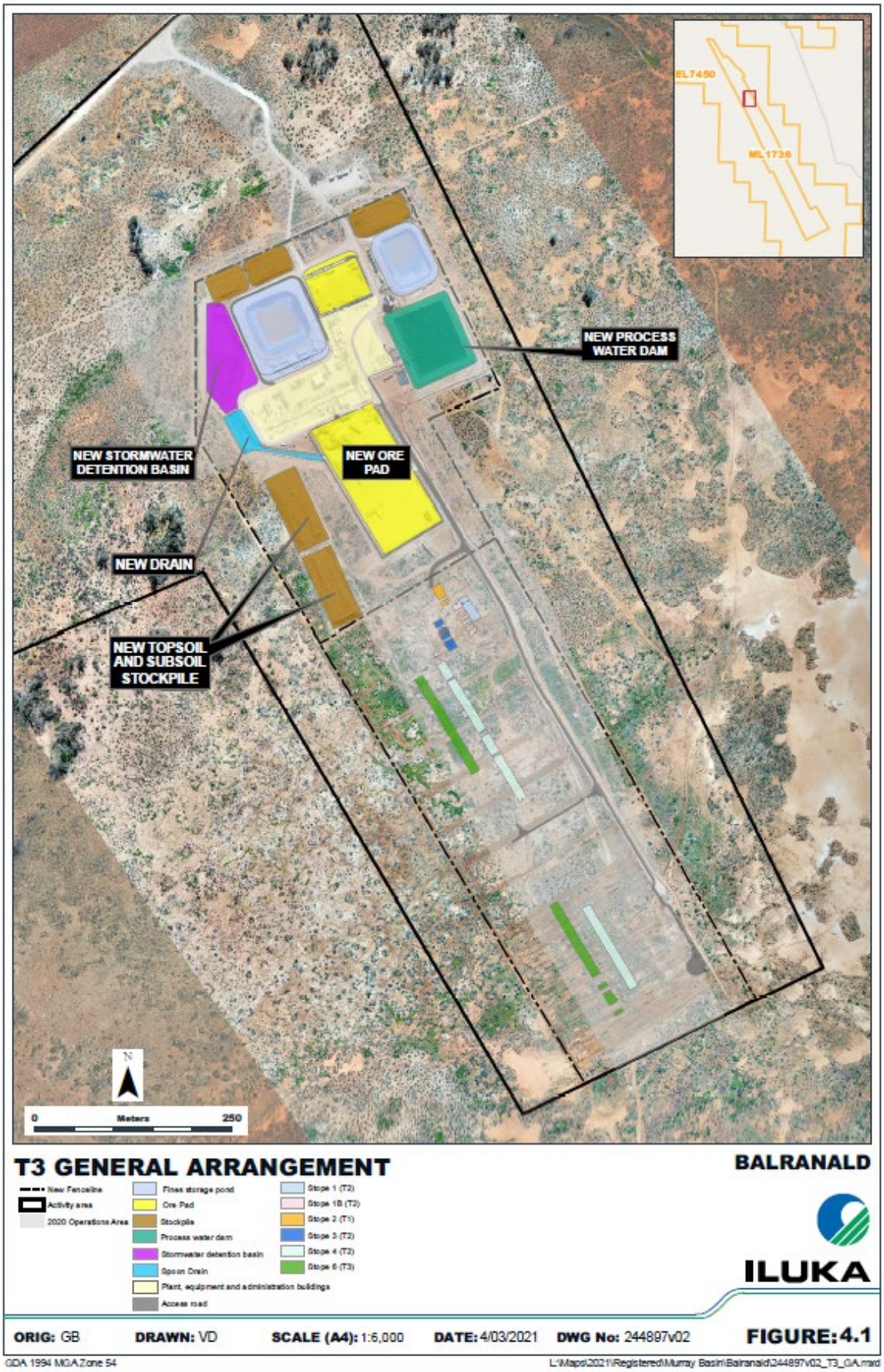

Figure 2: T3 trial site general arrangement

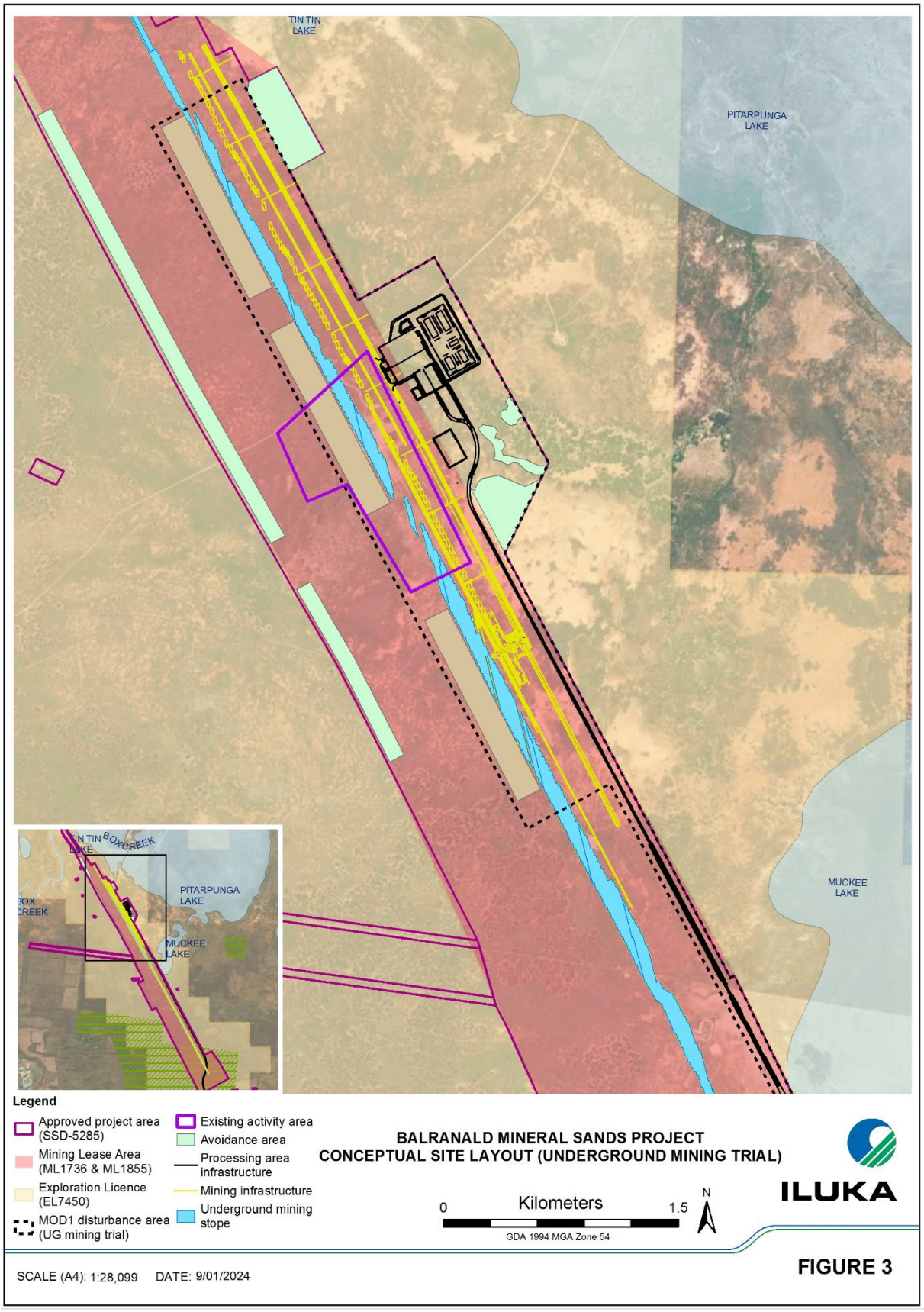

Figure 3: Approved modified project (MOD1) conceptual site layout

3 APPROVALS

The Balranald Project is a Level 1 mine and was assessed as a State Significant Development (SSD) under Part 4 of the EP&A Act.

The current approvals (including consents, authorisations, licenses and management plans) for the Project are summarised in Table 5 and Table 6.

Table 5: Current consents, authorisations and licenses

Type	Identification	Details
Development Consent	SSD-5285	Granted: 5 April 2016 Duration: 16 years
Development Consent Modification	SSD-5285 (MOD1)	Modified: 21 December 2022
Development Consent Modification	SSD-5285 (MOD2)	Modified: 1 August 2023
EPBC Act Referral 2012/6509	EPBC 2012/6509	Granted: 6 January 2017 Duration: 1 January 2046
EPBC Act Referral 2012/6509 Variation	EPBC 2012/6509 (Variation 1)	Varied: 1 August 2023
Mining Lease	ML1736	Granted: 9 May 2016 Duration: 21 years
Mining Lease	ML1855	Granted: 13 June 2023 Duration: 21 years
Environment Projection Licence	EPL20795	Granted: June 2016 and renewed annually
Water Access Licence(s)	WAL31101 WAL31102 WAL44602 WAL44970 WAL41857	Total allocation volume – 50 ML Total allocation volume – 0 M Total allocation volume – 1,950 ML Total allocation volume – 3,400 ML Total allocation volume – 101 ML

Table 6: Approved management plans during reporting period

Management Plan	Changes during reporting period
Environmental Management Strategy (9 February 2023, Version 1)	New plan: approved 28 February 2023.
Aboriginal Cultural Heritage Management Plan (ACHMP) (18 May 2023, Version 3)	Updated to include the management of Aboriginal Cultural Heritage within the approved MOD1 additional disturbance area.

Management Plan	Changes during reporting period
Air Quality Management Plan (8 March 2023, Version 1)	New plan: approved 17 March 2023.
Noise Management Plan (22 February 2023, Version 1)	New plan: approved 3 March 2023.
Water Management Plan (31 October 2023, Version 4)	New plan: approved 1 August 2023. Plan updated for take of water from Murrumbidgee River, approved 3 November 2023.
Traffic Management Plan (13 June 2023, Version 2)	New plan: approved 5 July 2023.
Biodiversity Management Plan (11 July 2023, Version 7)	New plan: approved 27 July 2023.

4 OPERATIONS SUMMARY

4.1 Introduction

The T3 mining trial commenced in early August 2020 and was completed in early November 2020. The trial site was demobilised and put into care and maintenance in November 2020. Iluka was granted approval in December 2022 to construct an underground mining operation, construction officially commenced on 7 August 2023.

4.2 Site construction

Construction activities during the reporting period included erecting of a temporary communications tower, relocation and refurbishment of portable offices, installation of an ablutions building and connection of water and electrical services.

An 8m wide track was initially cleared through 11km of Mallee vegetation along the approved mine access road corridor to allow preliminary site access.

Approximately 7km or 27Ha of the proposed mine access road corridor was cleared of vegetation and approximately 3km or 14Ha stripped of topsoil in preparation for road construction.

4.3 Mining operations

Production figures associated with construction of the MOD1 (extended underground mining trial) are provided in Table 7.

No mining or processing operations occurred during the reporting period with relevant activities limited to constriction-related soil stripping.

Table 7: Production summary (MOD1 Underground mining)

Material	Approved limit (specify source)	Previous reporting period (actual)	This reporting period (actual)	Next reporting period (forecast)
Topsoil (m3)	No limit	0	12,642	355,000
Subsoil (m3)	No limit	0	0	39,000
Overburden	No limit	0	0	115,000
Ore	No limit	0	0	0
Coarse reject	No limit	0	0	0
Fine reject (Tailings)	No limit	0	0	0
Product (HMC)	700,000 tonnes per annum (SSD-5285) MOD1	0	0	0

4.4 Exploration

Air core drilling (AC) was completed at West Balranald to define the strand geometry over two areas impacted by faulting at depth. At total of 36 AC drill holes were completed totaling 2,795m of drilling. Re-interpretations of the strand were completed followed by Mining Engineer review which confirmed that the new strand geometry in the faulted areas can be mined with the proposed underground mining method.

Prior to mining the northern faulted area, a grade control drill program consisting of between 10 to 16 AC drill holes will be required to refine the strand geometry and this is proposed to be completed in late 2025 or 2026. Further sonic drilling will be required in 2025 – 2026 to support conversion of Indicated Resources to Measured Resource classification in advance of mining.

4.5 Decommissioning

No decommissioning works were undertaken during the reporting period.

4.6 Next reporting period

During the next reporting period the remainder of the mine access road and processing area will be cleared of vegetation and the topsoil stripped. The road will be constructed to design by the appointed contractor.

The required public road upgrades within Balranald will be completed during the next reporting period as described in the Traffic Management Plan. Roads that will be upgraded in the next reporting period are Balranald-Ivanhoe Rd & Mine Access Road intersection, McCabe St and Balranald-Ivanhoe Rd intersection, Piper St, O'Connor St West, Moa St and Sturt Hwy & Balranald-Tooleybuc Rd intersection.

Other construction activities that will be at various stages during the next reporting period include:

- processing plant infrastructure;
- product and tails pad(s);
- process water, potassium amyl xanthate (PAX) and fines dams;

- underground mining infrastructure;
- hardstand and laydown areas;
- site offices, warehousing, workshops, amenities and carparking;
- services and utilities infrastructure;
- fuel storage and dispensing area;
- telecommunications tower;
- accommodation camp; and
- internal access tracks and roadways.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

No actions required from the previous Annual Review.

Table 8: Actions required from previous Annual Review

Action required from previous Annual Review	Requested by	Action taken by the Operator	Where discussed in Annual Review
Nil			

6 ENVIRONMENTAL PERFORMANCE

Table 9 provides a summary of the environmental performance monitoring completed during the reporting period in accordance with the approved management plans for the project.

Table 9: Environmental performance summary

Aspect	Approval criteria / EIS prediction	Performance during period	Trend / key management implications	Implemented/proposed management actions
Noise	Noise criteria specified in Table 2 of SSD-5285.	The first attended noise monitoring was conducted on 6th December 2023. Noise monitoring reports will be published on the Iluka website.	No noise was audible from construction activities.	Quarterly attended noise monitoring to continue through construction.

Aspect	Approval criteria / EIS prediction	Performance during period	Trend / key management implications	Implemented/proposed management actions
Air quality	Air quality criteria specified in Table 3 of SSD-5285.	Both PM10 and PM2.5 particulate matter remained below the Consent criteria with the exception of two events where 24hr averages were exceeded for PM10 on 20/11/23 and 9/12/23 respectively.	At the time of the exceedances there was no dust generating activities at the mine site. Elevated results are associated with sheep activity in vicinity of the BAM unit at the time. Wind speeds were recorded up to 33.9km/h with an average speed of 29.1km/h from a SSW direction during 17:00 to 21:00 on the 9/12/23. These windy conditions have caused temporary elevated PM10 dust levels during this period (Ave 167.41 µg/m³ and max 241.57 µg/m³).	Continue to monitor PM10 and PM2.5 taking note of any adverse weather conditions or dust events not attributed to construction activities. Continue to implement dust controls as outlined in the Air Quality Management Plan.
Groundwater	Water licence extraction limits, trigger levels specified in the Water Management Plan.	Meter readings recorded for all groundwater extraction. Quarterly groundwater levels obtained for regional monitoring sites. Annual groundwater quality testing conducted and reported.	All groundwater extraction was within extraction limits of Water Access Licences and Approvals. Quarterly groundwater levels remained stable and trigger levels reached. No adverse groundwater quality trends identified or trigger levels reached.	Compliant water meters with telemetry installed and meter readings recorded at least monthly. Continue monitoring groundwater levels each quarter. Quality monitoring to be undertaken annually. Groundwater monitoring reports to be published on the Iluka website.

Aspect	Approval criteria / EIS prediction	Performance during period	Trend / key management implications	Implemented/proposed management actions
Surface water / Erosion and sediment	No offsite release of turbid water or sediments.	Drainage networks monitored after rain events. Drains cleaned out around T3 site.	Drainage networks have performed well and maintained any runoff from disturbed areas within the site boundary.	Continue to implement erosion and sediment controls outlined in the Water Management Plan. Monitor drainage networks after rain events. Ensure temporary erosion controls are applied to construction areas where there is risk of erosion and offsite sedimentation. Monitoring of surface water quality in accordance with the Water Management Plan.
Biodiversity	Protection of Malleefowl, Corben's Long-eared Bat and Raptors.	Targeted threatened species surveys undertaken in October 2023. Pre-disturbance report attached as Appendix D. No impact to Malleefowl, Corben's Long-eared Bat or Raptors during clearing activities. Clearing report attached as Appendix E	One active Malleefowl mound identified within the disturbance footprint. Hollow bearing trees identified within Corben's Long-eared Bat habitat mapped as med-high density hollows. Raptor nests identified in clearing areas.	No vegetation clearing within 200m of the active Malleefowl mound until breeding has ceased. (i.e. end of Feb) No clearing within Corben's Long-eared Bat habitat between May and November. Hollow bearing trees (HBTs) within Corben's Long-eared Bat habitat to be marked up and surrounding vegetation cleared first followed by HBTs 48hrs later. Felled trees to be re-located 24hrs after felling. Raptor nests to be inspected with drone for presence of eggs and chicks prior to clearing.
	Minimise clearing in the approved footprint. Protect adjacent vegetation and habitat.	Site Disturbance Permits were issued for all ground disturbing activities undertaken. Clearing areas were demarcated on the ground by a competent surveyor.	No breaches of any permit occurred.	All future ground disturbing activities will be subject to this permitting process.

Aspect	Approval criteria / EIS prediction	Performance during period	Trend / key management implications	Implemented/proposed management actions
	Timber, vegetation and soil salvage.	Vegetation and topsoil removed from the mine access road has been stockpiled for future use in rehabilitation.	Topsoil stockpiles moderately erodible due to dry soil conditions.	Stockpile attributes and locations mapped and included in database. Stockpiles signposted with unique identification numbers. Stockpile volumes obtained from survey and included in database. Commercial soil binder applied to topsoil stockpiles to minimise erosion.
	Weed and feral pest management	All vehicles, plant and equipment were inspected for weed seeds and soil contamination before mobilising to site. Feral pests identified onsite and surrounding lands including feral goats, pigs and foxes.	Increasing number of feral animal sightings. Goat populations on the rise due to low commercial demand and price.	Lessees consulted to undertake pest control. Goat control scheduled for January 2024. Fox and pig baiting to be implemented in 2024. Weed control to be implemented in 2024.
	Bushfire prevention and response	Fence lines graded around the site to maintain a fire break between surrounding properties.	High than average rainfall in previous years has led to greater than average fuel loads.	Periodic fire break maintenance. Testing of emergency response procedure and equipment. Testing of the Pollution Incident Response Plan in accordance with the Environment Protection Licence 20795.
Aboriginal Cultural Heritage	Aboriginal Cultural Heritage Management Plan (ACHMP)	Salvage and storage of remaining artefacts within MOD1 additional disturbance area. Due Diligence survey of gravel pits and access tracks. Due Diligence survey of proposed fence lines. Sub-surface excavation and test pitting survey within location 8.	A number of sites identified within the EIS boundary will remain in situ and be avoided by development. Unexpected finds may be encountered during clearing and topsoil stripping works during construction.	Protection of modified trees and hearth sites identified for avoidance by fencing. Adherence to the unexpected finds protocols outlined in the ACHMP. Maintain consultation with Registered Aboriginal Parties for the Project through biannual Aboriginal Cultural Heritage working group meetings.

7 WATER MANAGEMENT

7.1 Water take

Water use for the previous water year 1 July 2022 to 30 June 2023 is summarised in Table 10.

Table 10: Summary of water use

Water Licence #	Water Source and Water Sharing Plan	Entitlement / allocation	Passive take / inflows	Active pumping	Total (ML)
44602	Western Murray Porous Rock Groundwater Source/NSW Murray Darling Basin Porous Rock Groundwater Sources 2020.	1,950 ML	0 ML	0 ML	0 ML
44970		3400 ML	0 ML	0 ML	0 ML
31101		50 ML	0 ML	0 ML	0 ML
31102		0 ML	0 ML	0 ML	0 ML
41857	Murrumbidgee Regulated River Water Source 2016	101 ML	0 ML	0 ML	0 ML

7.2 Groundwater monitoring

7.2.1 Underground bulk sampling activity (trial site)

Analysis of the February 2023 groundwater pressure and quality data, with comparison to the October 2021 pre-activity and during-activity data analysed by EMM (2021), found the following:

- The average change in groundwater levels which occurred in regional monitoring bores when comparing pre-activity and February 2023 data was an increase of 0.29 m. This increase is likely due to above average rainfall conditions experienced in the areas from January 2022 onwards. Trial 3 activities (T3) are considered to have had little or no impact on nearby groundwater levels.

- Minor changes in field pH, TDS, EC and total iron concentrations were observed when comparing pre-activity, October 2021 and February 2023 data from regional bores. Exceptions to this include considerable increases in the ORP measurements observed in regional SFM and LPS bores, which could suggest a natural trend occurring in these aquifers.

- No significant trends were found in any groundwater quality parameters that would suggest the local groundwater system was impacted by T3, or that any other impacts have occurred. In general, analyte concentrations measured in February 2023 were similar to those measured prior to the beginning of T3 and in October 2021.

- Some exceedances of groundwater quality SSTLs were noted but were determined to be due to natural fluctuations or local mineralisation (elevated background concentrations). In bores where an SSTL exceedance was noted, no increasing trends were observed, and no other bores showed similar exceedances.

The February 2023 Groundwater monitoring report is provided as Appendix A.

7.2.2 Underground mining operation

Regional groundwater monitoring commenced in September 2023 in accordance with the approved Water Management Plan for the Underground Mining Operation. Water levels were measured quarterly and published on the Iluka website. The frequency of water quality monitoring for regional bores will decrease from bi-annually to annually as required by the approved Water Management Plan. The first annual quality monitoring will be undertaken in Q1 2024.

Regional groundwater levels remained stable during the three month period, with only minor decreases in levels observed of between 0.03m and 0.06m recorded across all bores except LPSPB03 which had no change.

A graph of the quarterly regional groundwater levels is shown in Figure 4.Approximately 80 additional monitoring bores will be constructed within the Shepparton Formation, Loxton Parrilla Sands and Olney aquifers during the next reporting period in preparation for mining activities in 2025. Monitoring bores will be constructed by a qualified driller under Miscellaneous Works Approval (60MW583326). Baseline data will be collected from these locations at least 6 months prior to commencement of mining operations.

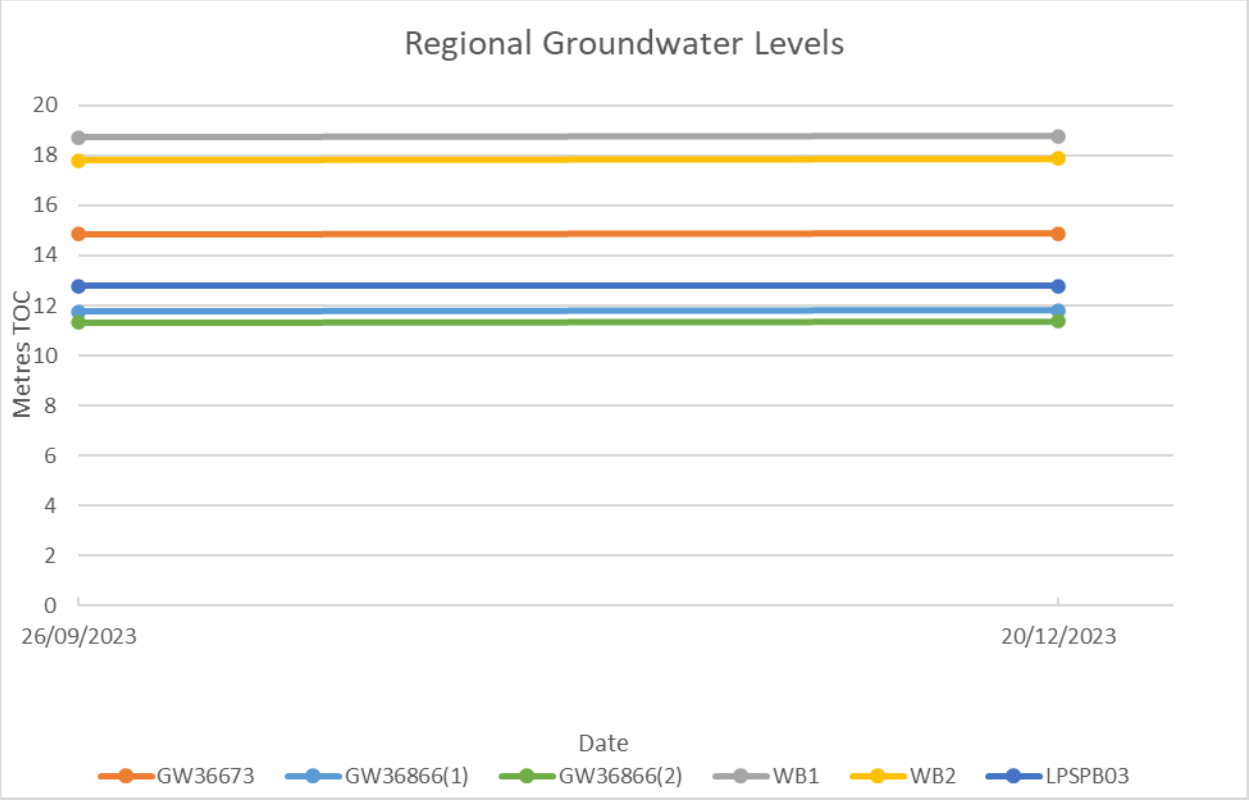

Figure 4- Quarterly groundwater levels for regional bores

7.3 Erosion and sediment

A total of 300mm of rainfall was recorded in 2023 at the Balranald RSL weather station located in the town of Balranald (BOM Station No. 049002). This is slightly below the average rainfall of 324.1mm for the region.

The only real significant rain event was on the 4th of October where 60.2mm of rain was recorded (Figure 5).

No sediment was observed to have discharged from the site and all drainage networks and storage basins were functional and below freeboard levels.

A site based weather station is now installed and all future weather data will be obtained from this station for better representation of actual site conditions.

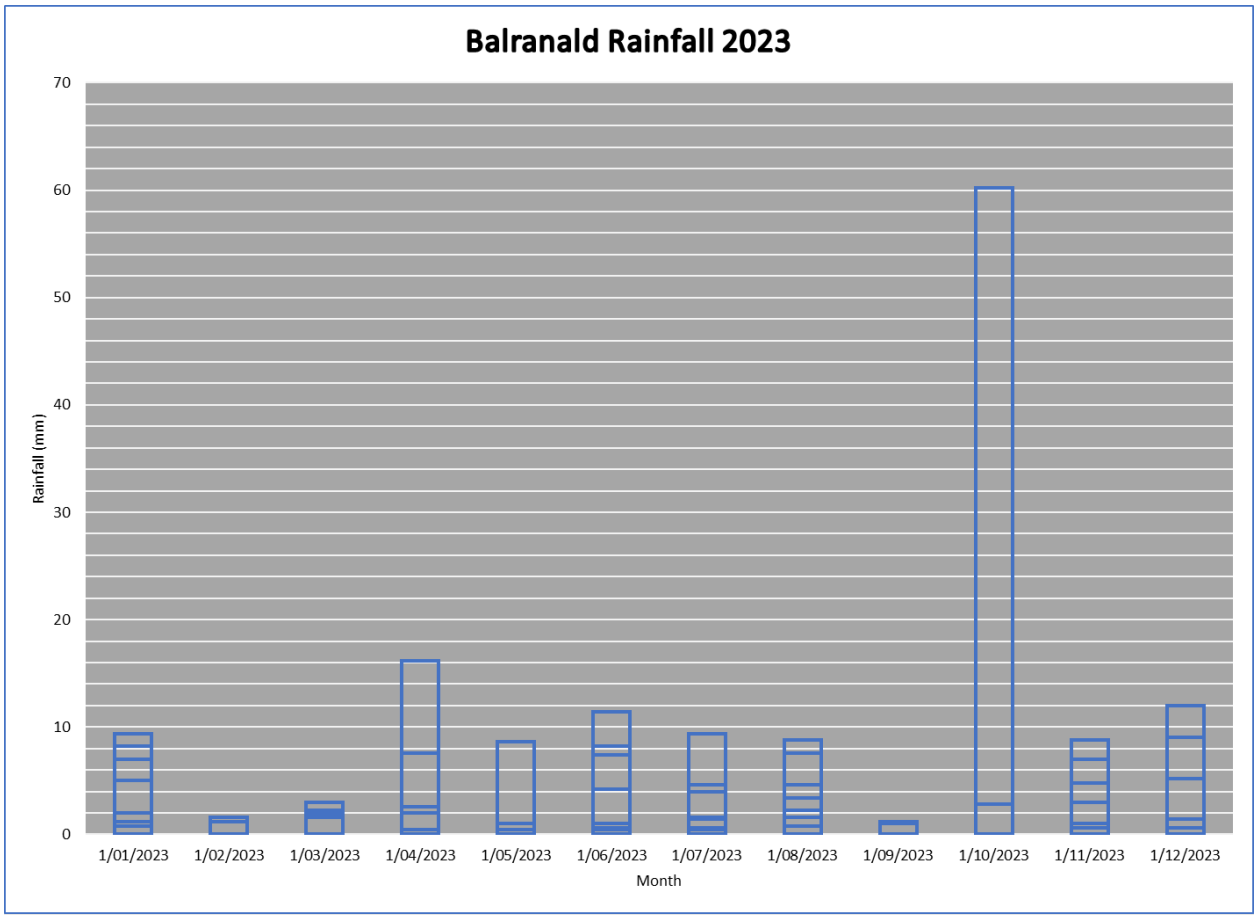

Figure 5- Balranald rainfall 2023

8 REHABILITATION

An Annual Rehabilitation Report and Forward Program has been prepared in accordance with *Mining Amendment (Standard Conditions of Mining Leases— Rehabilitation) Regulation 2021* under the *Mining Act 1992*.

The 2023 Annual Rehabilitation Report and 2024-2026 Three Year Forward Program are provided as Appendix B and Appendix C, respectively.

9 COMMUNITY

9.1 Complaints

No community complaints were received during the 2023 reporting period. A copy of the complaints register for the Project is provided on the Iluka Resources website in accordance with the Condition 11, Schedule 5 of SD-5285.

9.2 Community engagement

Town Hall Meeting

A community town hall meeting was held on 21 June 2023 at the Balranald Football Netball Club rooms. An update on the project was provided by the Balranald Project Manager and Operations Manager. The meeting provided opportunity for the community to speak with Iluka representatives about the project and enquire about any technical aspects, environmental issues or employment opportunities.

The meeting was well attended by both the local community and Balranald Shire Council.

Murray Basin Newsletter

Iluka published newsletters in July 2023 and November 2023 to inform the community about the progress of the Balranald Project and Iluka's other projects in the Murray Basin.

The newsletters and other project updates are available on the Iluka website Balranald Engagement Hub

Registered Aboriginal Parties (RAPs)

Iluka consulted and engaged with RAPs to undertake an Aboriginal Cultural Heritage surface collection program in May 2023 within the additional disturbance area approved under MOD1 Consent.

Iluka consulted and engaged with RAPs to undertake an Aboriginal cultural heritage due diligence assessment for gravel pit access tracks located outside the EIS boundary in accordance with the Heritage NSW Due Diligence Code of Practice for the Protection of Aboriginal Objects (DECCW 2010).

The field investigations and walk over of the proposed gravel pits and access tracks was completed on 26–27 May 2023 and 30–31 May 2023.

RAPs were engaged again during October 2023 to undertake archaeological subsurface excavation, geomorphic assessment and exploratory test pits within Location 8 of the approved Balranald EIS project boundary, in accordance with Section 6.1 of the approved Balranald Aboriginal Cultural Heritage Management Plan (ACHMP) (Niche 2016).

An Aboriginal Cultural Heritage Management Plan has been developed for the Balranald Mineral Sands Project, detailing the measures to be undertaken by Iluka to protect and manage Aboriginal cultural heritage within the area. A core component of the Aboriginal Cultural Heritage Management Plan includes the creation of the Balranald Mineral Sands Project Cultural Heritage Working Group.

The Balranald Mineral Sands Project Aboriginal Cultural Heritage Working Group terms of reference were established and signed by members on 2 August 2023. The working group will provide a formal platform for on-going engagement, communication and consultation between Iluka and Registered Aboriginal Parties.

Iluka is committed to protecting and preserving Aboriginal Cultural Heritage and consulting with Traditional Owners on all Cultural Heritage matters.

Balranald Shire Council (BSC)

Iluka undertook negotiations with BSC during 2023 to establish the Voluntary Planning Agreement (VPA) and Road Maintenance Agreement (RMA) required under condition 18 of Schedule 2 and condition 25 of Schedule 3 for the Balranald Mineral Sands Project Development Consent (SSD-5285).

Iluka and BSC were unable to reach an agreement prior to the commencement of construction and therefore requested an extension from DPE on 4 July 2023. An extension of time was granted by DPE on 27 July 2023 until 31 January 2024 for Iluka to enter into a VPA and a road maintenance agreement with Balranald Shire Council.

Following receipt of the Extension, Iluka was in regular communication with BSC and has continued to negotiate the VPA and RMA. Whilst most elements of the VPA and RMA have been agreed to in principle, it was unlikely to be formalised prior to 31 January 2024. Iluka requested a subsequent extension from DPE on 19 December 2023 to enable sufficient time to finalise the agreements. An extension to 30 July 2024 was granted by DPE on 22 December 2023 to finalise the details about the balance of the contributions and road maintenance framework and to fully execute the VPA.

9.3 Community contributions

Iluka's community contributions during the reporting period are summarised below in Table 11.

Table 11: Community contributions

Community Group	Sponsorship and Donations
Balranald Football Netball Club	Sponsorship over 4 year term to make improvements to the clubs facilities.
Balranald Murrumbidgee Classic	Sponsorship for Murrumbidgee Classic 2024 fishing competition.
Balranald Incorporated	Donation of redundant mining equipment for auction in 2023. All proceeds to go to local community groups.
Homebush Rodeo	Sponsorship for Homebush 2023 Rodeo event.

10 INDEPENDENT AUDIT

No Independent Audit was conducted during the reporting period. The first Independent Audit is required within 12 months from the commencement of construction associated with the underground mining trial.

DPE were formally notified in accordance with Schedule 2, Condition 11(b) and Condition 12 of Development Consent (SSD-5285) that the commencement date for construction is 7 August 2023.

The first Independent Environmental Audit is required by 7 August 2024.

11 INCIDENTS AND NON-COMPLIANCE

11.1 Non-compliances

No non-compliances with the conditions of the relevant statutory approvals occurred during the 2023 reporting period.

11.2 Reportable incidents or exceedances

No reportable incidents with the conditions of the relevant statutory approvals (Table 5) occurred during the 2023 reporting period.

11.3 Official cautions or warnings

No official cautions, warning letters, penalty notices or prosecution proceedings were received by any regulatory agency for the Project during the 2023 reporting period.

12 ACTIVITIES FOR NEXT REPORTING PERIOD (2024)

12.1 Environmental management

Quarterly attended noise monitoring will be conducted during construction in accordance with the approved Noise Management Plan.

Air quality monitoring for PM_{10} and $PM_{2.5}$ will continue during construction using a continuous particulate monitor to obtain data and provide ongoing compliance monitoring for air quality during construction. Air quality monitoring will be undertaken in accordance with an approved Air Quality Management Plan.

Regional groundwater bore levels will be taken each quarter and samples taken for quality analysis taken once in the reporting period.

Groundwater monitoring bores will be installed during construction to obtain baseline data prior to the commencement of mining operations. Groundwater monitoring will be undertaken in accordance with an approved Water Management Plan.

The Water Management Plan will require updating during the next reporting period in preparation for operations in 2025.

12.2 Stakeholder engagement

Balranald Shire Council will be consulted in 2024 to finalise the Voluntary Planning Agreement and Road Maintenance Agreement required under condition 18 of Schedule 2 and condition 25 of Schedule 3 for the Balranald Mineral Sands Project Development Consent (SSD-5285).

Balranald Shire Council and Transport for NSW will be consulted during 2024 regarding the required public road upgrades required under Condition 22 of Schedule 3 for the Balranald Mineral Sands Project Development Consent (SSD-5285).

Consultation with RAPs will continue in 2024 to maintain the Aboriginal Cultural Heritage Working Group. The group will meet at least twice per year, and will be an advisory committee which Iluka will work with in relation to ongoing management of Aboriginal heritage associated with the project.

Community consultation will be undertaken over the next reporting period, including attending community events, providing project updates and responding to queries or complaints during the construction phase.

12.3 Approval conditions triggered during next reporting period

Approval conditions to be triggered in the next reporting period are listed in Table 12.

Table 12: Approval conditions triggered during next reporting period

Action	Source	Timing
Enter into Voluntary Planning Agreement with Balranald Shire Council	SSD-5285 Schedule 2, Condition 18	Prior to 30 July 2024
Implement road upgrade works detailed in Table 8 of SSD-5285	SSD-5285 Schedule 3, Condition 22	Within 12 months of commencing construction (7 August 2024)

Action	Source	Timing
Enter into a road maintenance agreement with Balranald Shire Council	SSD-5285 Schedule 3, Condition 25	Prior to 30 July 2024
Conduct Independent Environment Audit	SSD-5285 Schedule 5, Condition 8	Within 12 months of commencing construction (7 August 2024)
Retire stage 1 Offset credits as specified in Table 7 of SSD-5285	SSD-5285 Schedule 3, Condition 16A	Within 24 months of the commencement of disturbance
Notify the Department prior to the construction of the processing area in the West Balranald Mine	SSD-5285 Schedule 2, Condition 11(c)	1 week prior to commencing construction

APPENDICES

A-1.1 Appendix A: Hydrogeochemical assessment- March 2023 groundwater monitoring event.

Balranald Mineral Sands Project

Hydrogeochemical assessment - February 2023 groundwater monitoring event

Prepared for Iluka Resources Limited

March 2023

Balranald Mineral Sands Project

Hydrogeochemical assessment - February 2023 groundwater monitoring event

Iluka Resources Limited

S200529 RP1

March 2023

Version	Date	Prepared by	Approved by	Comments
v1 Draft	27 February 2023	Bill Bull	Paul Gibbons	
v2 Final	21 March 2023	Bill Bull	Paul Gibbons	

Approved by

Paul Gibbons
Director
22 March 2023

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Figures

1 Introduction

The purpose of this hydrogeochemical assessment is to present and interpret groundwater pressure and chemistry data collected from regional bores surrounding Iluka Resources Limited's (Iluka) Balranald Mineral Sands Project (the Balranald Project) in February 2023.

1.1 Overview

Iluka have approval to develop a mineral sand mine in south-western New South Wales (NSW), known as the Balranald Project. It includes construction, mining, primary processing, and rehabilitation of two linear mineral sand deposits, known as the West Balranald and Nepean deposits, located approximately 12 kilometres (km) and 66 km north-west of the town of Balranald, respectively.

Development Consent No. SSD-5285 (the consent) was granted by a delegate of the NSW Minister for Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) on 5 April 2016. The consent included approval to undertake a bulk sampling activity of up to 100,000 tonnes(t) of mineral ore at the West Balranald deposit to test the removal of the ore using underground mining methods.

Since the consent was granted, Iluka has undertaken the approved bulk sampling activity involving the extraction of the mineral ore from depth, using trial underground mining methods within the approved disturbance area of the West Balranald deposit. The underground mining trial site was placed into care and maintenance in late November 2020.

1.2 Underground mining trials

As part of the approved bulk sampling activity, Iluka has undertaken a series of underground mining trials involving the extraction of the mineral ore from depth within the approved disturbance area of the West Balranald deposit. The trials were conducted as follows:

- proof of concept undertaken between February and May 2015
- commerciality test Phase 1 undertaken between May to October 2016
- commerciality test Phase 2 undertaken between June to November 2020 (known as T3).

The outcome of the bulk sampling activity confirmed the effectiveness of the underground mining method, validated key elements of the mining unit design and have been used to guide future life-of-mine (LOM) operational conditions and inform the potential suitability (commerciality and potential reduced environmental impacts) of underground mining as an alternative method for resource extraction.

In December 2022, Iluka obtained approval to modify the consent (MOD1) under Section 4.55(1A) of the EP&A Act to extend the approved underground mining trial for up to 6 years.

The proposed MOD1 involves:

- Continuing the underground mining trial within a portion of the approved disturbance footprint of the West Balranald deposit pursuant to the consent.
- Development of approved mineral processing surface infrastructure and a portion of the access road outside of the approved disturbance footprint and excising a corresponding area from the approved disturbance footprint.

1.2.1 Existing site overview

A site layout plan of Balranald's T3 underground mining trial site is shown in Figure 1.2 and includes the following main features:

- The main processing area which includes the Process Water Dam (PWD), various processing plant equipment, fines storage, sand/ore stacking pad, site offices and the hard stand area which accommodates the HDD rig and supporting equipment.
- HDD decline holes.
- Mine stopes.

Phase 2 mining commenced in June 2020 with the development and mining of a new stope (Stope 6) and the re-entry and additional mining of Stope 4. Ore extraction took place between 19 August 2020 to 30 September 2020. The trial removed 30,900 t of material during mining with the ore processed on-site to produce 11,900 t of heavy mineral concentrate (HMC).

Backfilling took place between 1 October to 18 October 2020. Approximately 1,540 t of sand and clay tailings were backfilled into the mining zone and approximately 2,766 t were used to fill and rehabilitate the holes created during operation due to subsidence.

As previously stated, the underground mining trial site was placed into care and maintenance in late November 2020.

1.2.2 Water supply

Saline groundwater was abstracted from the Loxton-Parilla Sands (LPS) Aquifer as a process water supply during in-situ mining and backfilling. This occurred via the P1 and P2 production bores.

Subsequently, water sourced from the PWD was re-injected into the LPS aquifer as a component of the in-situ mining process and during stope-backfilling with mining by-products.

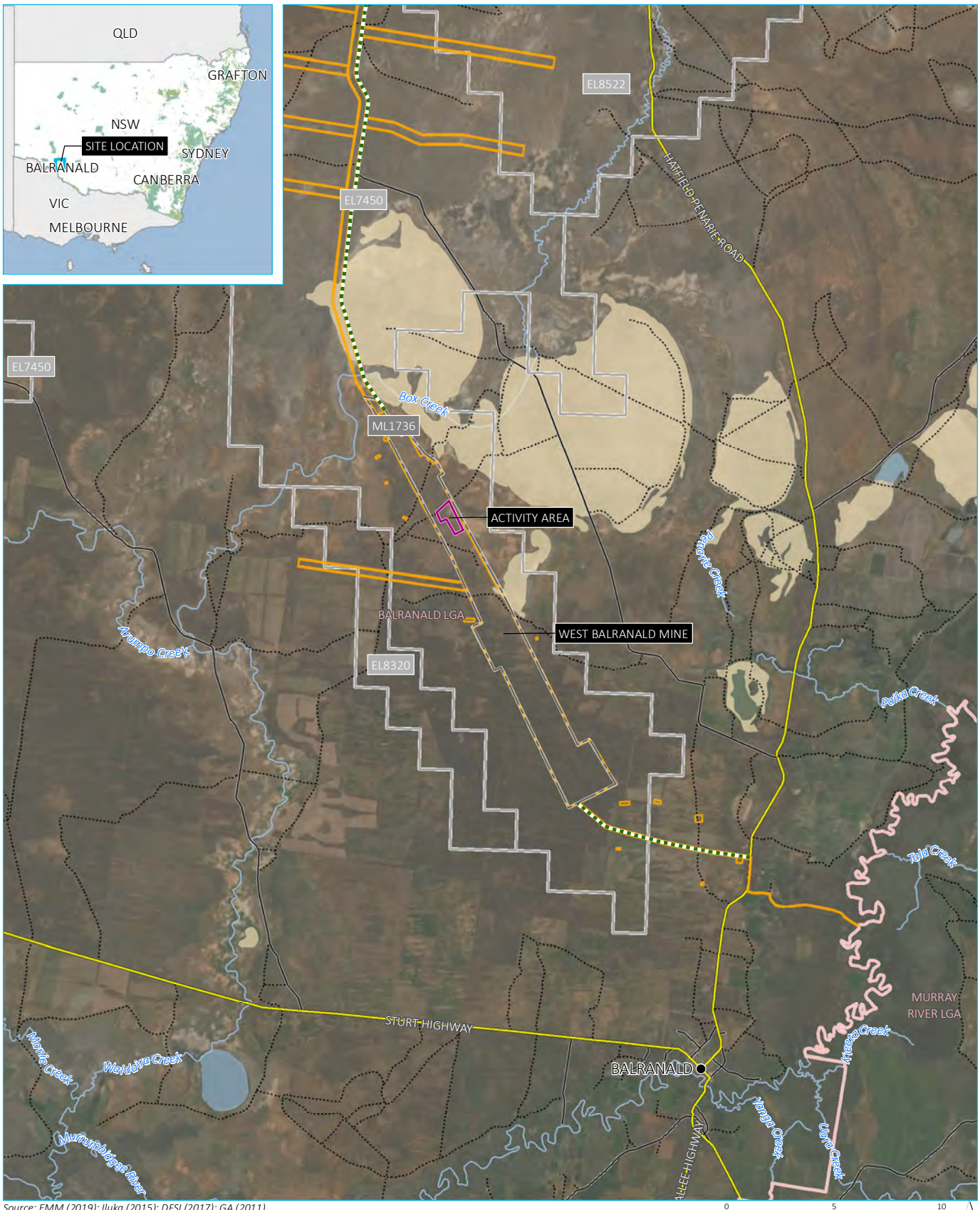
Water usage during the underground mining trials was in accordance with a 2,500 megalitre (ML) water trade with Tronox, assigned to Iluka's Water Access Licences (WAL) 31101 and WAL31102. Nominated extraction points during the activity included production bores P1 and P2 (LPS Aquifer) and the Karra Homestead Bore (Lower Renmark Group Aquifer).

Groundwater abstraction was also undertaken from Karra Homestead Bore, which is screened within the Lower Renmark Group (LRG) aquifer. This brackish water source was used primarily for dust suppression and soil/heavy-mineral stockpile management.

1.3 Project objectives

The objective of this hydrogeochemical assessment report is to:

- Review hydraulic data to determine how groundwater pressures in regional bores have changed when compared to pre-activity measurements, the previous assessment undertaken by EMM (2022) and hydraulic operating conditions (HOCs).
- Review hydrogeochemical data to determine how groundwater chemistry has changed since the previous assessment undertaken by EMM (2022) and determine if any site-specific trigger levels (SSTLs) have been exceeded.



Source: EMM (2019); Iluka (2015); DFSI (2017); GA (2011)

0 5 10 km

GDA 1994 MGA Zone 54

N

\\Emmsvr1\EMMJobs\2019\S190512 - Balranald T3 Ancillary Support\GIS\02_Maps_Hydrogeo\HG001_RegionalLocation_20201204_01.mxd 4/12/2020

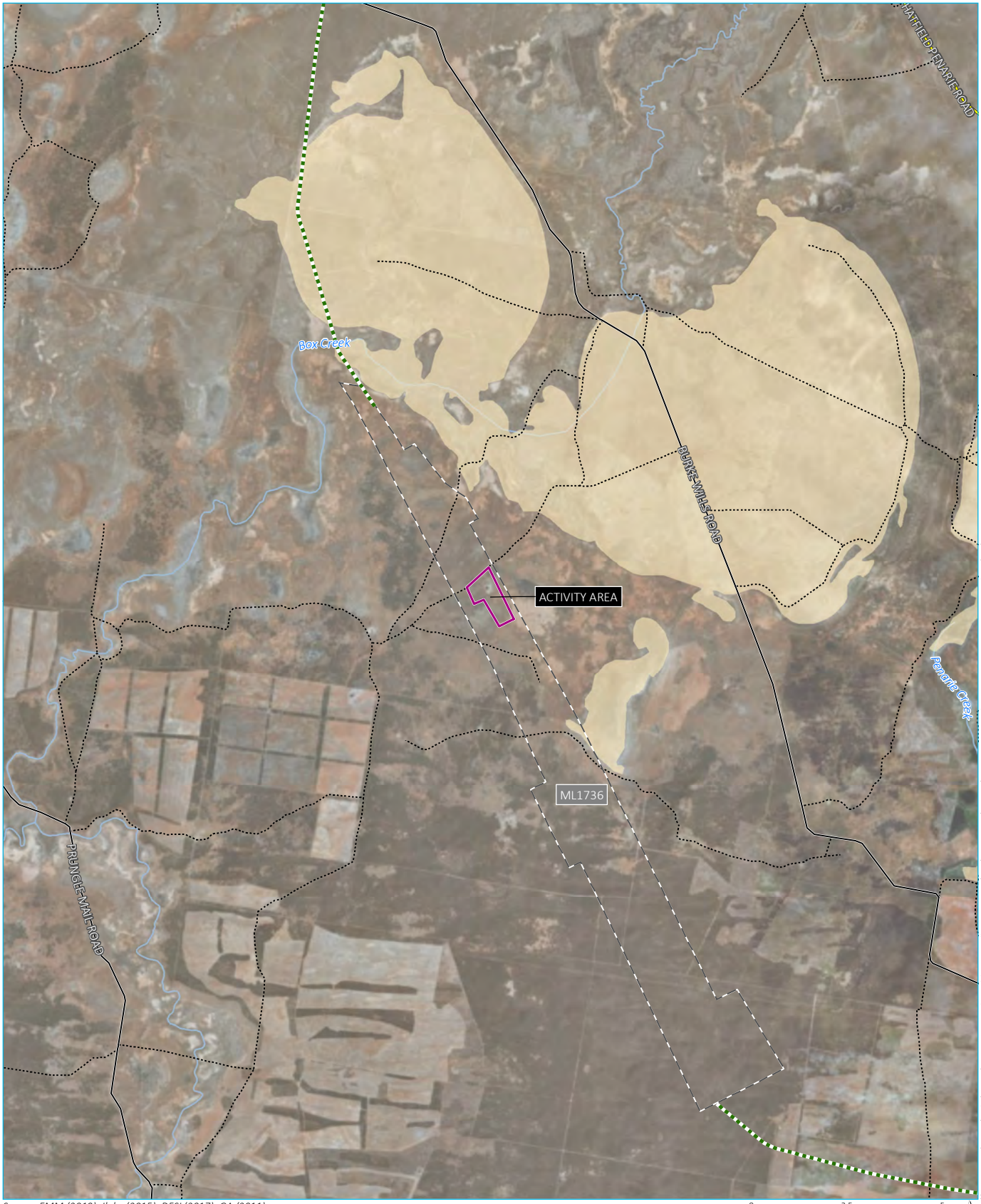
KEY

- Activity area
- Project boundary
- Place
- Access road
- Mining Lease 1736
- Iluka mineral tenement
- Main road
- Local road
- Vehicular track
- Named watercourse
- Perennial lake
- Ephemeral lake
- Local government area

Regional location

Balranald Mineral Sands Project
Hydrogeochemical assessment addendum
Figure 1.1

EMM creating opportunities



Source: EMM (2019); Iluka (2015); DFSI (2017); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 54

N

KEY

- Activity area
- Access road
- Mining Lease 1736
- Main road
- Local road
- Vehicular track
- Named watercourse
- Ephemeral lake

Location of the T3 activity within the Balranald project mine footprint

Balranald Mineral Sands Project
Hydrogeochemical assessment addendum
Figure 1.2

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EMM creating opportunities

2 Hydrogeochemical setting

2.1 Geology

The Cainozoic Murray Basin is an intra-cratonic basin extending over 300,000 km^2 across parts of New South Wales, Victoria and South Australia, containing a complex sequence of marine, coastal and continental sediments (Brown and Stephenson 1991; Whitehouse 2009).

The stratigraphic units of the Murray Basin (Figure 2.1) form important regional aquifers, confining aquitards and barriers for commonly saline groundwater (Evans and Kellett 1989). Very low rates of sedimentation and restricted sediment supply resulted in the development of a relatively thin sequence, commonly less than 200 m thick, of flat-lying, poorly lithified, partly consolidated sand, silt, clay, and lime-rich sediments (Whitehouse, Roy and Oakes 1999). In the central and western Murray Basin, the Tertiary sequences are largely concealed by younger aeolian, fluvial and lacustrine sediments (Brown and Stephenson 1991).

Three main Tertiary depositional cycles within the Murray Basin, were distinguished by Brown and Stephenson (1991), which led to the deposition of the fluvial Warina Sand of the Renmark Group, then overlain by the predominantly fluvial and lacustrine Olney Formation. Shallow shelf deposits were followed by deeper water limestone sequences. The Ettrick and Winambool formations, the Geera Clay (including Geera Clay equivalents) and Murray Group limestone sequences were deposited during development and final contraction of these marine environments. This was followed by a regression that was accompanied by the seaward spread of the Upper Renmark Group across the Geera Clay. This period also resulted in the development of the Bookpurnong Formation (Fabris 2002). The final depositional cycle was initiated by a rapid marine transgression at the end of the Miocene. Deposition throughout the Pliocene led to the progradation of the LPS; a composite assemblage of (regressive) shoreface, beach, dune and back barrier-lagoonal facies that covers more than half the basin and are the host to economic deposits of heavy mineral (Roy et al 2000).

During the Pliocene, barrier sands, at various times, were subject to lateritic weathering during depositional breaks to produce ferricrete (iron-rich) horizons, palaeosols and erosional surfaces. The LPS contains widely dispersed economic concentrations of heavy minerals, notably ilmenite, rutile and zircon (Whitehouse, Roy and Oakes 1999; Roy et al 2000). In the southern section of the basin, the LPS Formation overlies ‘shelf muds’ and the Bookpurnong Formation.

During the Pliocene to Quaternary period, the Shepparton Formation was deposited directly onto the erosional surface formed after the LPS depositional cycle (the Karoonda Surface in some areas), in a predominantly fluvial-lacustrine setting. In much of the Riverine Plain, this sequence is associated with the Coonambidgal Formation, primarily a poorly consolidated, mottled, variegated clay and silty lenses of polymictic sand and gravel (Brown and Stephenson 1991).

These sediments are shown in Figure 2.1, which detail the aquifer systems of the Murray Basin.

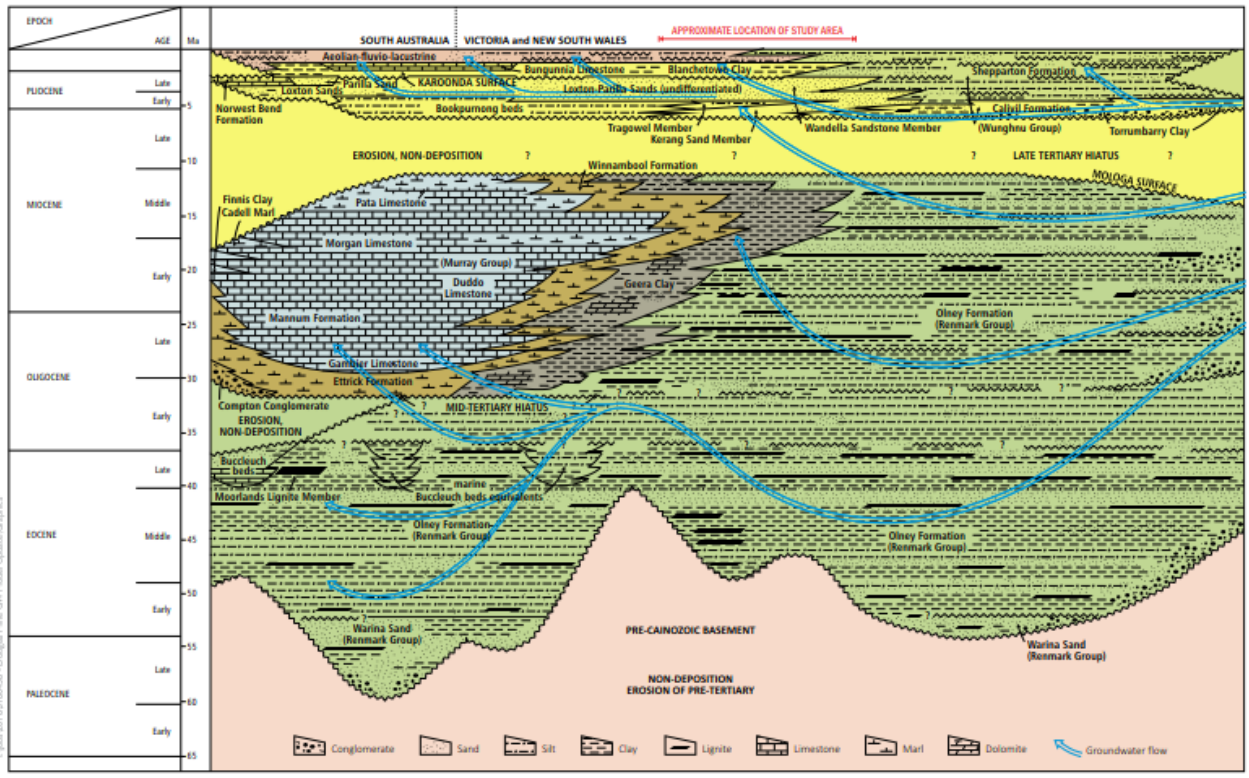
Kellett (1994) indicates that the local geology is comprised of the key units summarised in Table 2.1, where the lithology descriptions have been adapted from Geoscience Australia’s (2020) Stratigraphic Units Database.

Table 2.1 Local geology at Balranald (from oldest to youngest)

Age	Group	Unit	Lithology
Pre-Tertiary		Basement rock	
Eocene to Early Oligocene	Lower Renmark Group	Olney Formation	Unconsolidated to poorly consolidated, blue-grey/dark-brown carbonaceous sand and silt.
Oligocene to Middle Miocene	Middle Renmark Group	Olney Formation	Unconsolidated to poorly consolidated, dark-grey, blue, or black carbonaceous clay or silty sand. Commonly pyritic and ligneous.
Late Oligocene to Middle Miocene	Murray Group	Geera Clay	Poorly consolidated, plastic to friable, dark greenish-grey or black silt and clay. Potentially glauconitic, pyritic, calcareous, carbonaceous, or fossiliferous. Local sandy and dolomitic hardbands.
Middle Miocene	Upper Renmark Group	Olney Formation	Unconsolidated to poorly consolidated, brown-grey, carbonaceous, medium to fine sand with interbedded silt. Micaceous and pyritic.
Late Miocene to Early Pliocene	Wunghnu Group	Calivil Formation[1]	Interbedded clay, silty clay, silt and fine to coarse-grained quartz sand, reef quartz and metasediment gravel. Minor ligneous clay.
Late Miocene to Pliocene		Loxton-Parilla Sands	Unconsolidated to weakly cemented, yellow-brown, fine to coarse, well to poorly-sorted, quartz sand and sandstone. Minor clay and silt.
Quaternary (Holocene)		Floodplain Sediments: (Coonambidgal Formation)	Exists within the Murray River floodplain. Unconsolidated, grey, brown, micaceous silty clay, silt, polymictic sand and gravel.

Source: Geoscience Australia (2020)

1. Not identified at the project site.



Aquifer systems of the Murray Basin (after Evans and Kellett, 1989 and Brown and Stephenson, 1991)

Iluka Resources
Balranald Mineral Sands Trial – Hydrogeochemical assessment of the T3 mining trial
Figure 3.1

Figure 2.1 Aquifer systems of the Murray Basin (after Evans and Kellett, 1989 and Brown and Stephenson 1991)

2.2 Regional hydrogeology

The hydrostratigraphy of the area at the unconventional mining trial, and across the wider Balranald Project, is consistent within the Murray Basin and has previously been described by Iluka (2015) and Jacobs (2015) based on data collected during a series of large-scale field trials undertaken by Iluka and from a number of published reports and maps produced by Kellett (1989; 1991; 1994), Brown and Stephenson (1991), URS (2012) and SKM (2013).

There are three main aquifer units in the immediate vicinity of the unconventional mining trial area: the Shepparton Formation, the ore-hosting Loxton-Parilla Sands and the Lower Renmark Group (also known as the Olney Formation; Brown and Stephenson 1991). Other units, whose sediments are heterogeneous in nature, can act as aquifers in localised instances. The Olney Formation is the regionally extensive early-Tertiary lacustrine system, specifically underlying the wider Balranald Project, and consists of the Upper, Middle and Lower Renmark Group.

The Upper and Middle Renmark Groups are separated by the Geera Clay, which acts as an aquitard, disrupting flow between the Renmark Group and the overlying Pliocene sands.

The Palaeozoic rocks of the Lachlan Fold Belt underlie the Murray Basin sediments and form the basement to the basin. The basement contains structures such as ridges and troughs that have influenced deposition of the sediments and therefore also influence the hydrogeology of the Murray Basin.

The regional geology and hydrostratigraphy of the Murray Basin within the Balranald region are shown on Figure 2.2.

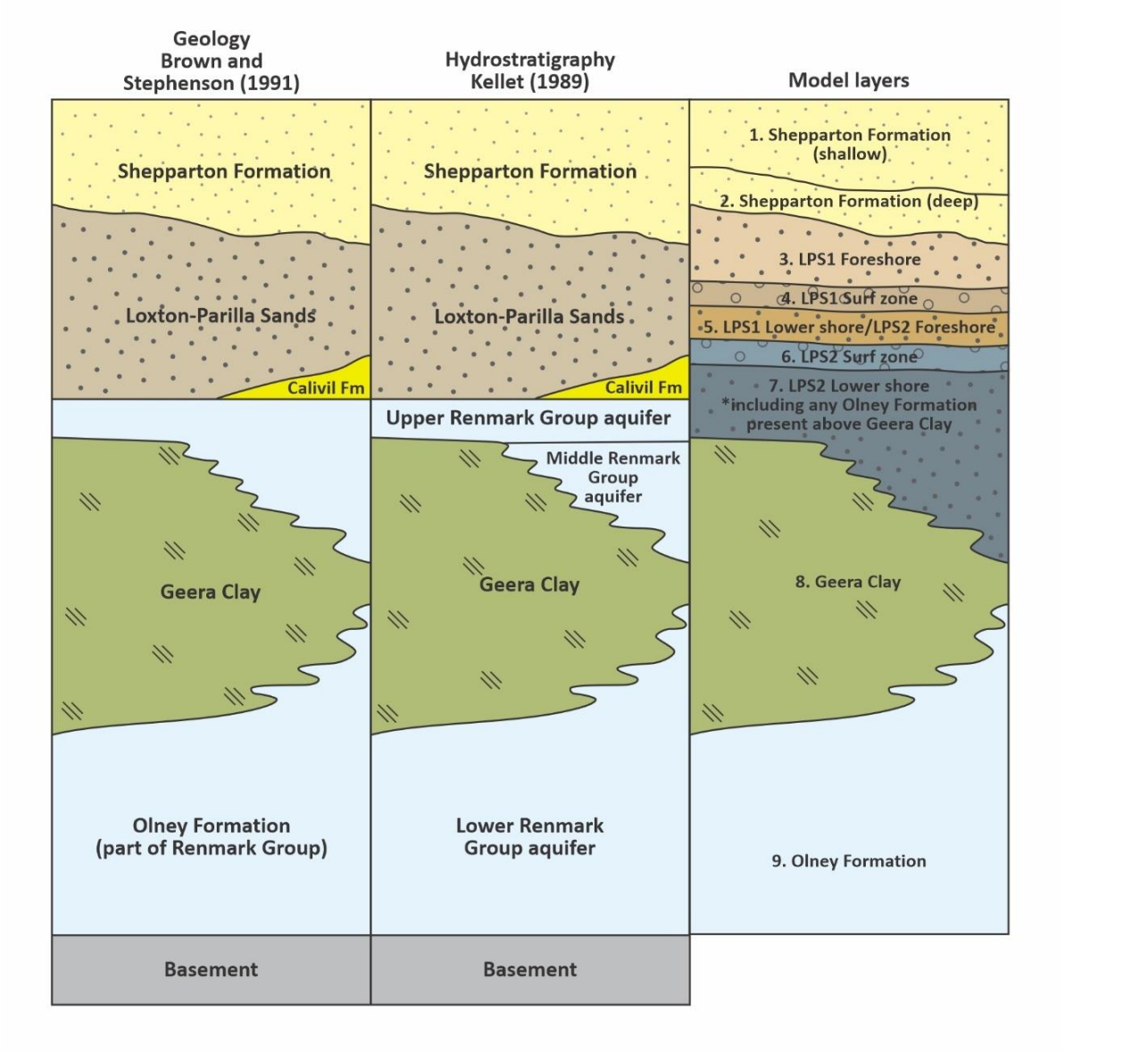


Figure 2.2 **Geological (Brown and Stephenson 1991), hydrostratigraphic (Kellett 1989) and numerical model framework of the study area (after Jacobs 2015)**

2.3 Local stratigraphy

The local stratigraphy consists of the following sequence (from shallowest to deepest) (EMM 2020):

1. The Shepparton Formation: Deposited within a fluvial-lacustrine environment, the water-table hosting unit consists of sand-clay to clay sediments with bands of fine-grained sand. The base of this unit was often defined by a ferricrete/lateritic horizon. The unit was consistently 30 to 35 m thick throughout the trial sites and was later validated with the use of downhole geophysics.

2. LPS 1 dunal sequence: Occasionally, a fine to very fine narrow band of sand was encountered representing the aeolian-dunal sequence of the ancient beach. This light grey to pale yellow sand is very well sorted and sub rounded to sub-angular in nature with an abraded appearance.

3. LPS1 foreshore: Deposited within a low energy marine environment, this light to dark grey coloured sand consisted of predominantly fine, sub-angular to sub-rounded grains with moderate sorting. Above this unit, occasionally a moderate to highly plastic clay existed which resembled a “natural bentonite”.

4. LPS1 surf zone: Deposited within a high energy marine environment, this light to dark grey/brown coloured sand consisted of medium to gravel-sized sand, with moderate to well sorting. Occasionally, lignitic and/or carbonaceous material was present within this unit.

5. LPS1 lower-shore: The lower- or off-shore sediments are deposited within low energy deep water environments. These sediments generally consist of light to dark grey/black sand to silty-sand with sub angular to sub rounded grains of moderate sorting. The presence of lignitic and carbonaceous material was common and tended to be more prolific from these depths onwards.

6. LPS2 foreshore: Although the lithology of this unit is similar to the LPS1 lower-shore package above, there are subtle changes in grain morphology. The grains tend to be fine to very fine sand with less silts being present. Grain size sorting is better than the overlying LPS1 lower-shore package. Mica and pyrite is also present and traces of heavy mineral (HM) becomes apparent.

7. LPS2 surf zone: Deposited within a high energy marine environment, this light to dark grey/brown/black coloured sand consisted of medium to gravel-sized grains and is well sorted. Occasionally, lignitic and/or carbonaceous lagoonal material was present within this unit. However, unlike the LPS1 surf zone package, this unit consists of mica and pyrite and generally hosts large percentages of HM on strike.

8. LPS2 lower-shore: These sediments generally consist of light to dark grey/black very fine to fine sand, which is well sorted in nature. Often lignitic with traces of HM, mica and pyrite.

9. Geera Clay: A thick sequence of marginal marine and estuarine clays and muds, with a confirmed thickness of greater than 70 m at the Long Term Trial (LTT) production and injection sites. This unit was generally black with a blue/green tinge, highly plastic with some fossiliferous/calcareous matter. The transition zone into the Geera Clay from the LPS generally consisted of a mudstone with hard red and white fine clay shards with low plasticity and the presence of low competent lignite was common.

10. Olney Formation: This formation was deposited within a fluvial/lagoonal environment and generally consists of dark grey to brown-black silty sand to sand, with silt to medium sized grains with moderate to poor sorting.

2.4 Sensitive receptors

A number of receptors have been identified as being potentially sensitive to water impacts across the Balranald Project, including:

- ecosystems that rely on groundwater, including Groundwater Dependant Ecosystems (GDEs)
- the Murrumbidgee River and ephemeral surface water courses
- private landholder bores.

As indicated by Jacobs (2015) and CDM Smith (2015), ecosystems that rely on groundwater are important environmental assets and typically occur where groundwater is at or near the land surface, with the major potential GDE types across the Balranald Project being:

- wetlands and vegetation associated with the Murrumbidgee, Lachlan and Murray River Floodplain environments
- terrestrial vegetation (primarily Black Box trees) located outside the floodplain area but within topographic depressions where the water table may be shallow (i.e. <10 m) with low salinity.

The Murrumbidgee River is a permanent surface water feature located to the south and east of the Balranald Project region. This river is home to many sites of environmental importance and is a critical water source for the communities that rely on water from the river for predominantly irrigation and potable supply.

A number of landholders in the area rely on groundwater, sourced from the Lower Renmark Group Aquifer, for stock, irrigation, and domestic use. Figure 3.1 shows the locations of the water supply bores; P1, P2 and Karra Homestead.

The T3 underground mining trial site is located outside the area of any defined GDEs and surface water resources (EMM 2020).

3 Groundwater monitoring

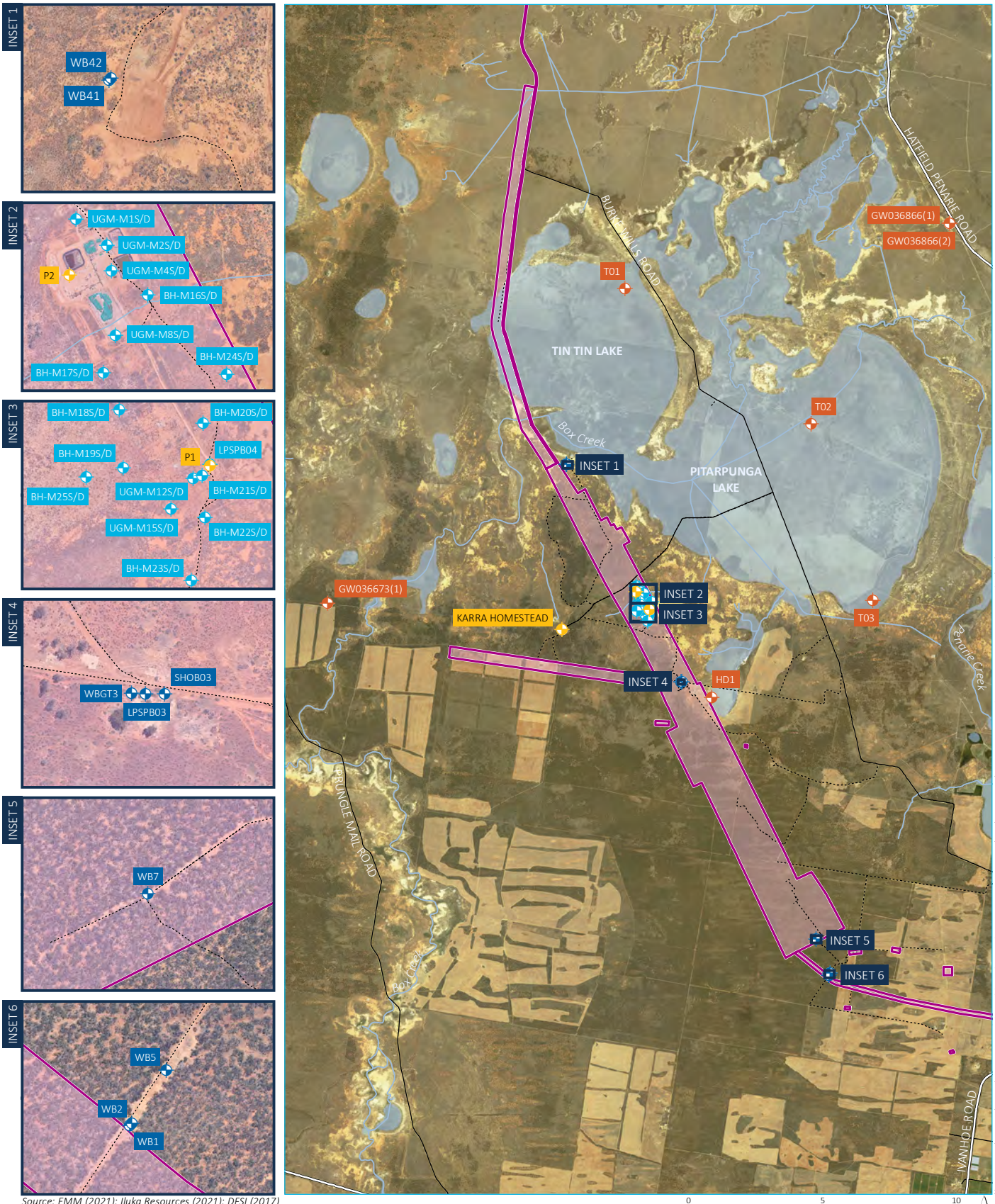
The post-mining regional groundwater monitoring was undertaken between 31 January 2023 and 2 February 2023 in accordance with the GMP (EMM 2020), with any differences noted in the following sections.

3.1 Groundwater monitoring infrastructure

Table 3.1 summarises the regional and third-party bores which were monitored as part of the February 2023 monitoring event. A total of 17 bores were monitored, comprising seven third-party bores, one production bore and nine regional bores. The regional monitoring network is shown in Figure 3.1.

Table 3.1 Post-mining monitoring locations

Bore ID	Easting	Northing	Type	Screened formation
Karra Homestead	720430	6188310	Production bore	LRG
T01	722791	6201032	Third-party	LRG
T02	729728	6195981	Third-party	LRG
T03	732044	6189404	Third-party	LRG
HD1	726021	6185781	Third-party	LRG
GW036673(1)	711680	6189281	Third-party	SFM
GW036866(1)	734900	6203463	Third-party	SFM
WB1	730399	6175412	Regional	SFM
WB42	720599	6194491	Regional	SFM
SHOB03	724911	6186351	Regional	SFM
GW036866(2)	734900	6203463	Third-party	LPS
WB2	730402	6175415	Regional	LPS
WB5	730450	6175489	Regional	LPS
WB7	729924	6176754	Regional	LPS
WB41	720596	6194488	Regional	LPS
WBGT3	724880	6186352	Regional	LPS
LPSPB03	724893	6186351	Regional	LPS



Source: EMM (2021); Iluka Resources (2021); DFSI (2017)

\\emmsvr1\EMM3\2021\S210560 - Balranald Bridging Phase MOD1 Activities\GIS\02_Maps\W001_RegionalGWN_20211201_01.mxd 1/12/2021

KEY

- Mining project extent
- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line
- Waterbody

Groundwater bores

- Monitoring bore
- Regional monitoring bore
- Production bore
- Third-party bore

Groundwater monitoring network - Regional

Balranald Mineral Sands Project
T3 Hydrogeochemical assessment addendum
Figure 3.1

EMM
creating opportunities

3.2 Groundwater monitoring methodology

The following information was collected during the February 2023 monitoring event:

- manual groundwater level measurements were taken with a suitable water level meter
- groundwater samples for laboratory analysis were collected through low-flow pumping of the bores
- groundwater quality field measurements including pH, electrical conductivity (EC), total dissolved solids (TDS), temperature, dissolved oxygen and oxidation-reduction potential (ORP) were collected with an Aqua TROLL 500 water quality meter, while total iron measurements were taken with a Hanna Instruments field total iron test.

To ensure consistent field measurements, the water quality meter was calibrated each morning before commencing daily activities. Minimal drift was noted in each parameter during the daily calibrations, indicating the suitability of the meter for daily measurements.

It is noted that the Aqua TROLL 500 uses a silver/silver chloride (Ag/AgCl) electrode in potassium chloride (KCl) solution for ORP measurement, whereas the standard measurement for ORP is based on a standard hydrogen electrode (SHE), which for safety and economic reasons is rarely used in field instruments. To convert field ORP readings to the SHE standard, a temperature-based adjustment is needed. This typically adds approximately 200 mV to the instrument measurement and is an essential adjustment to make in order to compare data between sites. Given all ORP measurements are taken from the same site, corrections to the SHE standard have not been undertaken in this report.

All measurements and samples were collected following EMM's standard operating procedures (SOPs) for groundwater sampling. The field sheets produced for each monitoring round are presented in Appendix B, while the laboratory results are attached in Appendix C.

3.3 Site specific trigger levels (SSTLs)

The groundwater monitoring sites were assigned to 'chemical SSTL zones' based on their proximity to the mining activities, as defined in Table 3.2. These assignments were made based on preliminary hydrogeochemical modelling performed by LWC (2017b) which suggested that large groundwater quality changes may be observed within 20 m of the stope edges, which would then dissipate to background conditions within a 300 m buffer zone from the stope edges.

The purpose of these zones was to identify bores which should receive more frequent groundwater level and quality monitoring, assign chemical analysis suites, and identify how groundwater changes in one zone affect the zone(s) down hydraulic gradient. These changes satisfy recommendations by LWC (2017a) to change how monitoring occurs to prevent adverse trends being missed due to monitoring 'blind spots'.

These zones accept that the groundwater system may change directly adjacent to the mine stopes. However, the management objectives for groundwater chemical changes were focused on protecting the beneficial use[1] of the groundwater system down hydraulic gradient from the mining site, more-so than within the mine footprint itself. Therefore, the SSTL values are only applicable to the background zone, where no impact is expected or accepted. All of the bores sampled during the February 2023 monitoring event fall into the 'background zone' category and are therefore assessed against the groundwater quality SSTLs.

Groundwater quality SSTLs were previously listed in the GMP (EMM 2020) and were derived on a per aquifer basis using baseline data. The SSTLs applied during Phase 2 are presented in Appendix A.

[1] Although there no direct beneficial users currently identified for the SFM and LPS aquifers, the chemical SSTLs are designed to not decrease the groundwater quality down hydraulic gradient of the Phase 2 activity and maintain groundwater quality within historic statistical ranges.

Table 3.2 Zoned hydrogeochemical SSTL framework

Groundwater Monitoring Zone	Purpose	Details
Zone 1 Mining Zone	Operational	Adjacent and surrounding the actual mining area. Includes the stope areas plus a 20 m buffer. Required to understand immediate changes to groundwater quality and pressure. Large changes relative to baseline conditions are expected in this zone and represent the source location of both pressure and geochemical changes. Provide a leading indicator to potential impacts within Zone 2.
Zone 2 Transition Zone	Operational	Non-mining area and represents the zone between 20 m and 300 m from the stope edges. Data and trends within this zone are used to understand aquifer responses at various locations away from the stopes, during mining and backfill. Provide a leading indicator to potential impacts within Zone 3.
Zone 3 Background Zone	Compliance	Non mining area and represents the zone beyond 300 m from the stope edges. Bores located in this zone are part of the EPA Licence and are therefore required to adhere to the nominated SSTLs and associated compliance reporting.

3.4 Groundwater quality suite

Both field measurements and laboratory analyses were performed on the groundwater samples collected during the February 2023 monitoring event. The field-based properties were collected via a water level dipper (water levels), an In-Situ Aqua TROLL 500 (EC (automatically temperature-corrected), pH, TDS, DO (automatically temperature-corrected), temperature, and redox potential (ORP)) and a Hanna Instruments field total iron test.

Due to being part of a larger-scale monitoring program, the regional and third-party bores have a comprehensive (non-targeted) laboratory analysis suite, consisting of general chemical parameters, dissolved metals and speciated iron. The field and laboratory parameters measured are summarised in Table 3.3.

Table 3.3 Groundwater analysis suites

Description	Parameters	Notes
Field parameters	Water levels, Electrical conductivity (EC), pH, dissolved oxygen, temperature, oxidation reduction potential (redox), and field iron.	Taken whenever a groundwater sample is collected.
Laboratory parameters (Regional and third-party bores)	Acidity, laboratory pH, laboratory TDS. Major ions (Ca, Mg, K, Na, Cl, SO_4). Alkalinity (hydroxide, carbonate, bicarbonate, total). Dissolved metals (Al, Sb, As, Be, Bi, Cd, Cr, Cr (VI), Co, Cu, F, Fe, Pb, Li, Mn, Hg, Mo, Ni, Se, Ag, Sr, Th, Ti, U, V, Zn, Zr). Speciated iron (ferrous and ferric iron).	Collected for all regional and third-party bores.

3.5 Operational hydraulic pressure

The Hydraulic Operating Conditions (HOCs) represent the historical maximum pressures that have been experienced within the aquifers without any adverse impacts being observed. These values were derived using aquifer-specific methodologies. For the overlying SFM aquifer, HOCs were determined based on the rooting depths of nearby vegetation. Away from the Murrumbidgee River and associated floodplain region, vegetation relies predominantly on rainfall and soil water storages with the SFM aquifer, with root system depths of around 5 mBGL. Therefore, due to the high salinity of groundwater in the SFM aquifer, groundwater level rise into the root zone should be avoided. Temporary dewatering within the SFM and LPS is not deemed to adversely impact this groundwater system and HOCs have not been set for this scenario.

Water level trigger values for the LPS aquifer have been defined for the upper-most facie of this unit, which lies directly below the SFM. These HOCs have been set to avoid over-pressurising, and thus compromising, the integrity of the SFM layer, but more specifically, the bentonite clay layer existing at the base of the SFM. These conservative HOCs were based on past hydrogeological field programs which involved large scale reinjection activities (Iluka 2015; Iluka 2016).

The HOCs applied during Phase 2 were listed in the GMP (EMM 2020) and are summarised in Table 3.4.

Table 3.4 Groundwater operational hydraulic pressure

Parameter	Shepparton			Loxton Parilla Sands			Lower Renmark Group		
	Green	Yellow	Red	Green	Yellow	Red	Green	Yellow	Red
Depth to groundwater (mounding)	>8 mBGL[1]	≤8to >6 mBGL	≤6 mBGL	<15 mAGL$_2$	≥15 to <20 mAGL	≥20 mAGL	N/A	N/A	N/A
Depth to groundwater (dewatering)	N/A	N/A	N/A	N/A	N/A	N/A	≤8 mBGL	>8 to ≤10 BGL	>10 mBGL

Notes: 1. mBGL: metres below ground level
2. mAGL: metres above ground level

4 Groundwater pressure results

Groundwater level data was collected for the regional bores during the October 2021 (post-mining), July 2022 and February 2023 monitoring events.

The regional bores are not monitored using automatic loggers and therefore only manual level measurements were collected. These measurements are listed in Table 4.1 and compared to pre-activity values collected by LWC (2020) in December 2019. Manual groundwater level measurements were not able to be collected for LRG bores due to downhole pumps preventing access.

Table 4.1 shows that there is not a significant difference between the pre-activity and post-mining groundwater levels in regional bores, and none of the measurements exceed the HOCs. The most recent measurements in July 2022 and February 2023 show an increase in water levels for the majority of bores since October 2021. The groundwater level changes between pre-activity and February 2023 measurements range from 0.02 m to 0.53 m, with an average increase of 0.29 m, suggesting a regional and natural increase in groundwater levels. It is noted that the July 2022 measurement for bore WB5 is likely erroneous due to it being approximately 4 m higher than the post-mining and January 2023 measurements while nearby bores do not show the same trend.

Figure 4.1 presents a plot of the cumulative rainfall deviation at Balranald from January 2000 onwards. This figure shows periods of above average rainfall, indicated by an increasing trend on the plot, and periods of below average rainfall, indicated by a decreasing trend. The rainfall trend is relatively constant between the pre-activity and post-mining groundwater level measurements, indicating a similar amount of rainfall for these periods. From January 2022 onwards, a large increasing trend is observed, indicating an above average amount of rainfall has occurred, which may explain the widespread increase in groundwater levels observed.

As automatic water level loggers were not deployed in these bores, any changes in groundwater level that may have occurred between these measurements are unknown, but these measurements suggest that overall minimal or no impact to regional groundwater levels was caused due to Phase 2.

Table 4.1 Groundwater level measurements in regional monitoring bores

Bore	Pre-activity water level (mBTOC)	Post-mining (October 2021) water level (mBTOC)	July 2022 water level (mBTOC)	January 2023 water level (mBTOC)	Groundwater level change (m)
Shepparton Formation					
WB42	15.54	15.221	15.14	15.09	0.45
WB1	19.109	18.95	18.9	18.72	0.389
SHOB03	13.393	14.423	13.13	13.03	0.363
GW036866(1)	11.799	11.694	11.89	11.78	0.019
GW036673(1)	14.939	15.01	14.95	14.88	0.059
Loxton-Parilla Sands					
WBGT3	13.338	13.325	13.28	13.23	0.108
WB7	12.604	12.612	12.62	12.24	0.364
WB5	17.436	17.354	12.91[1]	16.96	0.476
WB41	15.366	14.892	14.87	14.84	0.526

Table 4.1 Groundwater level measurements in regional monitoring bores

Bore	Pre-activity water level (mBTOC)	Post-mining (October 2021) water level (mBTOC)	July 2022 water level (mBTOC)	January 2023 water level (mBTOC)	Groundwater level change (m)
WB2	18.04	17.913	18.03	17.57	0.47
LPSPB03	12.75	12.729	12.69	12.61	0.14
GW036866(2)	11.47	11.178	11.49	11.36	0.11

1. This groundwater level measurement from WB5 is likely erroneous.

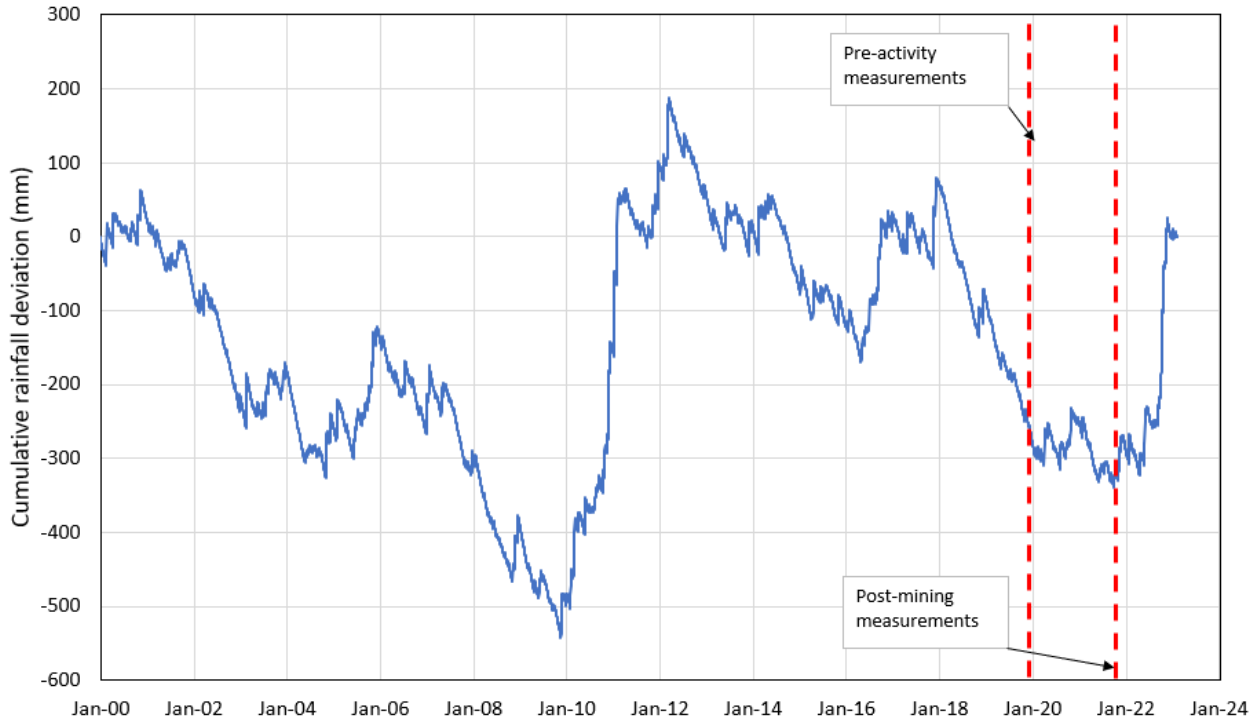


Figure 4.1 Cumulative rainfall departure – Balranald weather station (BoM 2023)

5 Hydrogeochemical results

5.1 Summary of previous findings

Groundwater quality data from the regional bores collected prior to and following the Phase 2 underground mining trial (to October 2021) has been analysed by EMM (2021). The main findings of this report with respect to groundwater quality can be summarised as follows:

- No significant trends that suggest worsening groundwater quality were observed throughout the Phase 2 activities.
- Some isolated exceedances of groundwater quality SSTLs were observed but were determined to be due to natural fluctuations or local mineralisation (elevated background concentrations). Exceedances of the 'yellow' or 'red' SSTLs were observed in the SFM and LPS aquifers for:
  - bismuth ('yellow' SSTL exceedance in SHOB03)
  - manganese ('red' SSTL exceedance in GW036673(1))
  - selenium ('red' SSTL exceedances in SHOB03, WB42, GW03667(1), WB41, LPSPB03, WB7 and WBGT3). It is noted that these exceedances were all values reported to be below the laboratory limit of reporting, which was higher than the 'red' SSTL, and therefore may not be true exceedances
  - silver ('yellow' SSTL exceedance in SHOB03)
  - arsenic ('yellow' SSTL exceedance in WB1)
  - zinc ('yellow' SSTL exceedance in WB42)
  - cobalt ('yellow' SSTL exceedance in WB7)
  - nickel ('yellow' SSTL exceedance in WB7).

The last review of groundwater quality in the regional bores was undertaken in August 2022 by EMM (2022). This review found exceedances of the 'yellow' or 'red' SSTLs in the SFM and LPS aquifers for:

- Manganese ('red' SSTL exceedance in GW036673(1)). Groundwater from this bore was noted to have a naturally high concentration of manganese.
- Selenium ('red' SSTL exceedances in several bores). These exceedances were all noted in measurements which were found to be below the laboratory limit of reporting and are not considered to be true exceedances.
- Arsenic ('yellow' SSTL exceedance in WB1). Groundwater from this bore was noted to have a naturally high concentration of arsenic.
- Zinc ('yellow' SSTL exceedance in WB1 and WB7). Groundwater from WB1 was noted to have consistently low zinc concentrations suggesting this exceedance may have been erroneous. Groundwater zinc concentrations were noted to be naturally high in WB7.
- Cobalt ('yellow' SSTL exceedance in WB7). Groundwater from this bore was noted to have a naturally high concentration of cobalt.

- Uranium ('yellow' SSTL exceedance in WB7). Groundwater from this bore was noted to have a naturally high uranium concentration.

- Nickel ('yellow' SSTL exceedance in WB7). Groundwater from this bore was noted to have a naturally high nickel concentration.

The majority of exceedances observed in the previous review were due to bores having naturally high concentrations of some analytes, particularly WB7. The only exceedance of potential concern noted was the elevated zinc concentration measured in WB1.

5.2 Field physiochemical results

Groundwater from the regional monitoring bores was analysed in the field for pH, EC, TDS, ORP, temperature and total iron.

A summary of the field data collected in February 2023 for SFM, LPS and LRG bores is presented in Table 5.1, Table 5.2 and Table 5.3 respectively, and compared to data collected post-mining (October 2021) and pre-Phase 2 activities (December 2019). This data is also presented in Figure 5.1, Figure 5.2 and Figure 5.3 in the form of box and whisker plots. The 'yellow' and 'red' SSTLs for each formation have been added to these plots for comparison.

It is noted that the regional bores were not monitored by EMM prior to Phase 2 activities and so the pre-activity values were obtained from the December 2019 biannual monitoring report by LWC (2020).

The following is observed within the SFM:

- The average February 2023 pH value of 6.54 in the regional SFM bores is approximately equal to the October 2021 mean of 6.59, which was slightly lower than the pre-activity mean of 6.70. The field pH box and whisker plot shows a general decrease in the 25th and 75th percentile values with time, although the median pH value has increased in February 2023 compared to October 2021. The latest values are more tightly grouped together, as shown by the narrower ranges between the 25th/75th percentile values and the minimum/maximum values.

- The average February 2023 TDS measurement of 29,379 mg/L in the regional SFM bores is slightly lower than the October 2021 mean of 29,985 mg/L and is approximately equal to the pre-activity mean of 29,404 mg/L. The box and whisker plot shows that the median TDS measurement and the range of values are approximately the same between October 2021 and February 2023.

- The average February 2023 field total iron measurement of 2.20 mg/L in the regional SFM bores is slightly lower than the October 2021 mean of 2.65 mg/L and considerably lower than the pre-mining mean of 3.86 mg/L. The box and whisker plot shows a reduction in total iron concentrations over time. The 25th/75th percentile range is wider for the February 2023 measurements compared to the pre-mining and October 2021 measurements.

- The average February 2023 ORP measurement of 86.8 mV is significantly higher than the October 2021 and pre-activity mean values of -29.2 mV and -97.4 mV, respectively. These results show that the SFM aquifer has been trending towards becoming more oxidising over time. An oxidising environment could lead to the oxidation of any sulfide minerals present in the aquifer and create acidity, which could lead to lower pH values in the future.

The following is observed within the LPS:

- The average February 2023 pH value of 6.56 in the regional LPS bores is approximately equal to the October 2021 mean of 6.53 and the pre-activity mean of 6.58. The box and whisker plot shows that the median pH value is nearly identical between pre-mining, October 2021 and February 2023 data. The 25th/75th percentile range has become narrower in February 2023 compared to previous measurements, although the minimum and maximum values have been approximately equal across each monitoring event.

- The average February 2023 TDS measurement of 28,204 mg/L in the regional LPS bores is lower than the October 2021 mean of 29,147 mg/L and approximately equal to the pre-activity mean of 28,217 mg/L. The box and whisker plot shows that the median TDS measurement is lowest in February 2023 and that maximum and minimum values measured are similar across each monitoring event.

- The average February 2023 field total iron measurement of 1.1 mg/L in the regional LPS bores is slightly lower than the October 2021 mean of 1.32 mg/L and is approximately equal to the pre-activity mean of 1.07 mg/L. The box and whisker plot shows that the median iron measurement in regional LPS bores decreased between the October 2021 and February 2023 period, however the $25^{th}/75^{th}$ percentile range in February 2023 has become larger.

- The average February 2023 ORP measurement of 8.2 mV is significantly higher than the October 2021 and pre-activity mean values of -166 mV and -114.4 mV, respectively. These results show that the LPS aquifer has been trending towards becoming more oxidising over time. An oxidising environment could lead to the oxidation of any sulfide minerals present in the aquifer and create acidity, which could lead to lower pH values in the future.

The following is observed within the LRG:

- The average February 2023 pH value of 7.23 in the regional LRG bores is slightly lower than the October 2021 mean of 7.51 and the pre-activity mean of 7.58. The box and whisker plot shows the median pH value for February 2023 is lower than the median values from pre-activity and October 2021 sampling. The $25^{th}/75^{th}$ percentile range has moved towards slightly lower pH values in February 2023 compared to pre-activity and October 2021. The lowest pH measurement taken in February 2023, a value of 6.70 from the Karra Homestead bore, was much lower than the previous minimum observed of approximately 7.5.

- The average February 2023 TDS measurement of 4,625 mg/L in the regional LRG bores is slightly higher than the October 2021 mean of 4,500 mg/L and slightly lower than the pre-activity mean of 4,734 mg/L. The box and whisker plot suggests that there was minimal change in groundwater TDS between the three periods, with the pre-activity, October 2021 and February 2023 plots being nearly identical with small standard deviation ranges.

- The average February 2023 field total iron measurement of 0.2 mg/L in the regional LRG bores is slightly lower than the pre-activity mean of 0.42 mg/L.

Table 5.1 Field parameter statistics for regional SFM bores

Parameter	pH	EC (us/cm)	TDS (mg/L)	Redox (mV)	Temperature (°C)	Total Iron (mg/L)
Minimum	6.33	32,508	21,130	53.8	19.9	0.4
Maximum	6.66	60,293	39,190	116.8	24.5	5.0
Mean	6.51	45,198	29,379	86.8	22.0	2.2
Post-mining mean (October 2021)	6.59	41,988	29,985	-29.2	21.5	2.65
Pre-activity mean	6.70	45,237	29,404	-97.4	22.2	3.86

Table 5.2 Field parameter statistics for regional LPS bores

Parameter	pH	EC (us/cm)	TDS (mg/L)	Redox (mV)	Temperature (°C)	Total Iron (mg/L)
Minimum	5.85	21,414	13,919	-74.6	20.7	0.05
Maximum	6.84	59,264	38,521	95.0	22.2	2.8
Mean	6.56	43,391	28,204	8.2	21.4	1.1
Post-mining mean (October 2021)	6.53	48,516	29,147	-166.0	21.1	1.32
Pre-activity mean	6.58	43,410	28,217	-114.4	22.8	1.07

Table 5.3 Field parameter statistics for regional LRG bores

Parameter	pH	EC (us/cm)	TDS (mg/L)	Redox (mV)	Temperature (°C)	Total Iron (mg/L)
Minimum	6.70	5,668	3,683	6.4	21.2	0.03
Maximum	7.58	8,708	5,660	205	29.0	0.3
Mean	7.23	7,116	4,625	87.9	26.5	0.2
Post-mining mean (October 2021)	7.51	6,923	4,500	-131.2	27.2	-
Pre-activity mean	7.58	7,283	4,734	-105.2	25.9	0.42

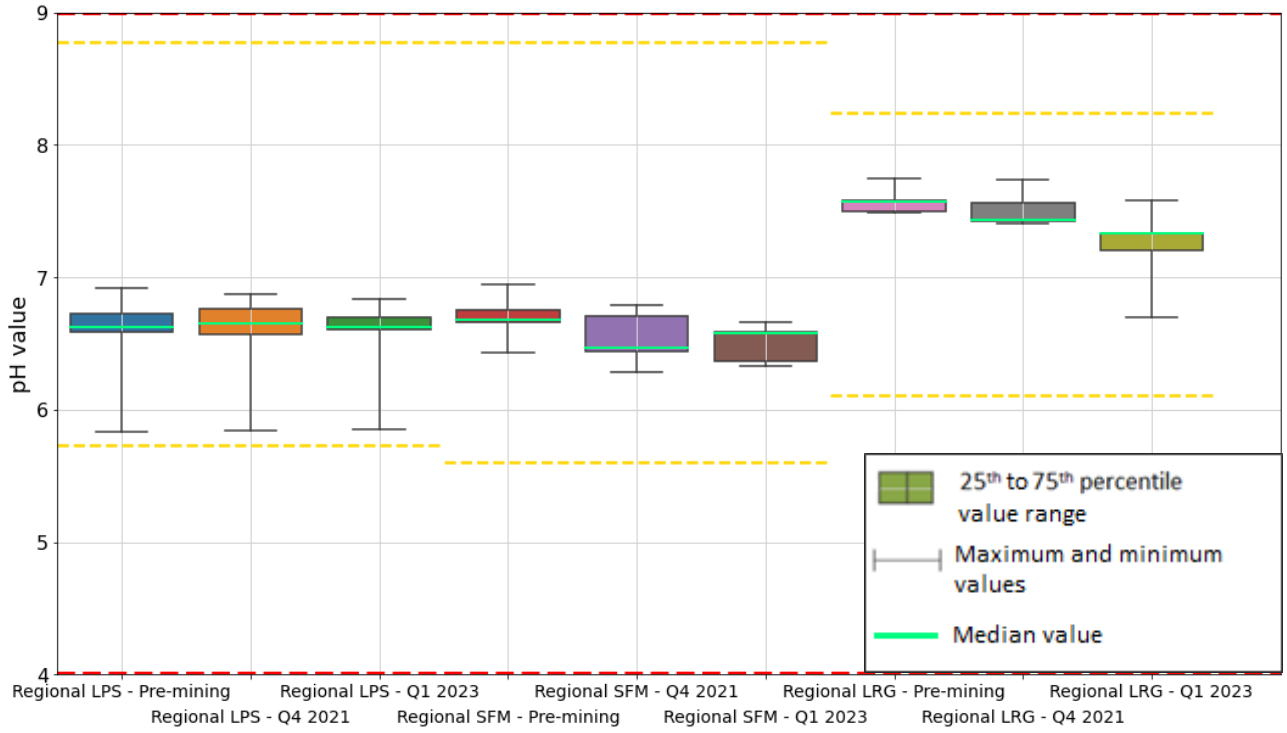


Figure 5.1 Box and whisker plot of regional field pH measurements before and post Phase 2 activities

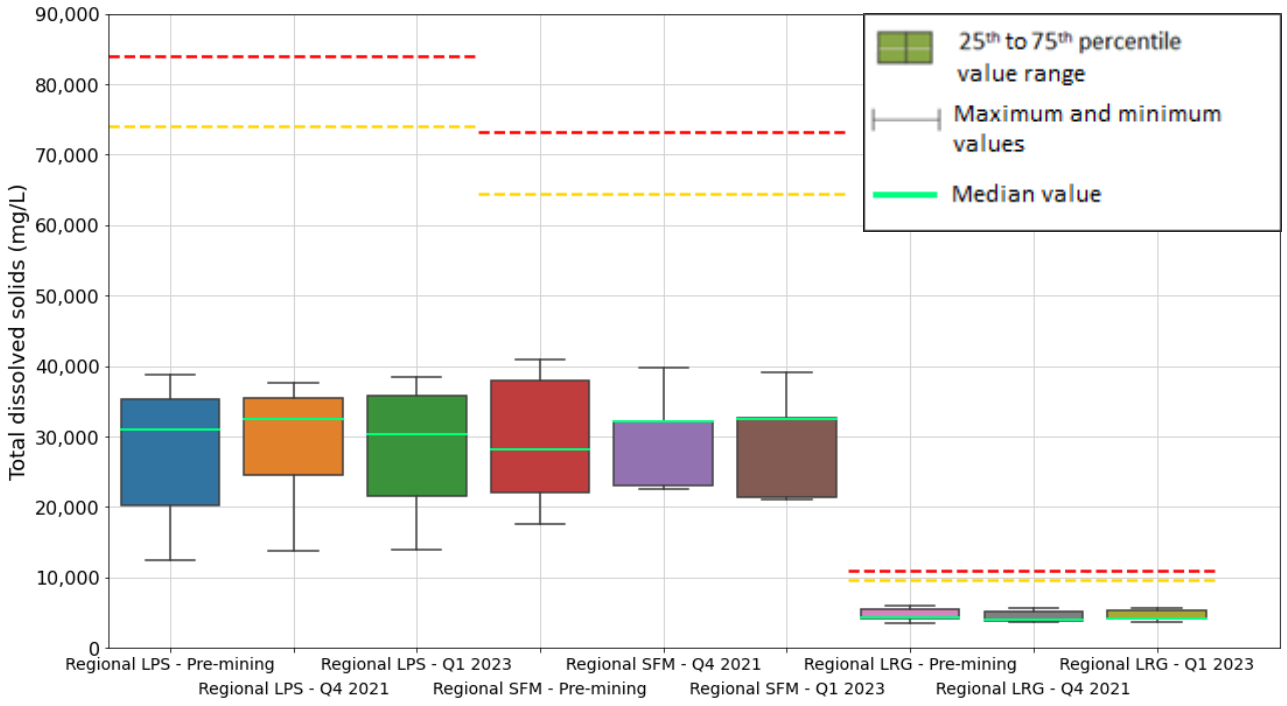


Figure 5.2 Box and whisker plot of regional field TDS measurements before and post Phase 2 activities

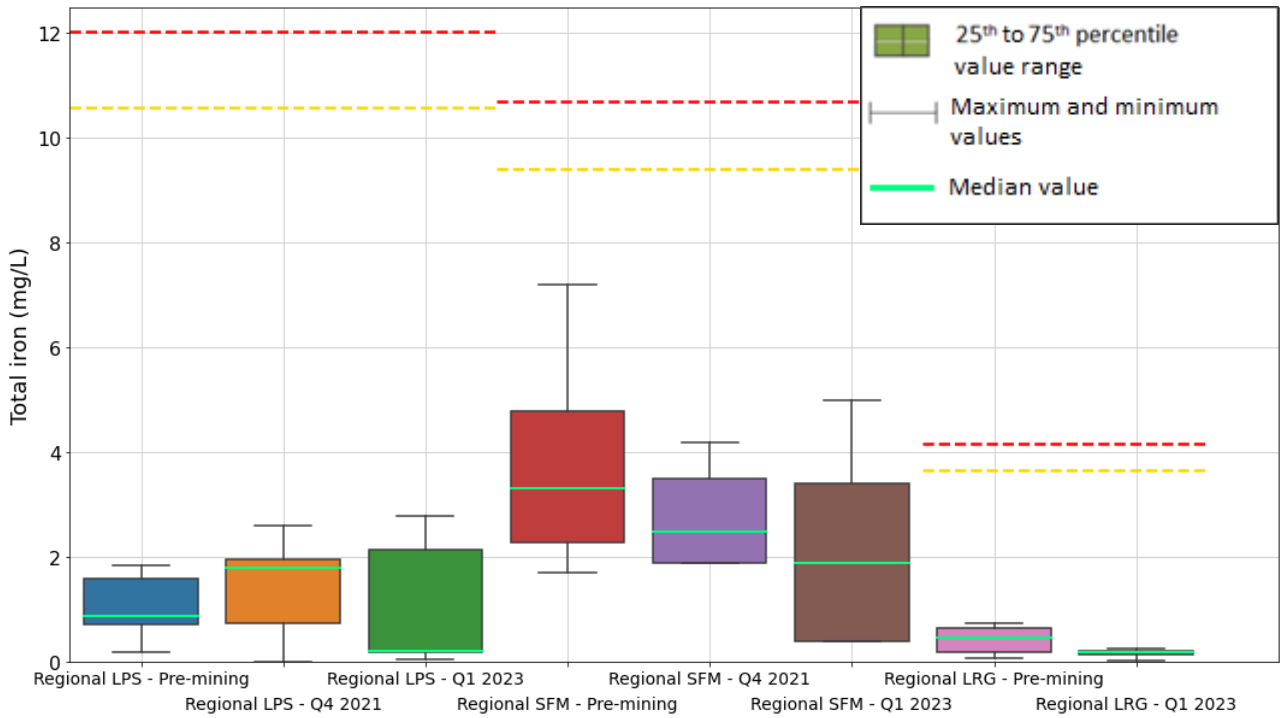


Figure 5.3 **Box and whisker plot of regional field total iron measurements before and post Phase 2 activities**

5.3 Groundwater quality results and comparison to SSTLs

Regional monitoring and third-party bores were sampled for laboratory analysis as part of the October 2021 and February 2023 groundwater monitoring events (regional monitoring previously undertaken by Land & Water Consulting).

Summaries of the February 2023 laboratory results for the regional SFM, LPS and LRG bores are provided in Table 5.4, Table 5.5 and Table 5.6 respectively. These results have been compared to the relevant SSTL values from Appendix A where available. Where a value exceeds the 'yellow' or 'red' SSTL, it has been shaded yellow or red, respectively.

Average values from the data collected post-mining (October 2021) and pre-Phase 2 activities (December 2019, from LWC 2020) have also been provided in these tables for comparison. Note that for all of the statistics shown, any value which was measured to be less than the laboratory limit of reporting (LOR) was conservatively assumed to be equal to the LOR.

Box and whisker plots of pre-activity, post-mining and February 2023 concentrations of manganese (Figure 5.4), arsenic (Figure 5.5), selenium (SFM; Figure 5.6), cobalt (Figure 5.7), selenium (LPS; Figure 5.8) and nickel (Figure 5.9), which showed exceedances in bores in February 2023, are shown below. The 'yellow' and 'red' SSTL values for each formation are also shown on these plots for comparison.

i Shepparton Formation

The following is observed within the regional SFM bores:

- The highest dissolved manganese concentration measured in the regional SFM bores in February 2023, 3.9 mg/L, exceeds the 'red' SSTL and is the only measurement to exceed the manganese SSTLs. This measurement is from bore GW036673(1) which is known to have naturally high concentrations of manganese. Since monitoring began for this bore in 2013, it has regularly been found to have dissolved manganese concentrations of 4 mg/L or more.

- The maximum dissolved selenium value of 0.02 mg/L is equal to the 'yellow' SSTL. This exceedance is due to an increased selenium LOR for some samples from the February 2023 monitoring event. Due to the sample matrix present, some of the samples had to be diluted prior to analysis, leading to a higher LOR of 0.02 mg/L, instead of the usual 0.01 mg/L LOR. All of the dissolved selenium measurements taken were found to be below the LOR and therefore are not considered to be exceeding.

- The maximum dissolved arsenic concentration of 0.059 mg/L exceeds the 'yellow' SSTL. This measurement is from bore WB1 which has historically had high levels of dissolved arsenic. Since monitoring began for this bore in 2013, it has been regularly found to have arsenic concentrations of 0.05 mg/L or higher.

- It is noted that no exceedances were observed for zinc, whereas previously WB1 was found to have an unexpected zinc concentration exceeding the 'yellow' SSTL (EMM 2022). Therefore, this previous measurement may have been erroneous.

ii Loxton-Parilla Sands

The following is observed within the regional LPS bores:

- The maximum dissolved cobalt concentration of 0.067 mg/L exceeds the 'yellow' SSTL. This concentration was measured in bore WB7 and no other regional LPS bores were found to be exceeding any SSTL for dissolved cobalt. Since monitoring began for WB7 in 2013, dissolved cobalt concentrations of 0.05 mg/L or higher have consistently been measured. Therefore, this exceedance is considered to be due to naturally high cobalt concentrations and unrelated to Phase 2 activities.

- The maximum dissolved selenium value of 0.02 mg/L exceeds the 'yellow' SSTL. This exceedance is due to an increased selenium LOR for some samples from the February 2023 monitoring event. Due to the sample matrix present, some of the samples had to be diluted prior to analysis, leading to a higher LOR of 0.02 mg/L, instead of the usual 0.01 mg/L LOR. All of the dissolved selenium measurements taken were found to be below the LOR and therefore are not considered to be exceeding.

- The maximum dissolved nickel concentration of 0.026 mg/L exceeds the 'yellow' SSTL. This concentration was measured in bore WB7 and no other regional LPS bores were found to be exceeding any SSTL for dissolved nickel. Higher concentrations of dissolved nickel are common in WB7, with concentrations between 0.02 mg/L and 0.03 mg/L commonly being measured since monitoring began for this bore in 2013. Therefore, this exceedance is considered to be due to naturally high nickel concentrations and unrelated to Phase 2 activities.

iii Lower Renmark Group

No exceedances of the SSTLs occurred in the LRG. Concentrations of all dissolved metals were minimal and usually below the LOR. Comparing the average values measured in February 2023 to those measured in October 2021 and pre-activity shows that there has not been any significant change to the groundwater quality of the LRG over the course of Phase 2.

Table 5.4 February 2023 laboratory parameter statistics for regional SFM bores

Analyte	Unit	Sample Count	February 2023 minimum	February 2023 maximum	February 2023 mean	Post-mining mean (October 2021)	Pre-activity mean	Yellow SSTL	Red SSTL
Major Ions									
Bicarbonate Alkalinity	mg/L	5	191	399	343	345	357	-	-
Total alkalinity	mg/L	5	191	399	343	345	357	628	754
Sulphate	mg/L	5	1570	4,500	3,042	3,514	3,630	8,254	9,905
Chloride	mg/L	5	12,300	23,900	17220	16,840	18,200	42,672	51,206
Calcium	mg/L	5	341	608	489	583	532	1,112	1,335
Magnesium	mg/L	5	731	1,570	1173	1,328	1,438	3,219	3,863
Sodium	mg/L	5	5,780	11,800	8234	9,494	10,634	23,586	28,303
Potassium	mg/L	5	25	57	42	40	52	141	169
Anions	meq/L	5	393	772	556	555	596	-	-
Cations	meq/L	5	337	674	480	552	609	-	-
Balance	%	5	6.19	8.4	7.30	0.81	4.60	-	-
CL:SO4	-	5	5.09	7.96	6.02	5.14	5.01	-	-
Dissolved metals									
Antimony	mg/L	5	0.001	0.002	0.001	0.003	0.002	0.01	0.05
Beryllium	mg/L	5	0.001	0.002	0.001	0.003	0.002	0.1	0.5
Bismuth	mg/L	5	0.001	0.002	0.001	0.005	0.002	0.01	0.05
Cobalt	mg/L	5	0.001	0.014	0.006	0.007	0.005	0.05	0.10
Lithium	mg/L	5	0.078	0.141	0.108	0.103	0.104	0.23	2.50
Manganese	mg/L	5	0.16	3.9	1.08	1.12	0.998	1.48	1.67
Molybdenum	mg/L	5	0.001	0.004	0.002	0.004	0.004	0.024	0.028
Selenium	mg/L	5	0.01	0.02	0.014	0.034	0.017	0.020	0.050
Silver	mg/L	5	0.001	0.003	0.002	0.005	0.002	0.010	0.050
Strontium	mg/L	5	9.01	19	14.03	16.36	15.47	26.964	30.641
Titanium	mg/L	5	0.01	0.02	0.014	0.034	0.017	-	-
Vanadium	mg/L	5	0.01	0.02	0.014	0.034	0.017	0.100	0.500
Zirconium	mg/L	5	0.005	0.005	0.005	0.017	0.005	-	-
Aluminium	mg/L	5	0.01	0.02	0.014	0.034	0.017	0.129	5

Table 5.4 February 2023 laboratory parameter statistics for regional SFM bores

Analyte	Unit	Sample Count	February 2023 minimum	February 2023 maximum	February 2023 mean	Post-mining mean (October 2021)	Pre-activity mean	Yellow SSTL	Red SSTL
Thorium	mg/L	5	0.001	0.002	0.001	0.003	0.002	0.01	0.1
Uranium	mg/L	5	0.001	0.004	0.002	0.004	0.010	0.065	0.073
Iron	mg/L	5	0.05	5.44	2.26	2.95	2.21	9.42	10.71
Arsenic	mg/L	5	0.001	0.059	0.014	0.016	0.013	0.026	0.1
Cadmium	mg/L	5	0.0001	0.0002	0.0001	0.0003	0.0002	0.01	0.05
Chromium	mg/L	5	0.001	0.002	0.001	0.007	0.002	0.1	1
Copper	mg/L	5	0.001	0.004	0.002	0.004	0.006	0.042	0.2
Lead	mg/L	5	0.001	0.002	0.001	0.003	0.002	2	5
Nickel	mg/L	5	0.001	0.018	0.009	0.012	0.010	0.038	0.2
Zinc	mg/L	5	0.005	0.071	0.027	0.096	0.028	0.166	2.00
Mercury	mg/L	5	0.0001	0.0001	0.0001	0.0001	-	-	-

Table 5.5 February 2023 laboratory parameter statistics for regional LPS bores

Analyte	Unit	Sample Count	February 2023 minimum	February 2023 maximum	February 2023 mean	Post-mining mean (October 2021)	Pre-activity mean	Yellow SSTL	Red SSTL
Major Ions									
Bicarbonate Alkalinity	mg/L	7	253	466	402	412	413	-	-
Total alkalinity	mg/L	7	253	466	402	412	413	727	873
Sulphate	mg/L	7	946	4,280	2,513	2,863	2,611	9,642	11,570
Chloride	mg/L	7	7,140	22,300	16,106	15,501	14,765	41,875	50,250
Calcium	mg/L	7	200	663	431	478	419	1,220	1,464
Magnesium	mg/L	7	425	1,760	1,129	1,204	1,200	3,324	3,989
Sodium	mg/L	7	3,940	11,600	7,883	8,569	8,625	24,381	29,258
Potassium	mg/L	7	26	58	44	41	55	105	126
Anions	meq/L	7	234	714	515	505	479	-	-
Cations	meq/L	7	217	662	458	497	496	-	-
Balance	%	7	3.76	7.83	5.85	2.29	2.95	-	-
CL:SO4	-	7	5.00	12.47	7.68	6.89	5.66	-	-
Dissolved metals									
Antimony	mg/L	7	0.001	0.002	0.002	0.003	0.002	0.01	0.05
Beryllium	mg/L	7	0.001	0.002	0.002	0.003	0.002	0.1	0.5
Bismuth	mg/L	7	0.001	0.003	0.002	0.003	0.002	0.01	0.05
Cobalt	mg/L	7	0.001	0.067	0.011	0.01	0.01	0.05	0.10
Lithium	mg/L	7	0.002	0.163	0.105	0.10	0.10	0.28	2.5
Manganese	mg/L	7	0.002	1.26	0.393	0.47	0.44	1.342	1.525
Molybdenum	mg/L	7	0.001	0.002	0.002	0.003	0.002	0.007	0.01
Selenium	mg/L	7	0.01	0.02	0.016	0.03	0.016	0.02	0.05
Silver	mg/L	7	0.001	0.008	0.003	0.003	0.003	0.01	0.05
Strontium	mg/L	7	0.03	20.3	9.82	12.55	12.80	29.821	33.888
Titanium	mg/L	7	0.01	0.02	0.016	0.03	0.02	-	-
Vanadium	mg/L	7	0.01	0.02	0.016	0.03	0.02	0.100	0.500
Zirconium	mg/L	7	0.005	0.005	0.005	0.016	0.005	-	-

Table 5.5 February 2023 laboratory parameter statistics for regional LPS bores

Analyte	Unit	Sample Count	February 2023 minimum	February 2023 maximum	February 2023 mean	Post-mining mean (October 2021)	Pre-activity mean	Yellow SSTL	Red SSTL
Aluminium	mg/L	7	0.01	0.02	0.016	0.033	0.016	0.129	5
Thorium	mg/L	7	0.001	0.002	0.002	0.003	0.002	0.01	0.1
Uranium	mg/L	7	0.001	0.011	0.003	0.005	0.003	0.013	0.015
Iron	mg/L	7	0.05	1.71	0.753	1.00	0.69	10.59	12.03
Arsenic	mg/L	7	0.001	0.01	0.003	0.003	0.002	0.02	0.1
Cadmium	mg/L	7	0.0001	0.0002	0.0002	0.0003	0.0002	0.01	0.05
Chromium	mg/L	7	0.001	0.002	0.002	0.007	0.002	0.1	1
Copper	mg/L	7	0.001	0.007	0.003	0.003	0.002	0.018	0.2
Lead	mg/L	7	0.001	0.002	0.002	0.003	0.002	2	5
Nickel	mg/L	7	0.001	0.026	0.005	0.008	0.013	0.009	0.2
Zinc	mg/L	7	0.005	0.181	0.034	0.032	0.023	0.2	2
Mercury	mg/L	7	0.0001	0.0001	0.0001	0.0001	-	-	-

Table 5.6 February 2023 laboratory parameter statistics for regional LRG bores

Analyte	Unit	Sample Count	February 2023 minimum	February 2023 maximum	February 2023 mean	Post-mining mean (October 2021)	Pre-activity mean	Yellow SSTL	Red SSTL
Major Ions									
Bicarbonate Alkalinity	mg/L	5	242	452	385	430	433	-	-
Total alkalinity	mg/L	5	242	452	385	430	433	639	767
Sulphate	mg/L	5	1	1	1	1.2	2.0	4.0	5
Chloride	mg/L	5	1,460	2,600	1,926	2,240	2,192	4,556	5,468
Calcium	mg/L	5	33	61	45	52	44	101	121
Magnesium	mg/L	5	45	85	61	67	68	130	156
Sodium	mg/L	5	927	1,450	1,179	1,298	1,354	2,880	3,456
Potassium	mg/L	5	22	33	28	27	36	47	56
Anions	meq/L	5	46	81.8	62.0	72	79	-	-
Cations	meq/L	5	46.4	74	59.3	65	74	-	-
Balance	%	5	7.54	23.3	11.52	4.21	4.30	-	-
Dissolved metals									
Antimony	mg/L	5	0.001	0.001	0.001	0.001	0.001	0.01	0.05
Beryllium	mg/L	5	0.001	0.001	0.001	0.001	0.001	0.1	0.5
Bismuth	mg/L	5	0.001	0.001	0.001	0.001	0.001	0.01	0.05
Cobalt	mg/L	5	0.001	0.001	0.001	0.001	0.001	0.05	0.1
Lithium	mg/L	5	0.044	0.065	0.05	0.049	0.045	0.122	2.5
Manganese	mg/L	5	0.005	0.034	0.016	0.013	0.010	0.082	0.093
Molybdenum	mg/L	5	0.001	0.001	0.001	0.001	0.012	-	0.01
Selenium	mg/L	5	0.01	0.01	0.01	0.010	0.010	0.02	0.05
Silver	mg/L	5	0.001	0.001	0.001	0.001	0.001	0.01	0.05
Strontium	mg/L	5	0.859	2.0	1.24	1.40	1.36	3.755	4.267
Titanium	mg/L	5	0.01	0.01	0.01	0.010	0.010	-	-
Vanadium	mg/L	5	0.01	0.01	0.01	0.010	0.010	0.1	0.5
Zirconium	mg/L	5	0.005	0.005	0.005	0.005	0.005	-	-
Aluminium	mg/L	5	0.01	0.01	0.01	0.010	0.010	0.283	5

Table 5.6 February 2023 laboratory parameter statistics for regional LRG bores

Analyte	Unit	Sample Count	February 2023 minimum	February 2023 maximum	February 2023 mean	Post-mining mean (October 2021)	Pre-activity mean	Yellow SSTL	Red SSTL
Thorium	mg/L	5	0.001	0.001	0.001	0.001	0.001	0.01	0.1
Uranium	mg/L	5	0.001	0.001	0.001	0.001	0.001	-	0.01
Iron	mg/L	5	0.09	0.61	0.40	0.17	0.37	3.67	4.17
Arsenic	mg/L	5	0.001	0.001	0.001	0.001	0.001	-	0.1
Cadmium	mg/L	5	0.0001	0.0001	0.0001	0.0001	0.0001	0.01	0.05
Chromium	mg/L	5	0.001	0.001	0.001	0.001	0.001	0.1	1.0
Copper	mg/L	5	0.001	0.001	0.001	0.001	0.001	0.004	0.2
Lead	mg/L	5	0.001	0.001	0.001	0.001	0.001	2	5
Nickel	mg/L	5	0.001	0.001	0.001	0.001	0.001	-	0.2
Zinc	mg/L	5	0.005	0.671	0.145	0.026	0.008	-	2
Mercury	mg/L	5	0.0001	0.0001	0.0001	0.0001	-	-	-

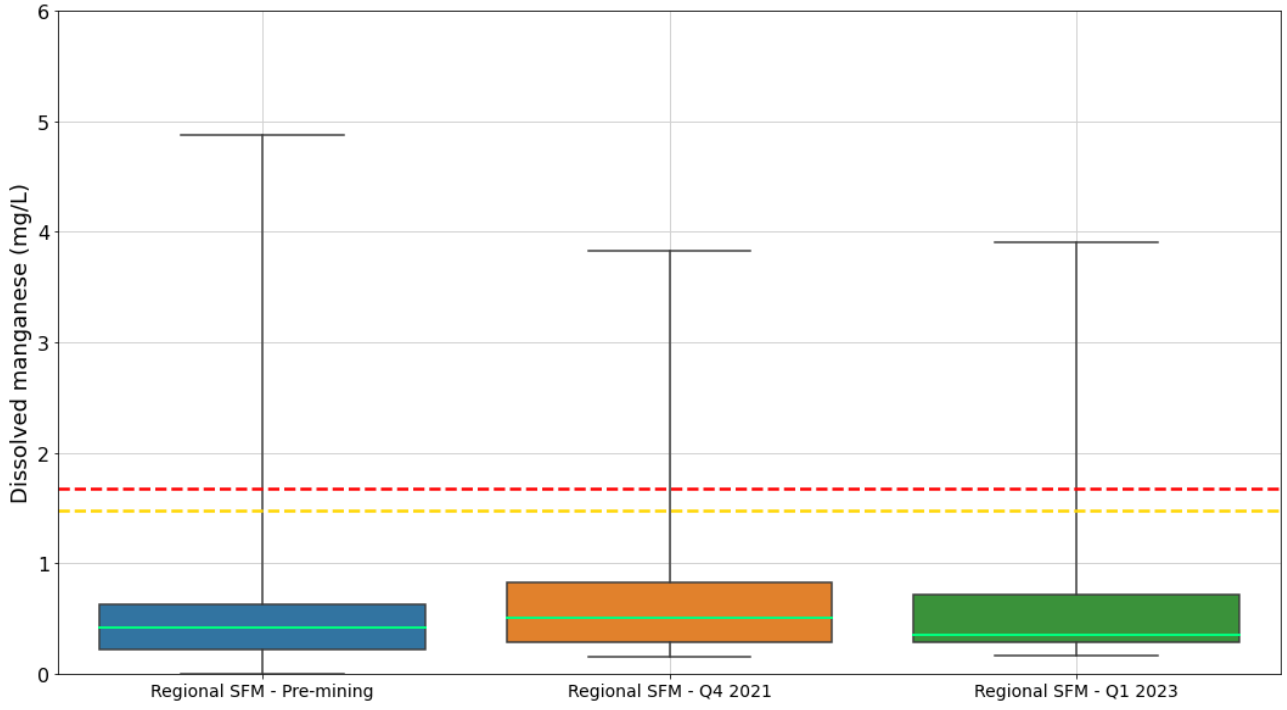


Figure 5.4 Box and whisker plot of regional dissolved manganese measurements before and post Phase 2 activities

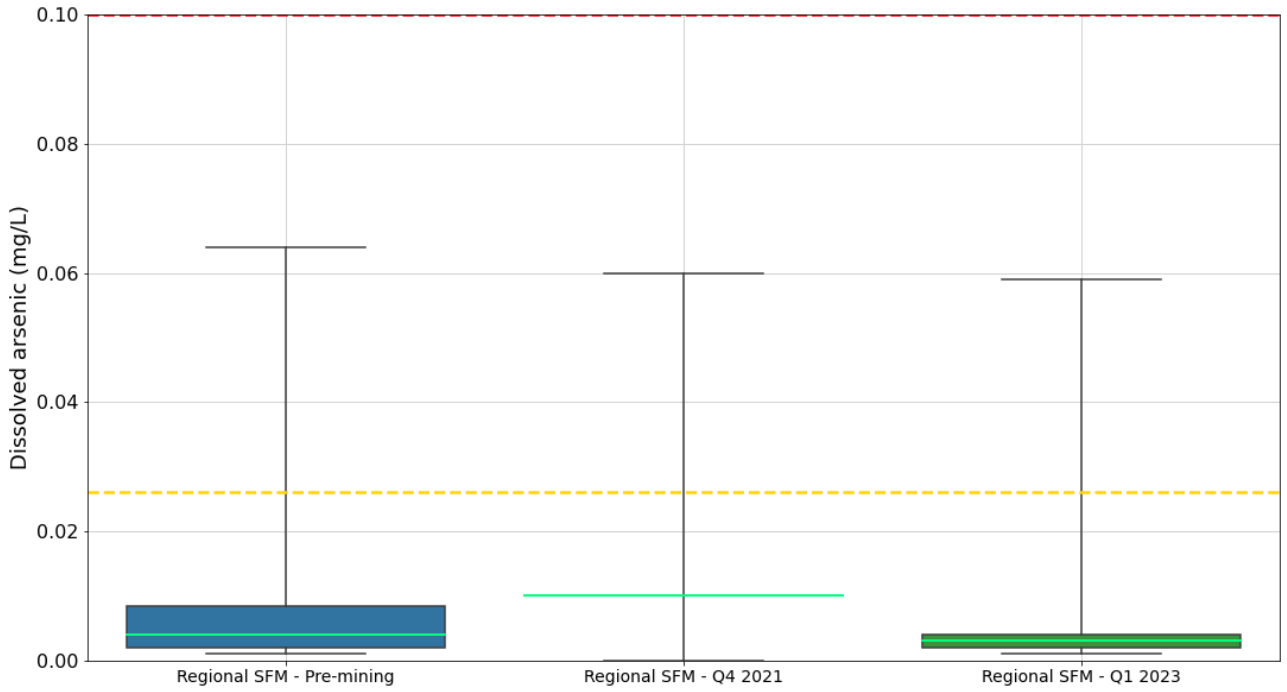


Figure 5.5 Box and whisker plot of regional dissolved arsenic measurements before and post Phase 2 activities

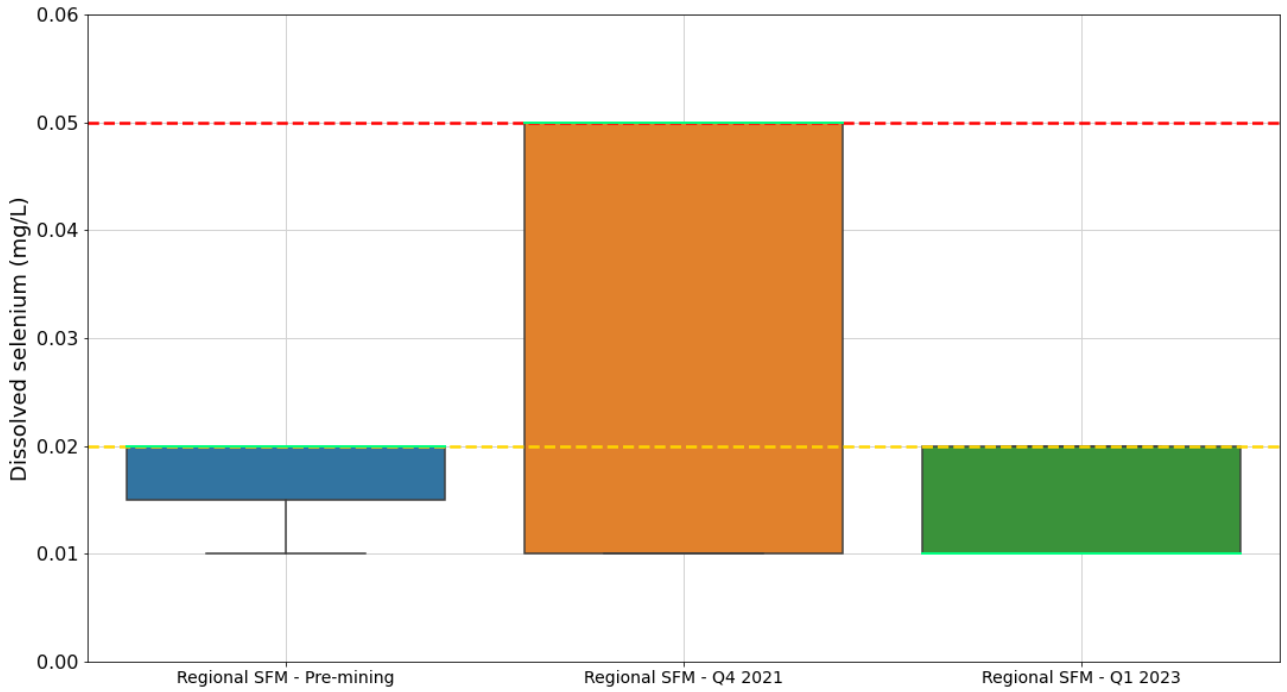


Figure 5.6 Box and whisker plot of regional dissolved selenium measurements before and post Phase 2 activities

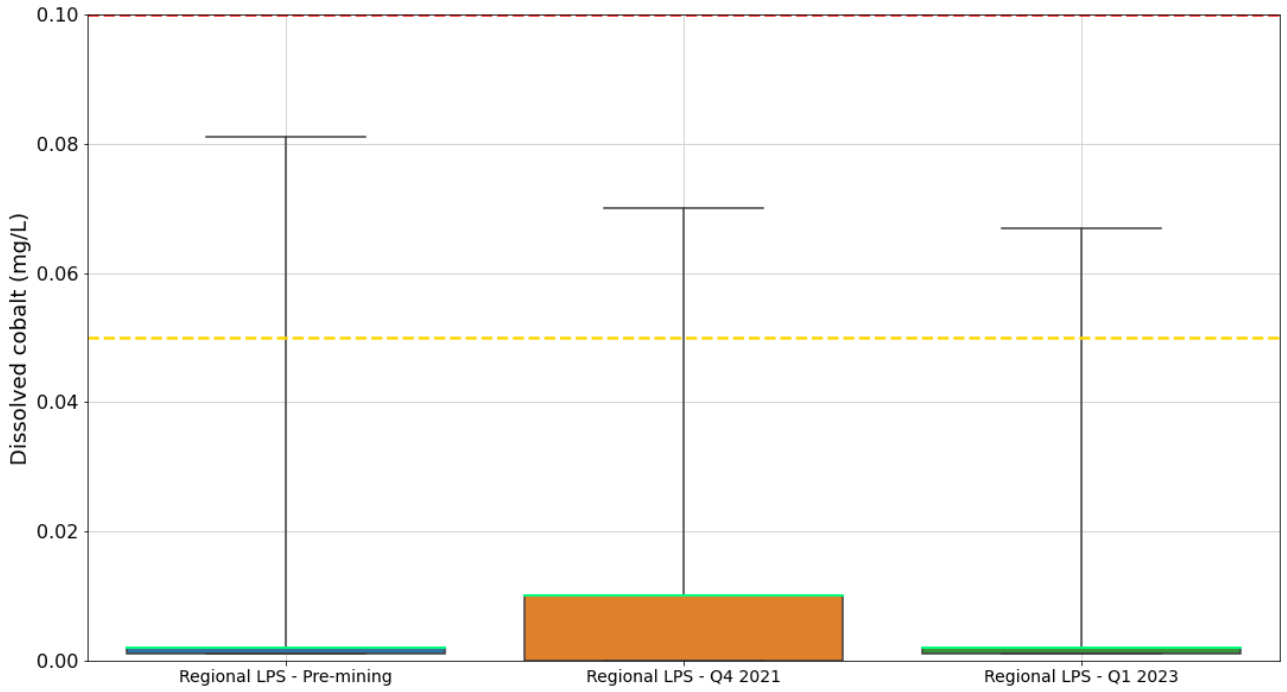


Figure 5.7 Box and whisker plot of regional dissolved cobalt measurements before and post Phase 2 activities

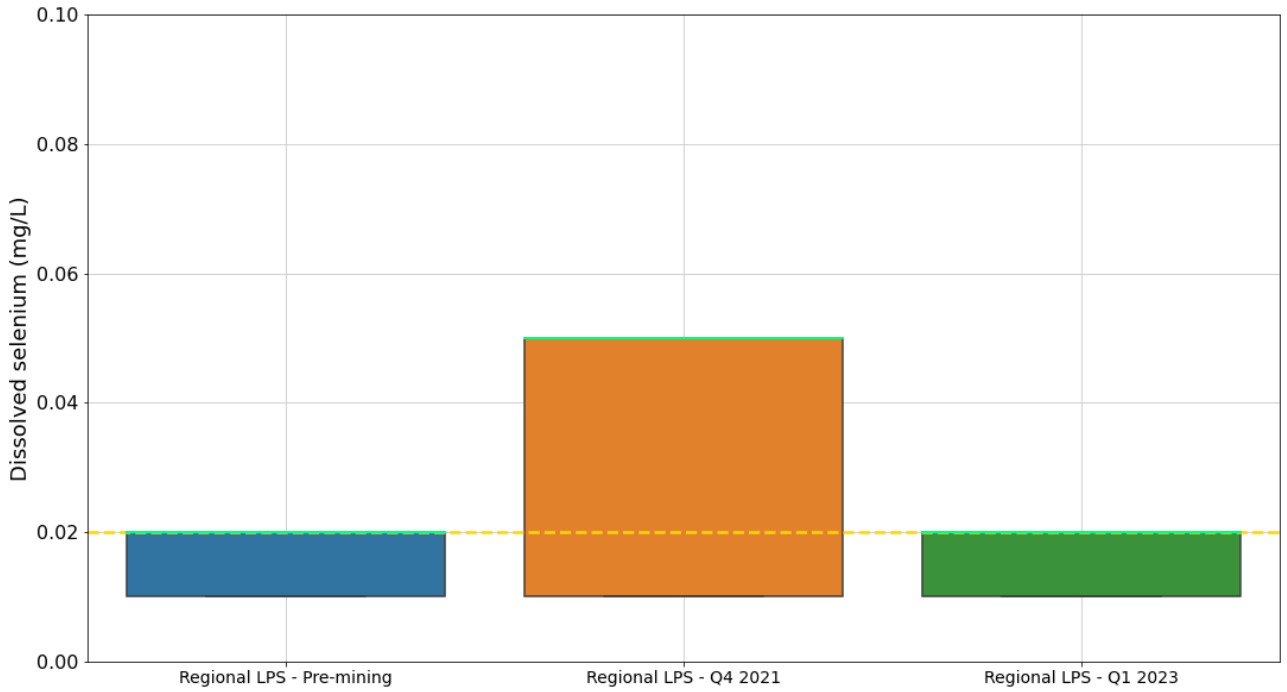


Figure 5.8 Box and whisker plot of regional dissolved selenium measurements before and post Phase 2 activities with 'red' SSTL of 0.05 mg/L

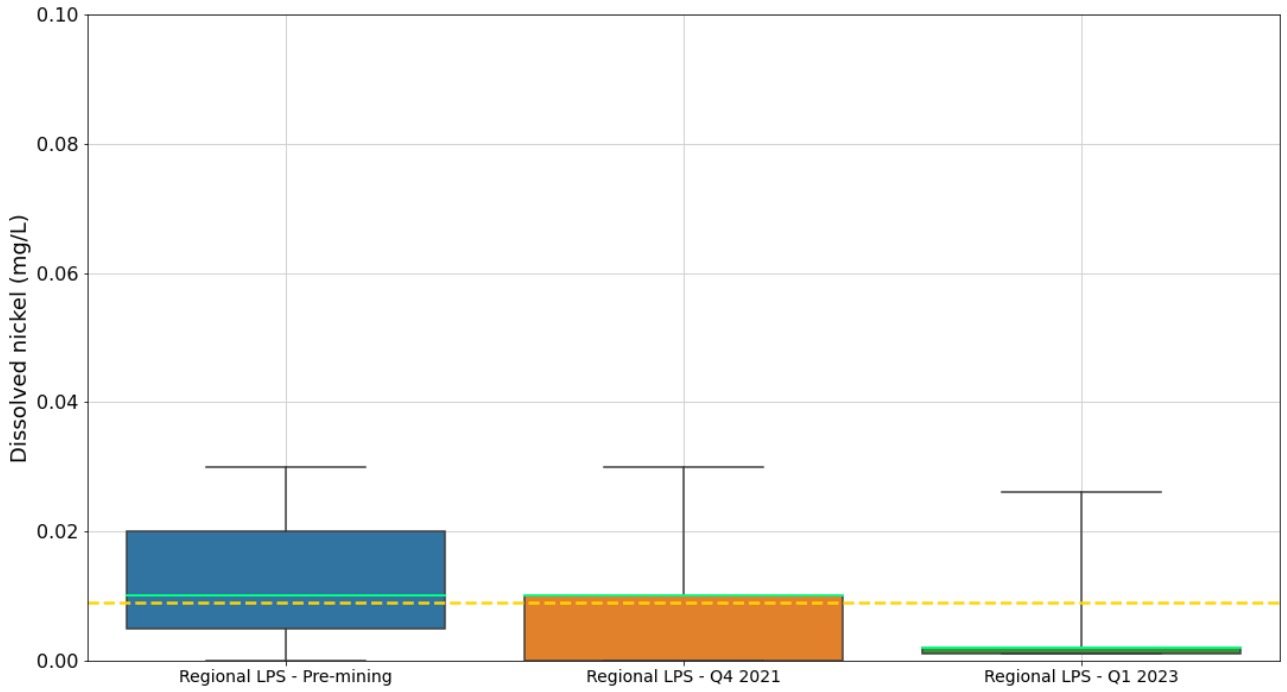


Figure 5.9 **Box and whisker plot of regional dissolved nickel measurements before and post Phase 2 activities with 'red' SSTL of 0.2 mg/L**

6 Conclusions

Analysis of the February 2023 groundwater pressure and quality data, with comparison to the October 2021, pre-activity and during activity data analysed by EMM (2021), has found the following:

- The average change in groundwater levels which occurred in regional monitoring bores when comparing pre-activity and February 2023 data was an increase of 0.29 m. This increase is likely due to above average rainfall conditions experienced in the areas from January 2022 onwards. Phase 2 activities are considered to have had little or no impact on nearby groundwater levels.

- Minor changes in field pH, TDS, EC and total iron concentrations were observed when comparing pre-activity, October 2021 and February 2023 data from regional bores. Exceptions to this include considerable increases in the ORP measurements observed in regional SFM and LPS bores, which could suggest a natural trend occurring in these aquifers.

- No significant trends were found in any groundwater quality parameters that would suggest the local groundwater system was impacted by Phase 2 activities, or that any other impacts have occurred. In general, analyte concentrations measured in February 2023 were similar to those measured prior to the beginning of Phase 2 and in October 2021.

  Some exceedances of groundwater quality SSTLs were noted but were determined to be due to natural fluctuations or local mineralisation (elevated background concentrations). In bores where an SSTL exceedance was noted, no increasing trends were observed, and no other bores showed similar exceedances.

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Appendix A
Groundwater SSTL values

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A.1 Field water quality SSTLs

The SSTLs that are applied to field water quality parameters are outlined in Table A.1.

Table A.1 Field parameter water quality SSTLs

Water Quality Parameter	Shepparton Formation			Loxton Parilla Sands Aquifer			Lower Renmark Group Aquifer		
	Green	Yellow	Red	Green	Yellow	Red	Green	Yellow	Red
pH Upper	<8.78	<8.78	>9	<8.78	≥8.78	>9	≤8.24	>8.24	>9
pH Lower	>5.60	>5.60	<4	>5.73	≤5.73	<4	≥6.11	<6.11	<4
EC (mS/cm)	<99.191	<99.191	>112.717	<113.808	≥113.808	>129.328	<14.948	≥14.948	>16.986
Total Iron	<9.422	<9.422	>10.706	<10.588	≥10.588	>12.031	<3.670	≥3.670	>4.170

A.2 Laboratory water quality SSTLs

The SSTLs that are applied to the results of laboratory analysed water quality samples are shown in Table A.2.

Table A.2 Laboratory water quality SSTLs

Water Quality Parameter	Shepparton Formation			Loxton Parilla Sands Aquifer			Lower Renmark Group Aquifer		
	Green	Yellow	Red	Green	Yellow	Red	Green	Yellow	Red
Indirect – Adverse Risk to Beneficial Users									
Total Alkalinity (mg/L CaCO3)	<628	≥628	>754	<727	≥727	>823	<639	≥639	>767
Calcium (mg/L)	<1,112	≥1,112	>1,335	<1,220	≥1,220	>1,464	<101	≥101	>121
Magnesium (mg/L	<3,219	≥3,219	>3,863	<3,324	≥3,324	>3,989	<130	≥130	>156
Sodium (mg/L)	<23586	≥23586	>28303	<24381	≥24381	>29258	<2880	≥2880	>3456
Potassium (mg/L)	<141	≥141	>169	<105	≥105	>126	<47	≥47	>56
Sulphate (mg/L)	<8254	≥8254	>9905	<9642	≥9642	>11570	<4	≥4	>5
Chloride (mg/L)	<42672	≥42672	>51206	<41875	≥41875	>50250	<4556	≥4556	>5468
Direct – Adverse Risk to Beneficial Users									
pH Upper	<8.78	≥8.78	>9	<8.78	≥8.78	>9	≤8.24	>8.24	>9
pH Lower	>5.60	≤5.60	<4	>5.73	≤5.73	<4	≥6.11	<6.11	<4
Total Alkalinity (mg/L CaCO3)	<628	≥628	>754	<727	≥727	>873	<639	≥639	>767
Total Dissolved Solids	<64474	≥64474	>73266	<73975	≥73975	>84063	<9716	≥9716	>11041
Al (mg/L)	<0.129	≥0.129	5	<0.129	≥0.129	5	<0.283	≥0.283	5
Ag (mg/L)	<0.01	≥001	>0.05	<0.01	≥0.01	>0.05	<0.01	≥0.01	>0.05
As (mg/L)	<0.026	≥0.026	>0.1	<0.020	≥0.02	>0.1	LOR	LOR	>0.1
B (mg/L)	<0.5	≥0.5	>1.0	<0.5	≥0.5	≥1.0	<0.5	≥0.5	>1.0

Table A.2 Laboratory water quality SSTLs

Water Quality Parameter	Shepparton Formation			Loxton Parilla Sands Aquifer			Lower Renmark Group Aquifer		
	Green	Yellow	Red	Green	Yellow	Red	Green	Yellow	Red
Be (mg/L)	<0.1	≥0.1	>0.5	<0.1	≥0.1	>0.5	<0.1	≥0.1	>0.5
Bi (mg/L)	<0.01	≥0.01	>0.05	<0.01	≥0.01	>0.05	<0.01	≥0.01	>0.05
Cd (mg/L)	<0.01	≥0.01	>0.05	<0.01	≥0.01	>0.05	<0.01	≥0.01	>0.05
Co (mg/L)	<0.05	≥0.05	>0.1	<0.05	≥0.05	>0.1	<0.05	≥0.05	>0.1
Cr (mg/L)	<0.1	≥0.1	>1.0	<0.1	≥0.1	>1.0	<0.1	≥0.1	>1.0
Cu (mg/L)	<0.042	≥0.042	>0.2	<0.018	≥0.018	>0.2	<0.004	≥0.004	>0.2
F (mg/L)	<1.0	≥1.0	>2.0	<1.0	≥1.0	>2.0	<1.0	≥1.0	>2.0
Fe (mg/L	<9.422	≥9.422	>10.706	<10.588	≥10.588	>12.031	<3.670	≥3.670	>4.170
Li (mg/L)	<0.233	≥0.233	>2.5	<0.283	≥0.283	>2.5	<0.122	≥0.122	>2.5
Mn (mg/L)	<1.472	≥1.472	>1.673	<1.342	≥1.342	>1.525	<0.0822	≥0.082	>0.093
Mo (mg/L)	<0.024	≥0.024	>0.028	<0.007	≥0.007	>0.01	LOR	≥LOR	>0.01
Ni (mg/L)	<0.038	≥0.038	>0.2	<0.009	≥0.009	>0.2	LOR	≥LOR	>0.2
Pb (mg/L)	<2.0	≥2.0	>5.0	<2.0	≥2.0	>5.0	<2.0	≥2.0	>5.0
Sb (mg/L)	<0.01	≥0.01	>0.05	<0.01	≥0.01	>0.05	<0.01	≥0.01	>0.05
Se (mg/L)	<0.02	≥0.02	>0.05	<0.02	≥0.02	>0.05	<0.02	≥0.02	>0.05
Sr (mg/L)	<29.964	≥26.964	>30.641	<29.821	≥29.821	>33.888	<3.755	≥3.755	>4.267
Th (mg/L)	<0.01	≥0.01	>0.1	<0.01	≥0.01	>0.1	<0.01	≥0.01	>0.1
U (mg/L)	<0.065	≥0.065	>0.073	<0.013	≥0.013	>0.015	<0.001	>LOR	>0.01
V (mg/L)	<0.1	≥0.1	>0.5	<0.1	≥0.1	>0.5	<0.1	≥0.1	>0.5
Zn (mg/L)	<0.166	≥0.166	>2	<0.199	≥0.199	>2	LOR	>LOR	>2
Gross alpha (Bq/L)	<1.5	1.5	3.0	<1.5	1.5	3.0*		N/A	
Gross beta (Bq/L)	<1.5	1.5	3.0	<1.5	1.5	3.0*		N/A	
Ra-226 (Bq/L)	N/A		≥5	N/A		≥5	N/A		>5
Ra-228 (Bq/L)	N/A		≥2	N/A		≥2	N/A		≥2
N- Species	<5	≥5	>25	>5	≥5	>25	>5	≥5	>25
Total Recoverable Hydrocarbons (TPH)	N/A		≥0.3	N/A		≥0.3	N/A		≥0.3

Note: *Gross alpha/Gross beta site-specific trigger of 3 Bq/L represents approximately a 2x increase in the maximum radioactivity measured in 2017

Appendix B
Field parameter sheets

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Low-Flow Test Report:

Test Date / Time: 2/02/2023 8:25:23 AM
Project:
Operator Name:

Location Name: WB1	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Iron 5mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
2/02/2023 8:25 AM	00:00	6.22 pH	19.13 °C	33,443 µS/cm	1.57 mg/L		159.8 mV	
2/02/2023 8:26 AM	01:30	6.28 pH	19.52 °C	34,048 µS/cm	0.75 mg/L		130.8 mV	
2/02/2023 8:28 AM	03:00	6.30 pH	19.72 °C	34,003 µS/cm	0.56 mg/L		115.7 mV	
2/02/2023 8:29 AM	04:30	6.32 pH	19.81 °C	33,923 µS/cm	0.49 mg/L		106.8 mV	
2/02/2023 8:31 AM	06:00	6.33 pH	19.50 °C	32,906 µS/cm	0.71 mg/L		100.5 mV	
2/02/2023 8:32 AM	07:30	6.33 pH	19.87 °C	33,033 µS/cm	0.60 mg/L		95.9 mV	
2/02/2023 8:34 AM	09:00	6.34 pH	19.89 °C	32,959 µS/cm	0.49 mg/L		91.7 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 2/02/2023 9:02:16 AM
Project:
Operator Name:

Location Name: WB2	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Sulfurous odour
Iron 0.05 mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
2/02/2023 9:02 AM	00:00	6.70 pH	19.93 °C	29,376 µS/cm	4.44 mg/L		85.8 mV	
2/02/2023 9:03 AM	01:00	6.67 pH	20.16 °C	182.98 µS/cm	6.54 mg/L		1.5 mV	
2/02/2023 9:04 AM	02:00	6.65 pH	20.42 °C	29,950 µS/cm	3.98 mg/L		-42.3 mV	
2/02/2023 9:05 AM	03:00	6.62 pH	20.41 °C	20,024 µS/cm	4.87 mg/L		-41.3 mV	
2/02/2023 9:06 AM	04:10	6.60 pH	20.60 °C	32,529 µS/cm	2.23 mg/L		-43.3 mV	
2/02/2023 9:07 AM	05:10	6.69 pH	20.49 °C	75.66 µS/cm	8.06 mg/L		-36.1 mV	
2/02/2023 9:08 AM	06:10	6.61 pH	20.73 °C	32,800 µS/cm	2.37 mg/L		-41.6 mV	
2/02/2023 9:09 AM	07:10	6.67 pH	20.57 °C	77.60 µS/cm	7.90 mg/L		-36.0 mV	
2/02/2023 9:10 AM	08:10	6.61 pH	20.79 °C	32,840 µS/cm	2.42 mg/L		-42.9 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 2/02/2023 9:40:19 AM
Project:
Operator Name:

Location Name: WB5	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Iron 0.18 mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
2/02/2023 9:40 AM	00:00	6.78 pH	20.36 °C	31,912 µS/cm	4.82 mg/L		102.4 mV	
2/02/2023 9:41 AM	01:00	6.63 pH	20.46 °C	31,630 µS/cm	2.26 mg/L		76.1 mV	
2/02/2023 9:42 AM	02:00	6.59 pH	20.56 °C	32,890 µS/cm	2.03 mg/L		13.3 mV	
2/02/2023 9:43 AM	03:00	6.69 pH	20.55 °C	108.43 µS/cm	6.95 mg/L		-14.7 mV	
2/02/2023 9:44 AM	04:00	6.59 pH	20.54 °C	33,293 µS/cm	2.07 mg/L		-36.5 mV	
2/02/2023 9:45 AM	05:00	6.64 pH	20.51 °C	89.11 µS/cm	7.63 mg/L		-38.5 mV	
2/02/2023 9:46 AM	06:00	6.59 pH	20.58 °C	33,307 µS/cm	2.16 mg/L		-50.9 mV	
2/02/2023 9:47 AM	07:00	6.62 pH	20.57 °C	63.49 µS/cm	6.43 mg/L		-50.8 mV	
2/02/2023 9:48 AM	08:00	6.59 pH	20.57 °C	33,312 µS/cm	2.10 mg/L		-59.9 mV	
2/02/2023 9:49 AM	09:00	6.63 pH	20.53 °C	127.11 µS/cm	6.78 mg/L		-55.9 mV	
2/02/2023 9:50 AM	10:00	6.62 pH	20.55 °C	33,311 µS/cm	2.54 mg/L		-64.4 mV	
2/02/2023 9:51 AM	11:00	6.60 pH	20.61 °C	113.63 µS/cm	4.97 mg/L		-64.7 mV	
2/02/2023 9:52 AM	12:00	6.60 pH	20.63 °C	33,311 µS/cm	2.67 mg/L		-70.5 mV	
2/02/2023 9:53 AM	13:00	6.58 pH	20.69 °C	22,540 µS/cm	3.46 mg/L		-74.4 mV	
2/02/2023 9:54 AM	14:00	6.60 pH	20.73 °C	33,311 µS/cm	2.78 mg/L		-74.6 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 2/02/2023 10:30:20 AM
Project:
Operator Name:

Location Name: WB7	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Iron 2.3 mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
2/02/2023 10:30 AM	00:00	6.01 pH	21.57 °C	55,674 µS/cm	2.89 mg/L		101.9 mV	
2/02/2023 10:32 AM	02:00	5.86 pH	21.52 °C	56,748 µS/cm	1.20 mg/L		93.1 mV	
2/02/2023 10:34 AM	04:00	5.84 pH	21.66 °C	57,048 µS/cm	1.23 mg/L		77.0 mV	
2/02/2023 10:36 AM	06:00	5.84 pH	21.26 °C	56,960 µS/cm	0.66 mg/L		56.5 mV	
2/02/2023 10:38 AM	08:00	5.84 pH	21.57 °C	56,960 µS/cm	0.61 mg/L		46.7 mV	
2/02/2023 10:40 AM	10:00	5.85 pH	21.36 °C	56,598 µS/cm	0.63 mg/L		39.9 mV	
2/02/2023 10:42 AM	12:00	5.85 pH	21.35 °C	56,896 µS/cm	0.57 mg/L		30.4 mV	
2/02/2023 10:44 AM	14:00	5.85 pH	21.58 °C	57,035 µS/cm	0.51 mg/L		25.4 mV	
2/02/2023 10:46 AM	16:00	5.85 pH	21.36 °C	56,853 µS/cm	0.49 mg/L		18.2 mV	
2/02/2023 10:48 AM	18:00	5.85 pH	21.47 °C	56,894 µS/cm	0.57 mg/L		12.1 mV	
2/02/2023 10:50 AM	20:00	5.85 pH	21.66 °C	57,030 µS/cm	0.59 mg/L		8.2 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 1/02/2023 9:18:16 AM
Project:
Operator Name:

Location Name: WB41	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Iron 2.8 mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
1/02/2023 9:18 AM	00:00	6.79 pH	20.86 °C	48,180 µS/cm	2.81 mg/L		156.5 mV	
1/02/2023 9:19 AM	01:30	6.78 pH	21.05 °C	48,097 µS/cm	2.39 mg/L		139.5 mV	
1/02/2023 9:21 AM	03:00	6.76 pH	20.93 °C	47,774 µS/cm	2.13 mg/L		125.1 mV	
1/02/2023 9:22 AM	04:30	6.76 pH	20.93 °C	47,488 µS/cm	1.77 mg/L		108.8 mV	
1/02/2023 9:24 AM	06:00	6.75 pH	20.84 °C	46,507 µS/cm	1.64 mg/L		92.1 mV	
1/02/2023 9:25 AM	07:30	6.73 pH	20.71 °C	46,682 µS/cm	0.97 mg/L		85.5 mV	
1/02/2023 9:27 AM	09:00	6.73 pH	20.87 °C	46,599 µS/cm	0.84 mg/L		81.1 mV	
1/02/2023 9:28 AM	10:30	6.73 pH	20.83 °C	46,627 µS/cm	0.82 mg/L		76.8 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 1/02/2023 8:40:07 AM
Project:
Operator Name:

Location Name: WB42	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
1.9mg/L iron

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
1/02/2023 8:40 AM	00:00	6.37 pH	21.56 °C	50,234 µS/cm	2.22 mg/L		167.5 mV	
1/02/2023 8:41 AM	01:30	6.52 pH	21.31 °C	50,324 µS/cm	1.20 mg/L		138.0 mV	
1/02/2023 8:43 AM	03:00	6.57 pH	21.45 °C	50,251 µS/cm	0.98 mg/L		122.5 mV	
1/02/2023 8:44 AM	04:30	6.57 pH	21.50 °C	50,308 µS/cm	0.95 mg/L		114.2 mV	
1/02/2023 8:46 AM	06:00	6.58 pH	21.50 °C	50,299 µS/cm	0.94 mg/L		108.8 mV	
1/02/2023 8:47 AM	07:30	6.59 pH	21.34 °C	50,257 µS/cm	0.90 mg/L		106.7 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 31/01/2023 9:22:07 AM
Project:
Operator Name:

Location Name: Wbgt3	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
2 mg/L iron

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
31/01/2023 9:22 AM	00:00	6.65 pH	21.87 °C	58,069 µS/cm	1.91 mg/L		138.8 mV	
31/01/2023 9:23 AM	01:00	6.59 pH	21.90 °C	58,273 µS/cm	0.81 mg/L		131.7 mV	
31/01/2023 9:24 AM	02:00	6.61 pH	21.74 °C	60,388 µS/cm	0.57 mg/L		117.5 mV	
31/01/2023 9:25 AM	03:00	6.60 pH	21.77 °C	60,573 µS/cm	0.49 mg/L		110.7 mV	
31/01/2023 9:26 AM	04:00	6.61 pH	21.71 °C	60,545 µS/cm	0.47 mg/L		98.2 mV	
31/01/2023 9:27 AM	05:00	6.61 pH	21.76 °C	60,620 µS/cm	0.43 mg/L		91.5 mV	
31/01/2023 9:28 AM	06:00	6.61 pH	21.73 °C	60,621 µS/cm	0.41 mg/L		78.6 mV	
31/01/2023 9:29 AM	07:00	6.61 pH	21.75 °C	60,689 µS/cm	0.38 mg/L		69.8 mV	
31/01/2023 9:30 AM	08:00	6.61 pH	21.80 °C	60,597 µS/cm	0.37 mg/L		59.3 mV	
31/01/2023 9:31 AM	09:00	6.62 pH	21.75 °C	60,642 µS/cm	0.36 mg/L		48.8 mV	
31/01/2023 9:32 AM	10:00	6.62 pH	21.79 °C	60,685 µS/cm	0.34 mg/L		38.2 mV	
31/01/2023 9:33 AM	11:00	6.62 pH	21.74 °C	60,504 µS/cm	0.34 mg/L		28.8 mV	
31/01/2023 9:34 AM	12:00	6.62 pH	21.79 °C	60,456 µS/cm	0.32 mg/L		23.3 mV	
31/01/2023 9:35 AM	13:00	6.62 pH	21.73 °C	60,029 µS/cm	0.31 mg/L		10.6 mV	
31/01/2023 9:36 AM	14:00	6.62 pH	21.75 °C	59,407 µS/cm	0.30 mg/L		9.0 mV	
31/01/2023 9:37 AM	15:00	6.62 pH	21.71 °C	59,374 µS/cm	0.30 mg/L		-7.2 mV	
31/01/2023 9:38 AM	16:00	6.62 pH	21.77 °C	59,198 µS/cm	0.29 mg/L		-2.5 mV	
31/01/2023 9:39 AM	17:00	6.62 pH	21.72 °C	58,767 µS/cm	0.29 mg/L		-20.3 mV	
31/01/2023 9:40 AM	18:00	6.62 pH	21.79 °C	58,836 µS/cm	0.28 mg/L		-15.4 mV	

31/01/2023 9:41 AM	19:00	6.62 pH	21.72 °C	58,539 µS/cm	0.28 mg/L		-32.9 mV	
31/01/2023 9:42 AM	20:00	6.62 pH	21.78 °C	58,981 µS/cm	0.27 mg/L		-27.0 mV	
31/01/2023 9:43 AM	21:00	6.62 pH	21.76 °C	58,639 µS/cm	0.27 mg/L		-43.2 mV	
31/01/2023 9:44 AM	22:00	6.62 pH	21.78 °C	59,227 µS/cm	0.27 mg/L		-38.4 mV	
31/01/2023 9:45 AM	23:00	6.62 pH	21.74 °C	59,083 µS/cm	0.27 mg/L		-51.0 mV	
31/01/2023 9:46 AM	24:00	6.62 pH	21.77 °C	59,203 µS/cm	0.26 mg/L		-46.7 mV	
31/01/2023 9:47 AM	25:00	6.62 pH	21.77 °C	58,732 µS/cm	0.26 mg/L		-57.3 mV	
31/01/2023 9:48 AM	26:00	6.62 pH	21.78 °C	59,264 µS/cm	0.25 mg/L		-54.2 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 31/01/2023 10:24:28 AM
Project:
Operator Name:

Location Name: LPSPB03	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Cloudy
Iron 0.2mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
31/01/2023 10:24 AM	00:00	7.03 pH	24.48 °C	46,037 µS/cm	4.73 mg/L		93.1 mV	
31/01/2023 10:25 AM	01:00	6.69 pH	22.76 °C	47,427 µS/cm	1.61 mg/L		78.5 mV	
31/01/2023 10:26 AM	02:00	6.68 pH	22.66 °C	48,981 µS/cm	0.48 mg/L		59.4 mV	
31/01/2023 10:27 AM	03:00	6.68 pH	21.96 °C	52,755 µS/cm	0.37 mg/L		56.4 mV	
31/01/2023 10:28 AM	04:00	6.67 pH	22.22 °C	52,968 µS/cm	0.39 mg/L		53.6 mV	
31/01/2023 10:29 AM	05:00	6.67 pH	21.82 °C	53,280 µS/cm	0.35 mg/L		51.2 mV	
31/01/2023 10:30 AM	06:00	6.66 pH	22.15 °C	53,251 µS/cm	0.41 mg/L		49.2 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 31/01/2023 11:01:07 AM
Project:
Operator Name:

Location Name: SHOB03	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Iron: 3.4mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
31/01/2023 11:01 AM	00:00	6.59 pH	26.73 °C	48,402 µS/cm	3.13 mg/L		82.8 mV	
31/01/2023 11:02 AM	01:30	6.43 pH	25.10 °C	48,948 µS/cm	0.65 mg/L		65.9 mV	
31/01/2023 11:04 AM	03:00	6.41 pH	23.67 °C	49,760 µS/cm	0.34 mg/L		63.8 mV	
31/01/2023 11:05 AM	04:30	6.40 pH	22.87 °C	49,922 µS/cm	0.32 mg/L		64.1 mV	
31/01/2023 11:07 AM	06:00	6.39 pH	22.47 °C	49,929 µS/cm	0.28 mg/L		64.5 mV	
31/01/2023 11:08 AM	07:30	6.39 pH	22.34 °C	49,842 µS/cm	0.26 mg/L		64.9 mV	
31/01/2023 11:10 AM	09:00	6.37 pH	22.57 °C	49,972 µS/cm	0.27 mg/L		64.9 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 31/01/2023 1:02:07 PM
Project:
Operator Name:

Location Name: GW36673(1)	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Iron: 0.4mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
31/01/2023 1:02 PM	00:00	6.69 pH	26.66 °C	61,474 µS/cm	2.87 mg/L		110.0 mV	
31/01/2023 1:03 PM	01:30	6.64 pH	25.00 °C	60,820 µS/cm	1.67 mg/L		109.3 mV	
31/01/2023 1:05 PM	03:00	6.61 pH	25.40 °C	61,844 µS/cm	1.36 mg/L		108.5 mV	
31/01/2023 1:06 PM	04:30	6.59 pH	24.88 °C	60,355 µS/cm	1.21 mg/L		110.2 mV	
31/01/2023 1:08 PM	06:00	6.59 pH	24.46 °C	60,318 µS/cm	1.11 mg/L		112.0 mV	
31/01/2023 1:09 PM	07:30	6.59 pH	24.20 °C	60,208 µS/cm	1.07 mg/L		113.6 mV	
31/01/2023 1:11 PM	09:00	6.59 pH	24.81 °C	59,741 µS/cm	1.02 mg/L		115.0 mV	
31/01/2023 1:12 PM	10:30	6.58 pH	24.61 °C	60,429 µS/cm	1.04 mg/L		115.7 mV	
31/01/2023 1:14 PM	12:00	6.58 pH	24.54 °C	60,293 µS/cm	1.01 mg/L		116.8 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 1/02/2023 12:54:05 PM
Project:
Operator Name:

Location Name: GW36866(1)	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Iron 2.4 mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
1/02/2023 12:54 PM	00:00	7.25 pH	24.12 °C	34,628 µS/cm	6.25 mg/L		134.3 mV	
1/02/2023 12:55 PM	01:30	6.72 pH	22.60 °C	35,907 µS/cm	1.77 mg/L		90.6 mV	
1/02/2023 12:57 PM	03:00	6.74 pH	21.86 °C	32,189 µS/cm	2.04 mg/L		77.8 mV	
1/02/2023 12:58 PM	04:30	6.69 pH	21.52 °C	32,258 µS/cm	1.12 mg/L		68.8 mV	
1/02/2023 1:00 PM	06:00	6.67 pH	21.25 °C	32,524 µS/cm	0.81 mg/L		62.6 mV	
1/02/2023 1:01 PM	07:30	6.66 pH	21.68 °C	32,525 µS/cm	0.73 mg/L		57.6 mV	
1/02/2023 1:03 PM	09:00	6.66 pH	21.51 °C	32,508 µS/cm	0.61 mg/L		53.8 mV	

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 1/02/2023 1:28:31 PM
Project:
Operator Name:

Location Name: GW36866(2)	Flow Cell Volume: 130 ml	Instrument Used: Aqua TROLL 500 Serial Number: 696591

Test Notes:
Iron 0.21 mg/L

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5
1/02/2023 1:28 PM	00:00	6.97 pH	24.54 °C	21,144 µS/cm	3.07 mg/L		92.1 mV	
1/02/2023 1:29 PM	01:00	6.87 pH	22.95 °C	21,373 µS/cm	1.76 mg/L		93.7 mV	
1/02/2023 1:30 PM	02:00	6.84 pH	21.74 °C	21,408 µS/cm	0.92 mg/L		94.1 mV	
1/02/2023 1:32 PM	04:23	6.87 pH	22.17 °C	21,433 µS/cm	0.65 mg/L		94.5 mV	
1/02/2023 1:34 PM	06:10	6.87 pH	21.64 °C	21,401 µS/cm	0.55 mg/L		94.7 mV	
1/02/2023 1:36 PM	07:50	6.85 pH	21.57 °C	21,370 µS/cm	0.46 mg/L		95.0 mV	
1/02/2023 1:36 PM	08:19	6.84 pH	21.65 °C	21,414 µS/cm	0.48 mg/L		95.0 mV	

Samples

Sample ID:	Description:

Appendix C
Groundwater quality results

EMM
creating opportunities

CHAIN OF CUSTODY
ALS Laboratory: please tick →

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

CLIENT: EMM CONSULTING PTY LTD	**TURNAROUND REQUIREMENTS :** ☒ Standard TAT **(List due date):**		**FOR LABORATORY USE ONLY (Circle)**
OFFICE: Ground Level, 188 Normanby Road, Southbank, VIC 3006	(Standard TAT may be longer for some tests e.g.. Ultra Trace Organics) ☐ Non Standard or urgent TAT **(List due date):**		Custody Seal Intact? Yes No N/A
PROJECT: Balranald Regional Sampling **PROJECT NO.:** S200529	**ALS QUOTE NO ME-780-21**	**COC SEQUENCE NUMBER (Circle)**	Free ice / frozen ice bricks present upon receipt? Yes No N/A
PURCHASE ORDER: S200529	**COUNTRY OF ORIGIN:**	COC (1) 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Paul Gibbons	**CONTACT PH:** 0477 702 413	OF: 1 (2) 3 4 5 6 7	Other comment:
SAMPLER: Bill Bull	**SAMPLER MOBILE: 0435 060 396**	**RELINQUISHED BY:** ~~D. Condon~~ Bill Bull	**RECEIVED BY:**
COC Emailed to ALS? (YES)	**EDD FORMAT (or default):**	DATE/TIME: 22/7/22	DATE/TIME:
Email Reports to: pgibbons@emmconsulting.com.au; ~~dcondon@emmconsulting.com.au~~ bbull6@emmconsulting.com.au		**RELINQUISHED BY:**	**RECEIVED BY:**
Email Invoice to: accounts@emmconsulting.com.au, pgibbons@emmconsulting.com.au		DATE/TIME: 25/7/22 @ 1600	DATE/TIME: 26/7

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS (Solid(S) Water(W))		MATRIX:	CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price). Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Suite 1	Suite 2	Total Metals + T, U and Al	Dissolved Metals	C6 - C9	Electrical Conductivity			Hold	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	GW36866(1)	20/7/22 16:20	W	P, S, N	3		✓								
2	WBGT3	19/7/22 1230	W	"	3		✓								
3	SHOB03	19/7/22 1415	W	"	3		✓								
4	GW3667(1)	20/7/22 1345	W	"	3		✓								
5	TO3	20/7/22 1500	W	"	3		✓								
6	GW36866(2)	20/7/22 1700	W	"	3		✓								
7	TO2	20/7/22 1130	W	"	3		✓								
8	WB42	20/7/22 0930	W	"	3		✓								
9	WB5	21/7/22 1000	W	"	3		✓								
10	RB1	19/7/22 1030	W	P	1			✓							
11	RB2	20/7/22 1715	W	P	1			✓							
12	RB3	21/7/22 1115	W	P	1			✓							
				TOTAL	30										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

Environmental Division
Melbourne
Work Order Reference
EM2214208

Telephone : + 61-3-8549 9600

CHAIN OF CUSTODY
ALS Laboratory: please tick →

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

CLIENT: EMM CONSULTING PTY LTD	**TURNAROUND REQUIREMENTS :** ☒ Standard TAT **(List due date):**		**FOR LABORATORY USE ONLY (Circle)**
OFFICE: Ground Level, 188 Normanby Road, Southbank, VIC 3006	(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) ☐ Non Standard or urgent TAT **(List due date):**		Custody Seal Intact? Yes No N/A
PROJECT: Balranald Regional monitoring **PROJECT NO.:** S200529	**ALS QUOTE NO ME-780-21**	**COC SEQUENCE NUMBER (Circle)**	Free ice / frozen ice bricks present upon receipt? Yes No N/A
PURCHASE ORDER: S200529	**COUNTRY OF ORIGIN:**	COC 1 (2) 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Paul Gibbons	**CONTACT PH:** 0477 702 413	OF: 1 (2) 3 4 5 6 7	Other comment:
SAMPLER: Bill Bull	**SAMPLER MOBILE:** 0435 060 396	**RELINQUISHED BY:** ~~D. Condon~~ Bill Bull	**RECEIVED BY:**
COC Emailed to ALS? (YES)	**EDD FORMAT (or default):**	DATE/TIME: 22/7/22	DATE/TIME:
Email Reports to: pgibbons@emmconsulting.com.au; ~~dcondon@emmconsulting.com.au;~~ bbull@emmconsulting.com.au		**RELINQUISHED BY:**	DATE/TIME:
Email Invoice to: accounts@emmconsulting.com.au, pgibbons@emmconsulting.com.au		DATE/TIME:	**RECEIVED BY:** Manvir (Am) DATE/TIME: 26/7/22 11:40

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS (Solid(S) Water(W))		MATRIX:	CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Suite 1	Suite 2	Total Metals + T, U and Al	Dissolved Metals	C6 - C9	Electrical Conductivity			Hold	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	LPSPB03	19/7/22 1330	W	S, P, N	3		✓								
14	WB7	21/07/22 1045	W	S, P, N	3		✓								
15	Karra Home	19/07/22 1000	W	"	3		✓								
16	WB2	21/7/22 0915	W	"	3		✓								
17	TO1	20/7/22 1100	W	"	3		✓								
18	WB1	21/7/22 0830	W	"	3		✓								
19	HD1	19/7/22 1510	W	"	3		✓								
20	WB41	20/7/22 1000	W	"	3		✓								
				TOTAL	24										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2214208**	Page	: 1 of 12
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: PAUL GIBBONS	Contact	: Customer Services EM
Address	: Ground Floor, 188 Normanby Rd Southbank 3006	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61 3 8549 9600
Project	: S200529	Date Samples Received	: 26-Jul-2022 11:40
Order number	: S200529	Date Analysis Commenced	: 27-Jul-2022
C-O-C number	: ----	Issue Date	: 29-Jul-2022 17:33
Sampler	: BILL BULL		
Site	: ----		
Quote number	: ME/780/21		
No. of samples received	: 20		
No. of samples analysed	: 20		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Jarwis Nheu	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG035T: EM2214207 #2 Poor matrix spike recovery for total mercury due to sample matrix. Confirmed by re-extraction and re-analysis.
- EG020F: EM2214208 #2, #3, #4, #8, #13, #14, #16 and #20 Samples required dilution prior to metals analysis due to sample matrix. LOR values have been adjusted accordingly.
- EA015H: EM2214208 #14: TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW36866(1)	WBGT3	SHOB03	GW36673(1)	T03
			Sampling date / time	20-Jul-2022 16:20	19-Jul-2022 12:30	19-Jul-2022 14:15	20-Jul-2022 13:45	20-Jul-2022 15:00
Compound	CAS Number	LOR	Unit	EM2214208-001	EM2214208-002	EM2214208-003	EM2214208-004	EM2214208-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.31**	**7.40**	**6.95**	**5.96**	**7.86**
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**23000**	**40800**	**35700**	**44800**	**3000**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**386**	**425**	**338**	**187**	**371**
Total Alkalinity as CaCO3	----	1	mg/L	**386**	**425**	**338**	**187**	**371**
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**294**	**67**	**115**	**395**	**13**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**2070**	**3670**	**3720**	**4490**	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**11900**	**19200**	**15700**	**19800**	**1500**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**375**	**503**	**583**	**651**	**30**
Magnesium	7439-95-4	1	mg/L	**827**	**1680**	**1660**	**1720**	**42**
Sodium	7440-23-5	1	mg/L	**7320**	**12800**	**10500**	**13500**	**857**
Potassium	7440-09-7	1	mg/L	**24**	**53**	**53**	**53**	**22**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.05	<0.05	<0.05	<0.01
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.005	<0.005	<0.005	<0.001
Arsenic	7440-38-2	0.001	mg/L	**0.002**	<0.005	**0.005**	<0.005	<0.001
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.005	<0.005	<0.005	<0.001
Bismuth	7440-69-9	0.001	mg/L	<0.001	<0.005	<0.005	<0.005	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0005	<0.0005	<0.0005	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.005	<0.005	<0.005	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.005	<0.005	<0.005	**0.001**
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.005	**0.016**	<0.005	<0.001
Nickel	7440-02-0	0.001	mg/L	**0.003**	<0.005	**0.011**	**0.023**	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.005	<0.005	<0.005	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.034**	<0.025	**0.078**	**0.148**	**0.019**
Lithium	7439-93-2	0.001	mg/L	**0.077**	**0.137**	**0.124**	**0.100**	**0.035**
Manganese	7439-96-5	0.001	mg/L	**0.304**	**0.576**	**0.750**	**3.90**	**0.014**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW36866(1)	WBGT3	SHOB03	GW36673(1)	T03
			Sampling date / time	20-Jul-2022 16:20	19-Jul-2022 12:30	19-Jul-2022 14:15	20-Jul-2022 13:45	20-Jul-2022 15:00
Compound	CAS Number	LOR	Unit	EM2214208-001	EM2214208-002	EM2214208-003	EM2214208-004	EM2214208-005
				Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued								
Molybdenum	7439-98-7	0.001	mg/L	**0.004**	<0.005	<0.005	<0.005	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.05	<0.05	<0.05	<0.01
Silver	7440-22-4	0.001	mg/L	**0.001**	<0.005	<0.005	<0.005	<0.001
Strontium	7440-24-6	0.001	mg/L	**11.2**	**13.5**	**17.5**	**19.2**	**0.869**
Thorium	7440-29-1	0.001	mg/L	<0.001	<0.005	<0.005	<0.005	<0.001
Titanium	7440-32-6	0.01	mg/L	<0.01	<0.05	<0.05	<0.05	<0.01
Uranium	7440-61-1	0.001	mg/L	**0.002**	<0.005	<0.005	<0.005	<0.001
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.05	<0.05	<0.05	<0.01
Zirconium	7440-67-7	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Iron	7439-89-6	0.05	mg/L	**2.55**	**1.53**	**2.88**	**1.34**	**0.26**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG049F: Dissolved Trivalent Chromium								
Trivalent Chromium	16065-83-1	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.4**	**0.3**	**0.4**	**0.2**	**0.4**
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**386**	**626**	**527**	**656**	**49.7**
ø Total Cations	----	0.01	meq/L	**406**	**721**	**624**	**763**	**42.8**
ø Ionic Balance	----	0.01	%	**2.44**	**7.05**	**8.40**	**7.53**	**7.49**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW36866(2)	T02	WB42	WB5	RB1
			Sampling date / time	20-Jul-2022 17:00	20-Jul-2022 11:30	20-Jul-2022 09:30	21-Jul-2022 10:00	19-Jul-2022 10:30
Compound	CAS Number	LOR	Unit	EM2214208-006	EM2214208-007	EM2214208-008	EM2214208-009	EM2214208-010
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.61**	**7.99**	**6.47**	**7.50**	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**12600**	**3400**	**34500**	**21100**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**414**	**376**	**336**	**415**	----
Total Alkalinity as CaCO3	----	1	mg/L	**414**	**376**	**336**	**415**	----
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**32**	**10**	**239**	**52**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**1090**	**1**	**3690**	**1010**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**6560**	**1820**	**16000**	**11100**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**207**	**38**	**671**	**327**	----
Magnesium	7439-95-4	1	mg/L	**455**	**58**	**1530**	**827**	----
Sodium	7440-23-5	1	mg/L	**4300**	**1180**	**10500**	**6840**	----
Potassium	7440-09-7	1	mg/L	**24**	**22**	**40**	**40**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	<0.02	<0.01	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.002	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	**0.002**	<0.001	**0.005**	<0.001	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.002	<0.001	----
Bismuth	7440-69-9	0.001	mg/L	<0.001	<0.001	<0.002	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0002	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.002	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	**0.003**	<0.001	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.002	<0.001	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	**0.012**	<0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.002	<0.001	----
Zinc	7440-66-6	0.005	mg/L	**0.017**	**0.006**	**0.143**	**0.012**	----
Lithium	7439-93-2	0.001	mg/L	**0.054**	**0.041**	**0.094**	**0.088**	----
Manganese	7439-96-5	0.001	mg/L	**0.419**	**0.018**	**0.449**	**0.152**	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GW36866(2)	T02	WB42	WB5	RB1
				Sampling date / time	20-Jul-2022 17:00	20-Jul-2022 11:30	20-Jul-2022 09:30	21-Jul-2022 10:00	19-Jul-2022 10:30
Compound	CAS Number	LOR	Unit		EM2214208-006	EM2214208-007	EM2214208-008	EM2214208-009	EM2214208-010
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.002	<0.001	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.02	<0.01	----
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.002	<0.001	----
Strontium	7440-24-6	0.001	mg/L		**6.31**	**1.02**	**17.3**	**8.10**	----
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	<0.002	<0.001	----
Titanium	7440-32-6	0.01	mg/L		<0.01	<0.01	<0.02	<0.01	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	**0.004**	<0.001	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.02	<0.01	----
Zirconium	7440-67-7	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	----
Iron	7439-89-6	0.05	mg/L		**6.90**	**0.10**	**1.63**	**0.36**	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		----	----	----	----	<0.01
Arsenic	7440-38-2	0.001	mg/L		----	----	----	----	<0.001
Cadmium	7440-43-9	0.0001	mg/L		----	----	----	----	<0.0001
Chromium	7440-47-3	0.001	mg/L		----	----	----	----	<0.001
Copper	7440-50-8	0.001	mg/L		----	----	----	----	<0.001
Nickel	7440-02-0	0.001	mg/L		----	----	----	----	<0.001
Lead	7439-92-1	0.001	mg/L		----	----	----	----	<0.001
Zinc	7440-66-6	0.005	mg/L		----	----	----	----	<0.005
Thorium	7440-29-1	0.001	mg/L		----	----	----	----	<0.001
Uranium	7440-61-1	0.001	mg/L		----	----	----	----	<0.001
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		----	----	----	----	<0.0001
EG049F: Dissolved Trivalent Chromium									
Trivalent Chromium	16065-83-1	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.4**	**0.3**	**0.6**	**0.2**	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**216**	**58.9**	**535**	**342**	----
ø Total Cations	----	0.01	meq/L		**235**	**58.6**	**617**	**383**	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GW36866(2)	T02	WB42	WB5	RB1
				Sampling date / time	20-Jul-2022 17:00	20-Jul-2022 11:30	20-Jul-2022 09:30	21-Jul-2022 10:00	19-Jul-2022 10:30
Compound	CAS Number	LOR	Unit		EM2214208-006	EM2214208-007	EM2214208-008	EM2214208-009	EM2214208-010
					Result	Result	Result	Result	Result
EN055: Ionic Balance - Continued									
ø **Ionic Balance**	----	0.01	%		**4.30**	**0.27**	**7.14**	**5.58**	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	RB2	RB3	LPSPB03	WB7	Karra Home
			Sampling date / time	20-Jul-2022 17:15	21-Jul-2022 11:15	19-Jul-2022 13:30	21-Jul-2022 10:45	19-Jul-2022 10:00
Compound	CAS Number	LOR	Unit	EM2214208-011	EM2214208-012	EM2214208-013	EM2214208-014	EM2214208-015
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	----	----	7.56	6.96	8.00
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	----	----	37900	41600	4840
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	----	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	----	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	----	417	240	416
Total Alkalinity as CaCO3	----	1	mg/L	----	----	417	240	416
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	----	----	55	75	10
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	----	3530	4450	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	----	----	18200	18300	2770
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	----	506	706	60
Magnesium	7439-95-4	1	mg/L	----	----	1590	1910	91
Sodium	7440-23-5	1	mg/L	----	----	12000	11600	1560
Potassium	7440-09-7	1	mg/L	----	----	50	54	32
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	----	----	<0.05	<0.05	<0.01
Antimony	7440-36-0	0.001	mg/L	----	----	<0.005	<0.005	<0.001
Arsenic	7440-38-2	0.001	mg/L	----	----	<0.005	0.008	<0.001
Beryllium	7440-41-7	0.001	mg/L	----	----	<0.005	<0.005	<0.001
Bismuth	7440-69-9	0.001	mg/L	----	----	<0.005	<0.005	<0.001
Cadmium	7440-43-9	0.0001	mg/L	----	----	<0.0005	<0.0005	<0.0001
Chromium	7440-47-3	0.001	mg/L	----	----	<0.005	<0.005	<0.001
Copper	7440-50-8	0.001	mg/L	----	----	<0.005	<0.005	<0.001
Cobalt	7440-48-4	0.001	mg/L	----	----	<0.005	0.073	<0.001
Nickel	7440-02-0	0.001	mg/L	----	----	<0.005	0.024	<0.001
Lead	7439-92-1	0.001	mg/L	----	----	<0.005	<0.005	<0.001
Zinc	7440-66-6	0.005	mg/L	----	----	<0.025	0.204	1.11
Lithium	7439-93-2	0.001	mg/L	----	----	0.116	0.086	0.046
Manganese	7439-96-5	0.001	mg/L	----	----	0.451	1.26	0.031

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RB2	RB3	LPSPB03	WB7	Karra Home
				Sampling date / time	20-Jul-2022 17:15	21-Jul-2022 11:15	19-Jul-2022 13:30	21-Jul-2022 10:45	19-Jul-2022 10:00
Compound	CAS Number	LOR	Unit		EM2214208-011	EM2214208-012	EM2214208-013	EM2214208-014	EM2214208-015
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Molybdenum	7439-98-7	0.001	mg/L		----	----	<0.005	<0.005	<0.001
Selenium	7782-49-2	0.01	mg/L		----	----	<0.05	<0.05	<0.01
Silver	7440-22-4	0.001	mg/L		----	----	<0.005	<0.005	<0.001
Strontium	7440-24-6	0.001	mg/L		----	----	**13.4**	**21.0**	**1.79**
Thorium	7440-29-1	0.001	mg/L		----	----	<0.005	<0.005	<0.001
Titanium	7440-32-6	0.01	mg/L		----	----	<0.05	<0.05	<0.01
Uranium	7440-61-1	0.001	mg/L		----	----	<0.005	**0.013**	<0.001
Vanadium	7440-62-2	0.01	mg/L		----	----	<0.05	<0.05	<0.01
Zirconium	7440-67-7	0.005	mg/L		----	----	<0.005	<0.005	<0.005
Iron	7439-89-6	0.05	mg/L		----	----	**1.53**	**1.24**	**0.60**
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	----	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	----	----	----
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	----	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		----	----	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EG049F: Dissolved Trivalent Chromium									
Trivalent Chromium	16065-83-1	0.01	mg/L		----	----	<0.01	<0.01	<0.01
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		----	----	<0.01	<0.01	<0.01
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		----	----	**0.3**	**0.5**	**0.2**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		----	----	**595**	**614**	**86.4**
ø Total Cations	----	0.01	meq/L		----	----	**679**	**698**	**79.2**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Sample ID	RB2	RB3	LPSPB03	WB7	Karra Home
				Sampling date / time	20-Jul-2022 17:15	21-Jul-2022 11:15	19-Jul-2022 13:30	21-Jul-2022 10:45	19-Jul-2022 10:00
Compound	*CAS Number*	*LOR*	*Unit*		**EM2214208-011**	**EM2214208-012**	**EM2214208-013**	**EM2214208-014**	**EM2214208-015**
					Result	Result	Result	Result	Result
EN055: Ionic Balance - Continued									
ø **Ionic Balance**	----	0.01	%		**----**	**----**	**6.60**	**6.46**	**4.40**

Analytical Results

Sub-Matrix: **WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	WB2	T01	WB1	HD1	WB41
				Sampling date / time	21-Jul-2022 09:15	20-Jul-2022 11:00	21-Jul-2022 08:30	19-Jul-2022 15:10	20-Jul-2022 10:00
					EM2214208-016	EM2214208-017	EM2214208-018	EM2214208-019	EM2214208-020
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.59**	**8.03**	**7.13**	**8.08**	**6.92**
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**20200**	**4400**	**22600**	**3710**	**32800**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**423**	**395**	**378**	**425**	**352**
Total Alkalinity as CaCO3	----	1	mg/L		**423**	**395**	**378**	**425**	**352**
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L		**46**	**10**	**97**	**9**	**107**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**998**	<1	**1640**	<1	**3360**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**10900**	**2660**	**11800**	**1860**	**15500**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**296**	**56**	**409**	**41**	**625**
Magnesium	7439-95-4	1	mg/L		**756**	**73**	**906**	**64**	**1440**
Sodium	7440-23-5	1	mg/L		**6260**	**1480**	**6770**	**1220**	**9420**
Potassium	7440-09-7	1	mg/L		**38**	**27**	**36**	**28**	**40**
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.02
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.002
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	**0.066**	<0.001	<0.002
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.002
Bismuth	7440-69-9	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.002
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0002
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.002
Copper	7440-50-8	0.001	mg/L		**0.001**	<0.001	**0.001**	<0.001	<0.002
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	**0.012**	<0.001	<0.002
Nickel	7440-02-0	0.001	mg/L		**0.001**	<0.001	**0.011**	<0.001	**0.006**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	**0.001**	<0.002
Zinc	7440-66-6	0.005	mg/L		**0.008**	<0.005	**0.186**	**0.037**	**0.047**
Lithium	7439-93-2	0.001	mg/L		**0.082**	**0.032**	**0.059**	**0.047**	**0.105**
Manganese	7439-96-5	0.001	mg/L		**0.094**	**0.006**	**0.165**	**0.010**	**0.456**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WB2	T01	WB1	HD1	WB41
				Sampling date / time	21-Jul-2022 09:15	20-Jul-2022 11:00	21-Jul-2022 08:30	19-Jul-2022 15:10	20-Jul-2022 10:00
Compound	CAS Number	LOR	Unit		EM2214208-016	EM2214208-017	EM2214208-018	EM2214208-019	EM2214208-020
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	**0.001**	<0.001	<0.002
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.02
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.002**
Strontium	7440-24-6	0.001	mg/L		**7.86**	**2.40**	**11.3**	**1.13**	**16.3**
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.002
Titanium	7440-32-6	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.02
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.002
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.02
Zirconium	7440-67-7	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	<0.005
Iron	7439-89-6	0.05	mg/L		**0.15**	**0.48**	**5.72**	**0.52**	**1.22**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG049F: Dissolved Trivalent Chromium									
Trivalent Chromium	16065-83-1	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.3**	**0.3**	**0.3**	**0.4**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**337**	**82.9**	**374**	**61.0**	**514**
ø Total Cations	----	0.01	meq/L		**350**	**73.9**	**390**	**61.1**	**560**
ø Ionic Balance	----	0.01	%		**1.97**	**5.78**	**2.07**	**0.11**	**4.30**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM2214208**	Page	: 1 of 11
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: PAUL GIBBONS	Contact	: Customer Services EM
Address	: Ground Floor, 188 Normanby Rd Southbank 3006	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61 3 8549 9600
Project	: S200529	Date Samples Received	: 26-Jul-2022
Order number	: S200529	Date Analysis Commenced	: 27-Jul-2022
C-O-C number	: ----	Issue Date	: 29-Jul-2022
Sampler	: BILL BULL		
Site	: ----		
Quote number	: ME/780/21		
No. of samples received	: 20		
No. of samples analysed	: 20		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Jarwis Nheu	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA005P: pH by PC Titrator (QC Lot: 4482977)									
EM2214208-001	GW36866(1)	EA005-P: pH Value	----	0.01	pH Unit	6.31	6.32	0.2	0% - 20%
EM2214208-013	LPSPB03	EA005-P: pH Value	----	0.01	pH Unit	7.56	7.59	0.4	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 4482436)									
EM2213947-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	8450	8490	0.4	0% - 20%
EM2214141-007	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	774	773	0.1	0% - 20%
EM2214192-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	1440	1400	2.9	0% - 20%
EM2214192-011	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	248	228	8.0	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 4482440)									
EM2214208-002	WBGT3	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	40800	42100	3.3	0% - 20%
EM2214208-015	Karra Home	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	4840	4610	4.9	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4482976)									
EM2214208-001	GW36866(1)	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	386	368	4.7	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	386	368	4.7	0% - 20%
EM2214192-011	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	75	76	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	75	76	0.0	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4482978)									
EM2214208-020	WB41	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	352	338	4.0	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED037P: Alkalinity by PC Titrator (QC Lot: 4482978) - continued									
EM2214208-020	WB41	ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	352	338	4.0	0% - 20%
EM2214208-013	LPSPB03	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	417	418	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	417	418	0.0	0% - 20%
ED038: Acidity (QC Lot: 4482974)									
EM2214208-001	GW36866(1)	ED038-P: Acidity as CaCO3	----	1	mg/L	294	277	5.9	0% - 20%
EM2214208-013	LPSPB03	ED038-P: Acidity as CaCO3	----	1	mg/L	55	54	2.6	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4482662)									
EM2214208-005	T03	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
EM2214134-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	52	52	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4482664)									
EM2214208-008	WB42	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3690	3650	1.2	0% - 20%
EM2214208-020	WB41	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3360	3320	1.3	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 4482661)									
EM2214134-006	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	2740	2750	0.2	0% - 20%
EM2214134-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	1000	1010	0.3	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 4482663)									
EM2214208-005	T03	ED045G: Chloride	16887-00-6	1	mg/L	1500	1500	0.2	0% - 20%
EM2214208-020	WB41	ED045G: Chloride	16887-00-6	1	mg/L	15500	15500	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 4482403)									
EM2214208-006	GW36866(2)	ED093F: Calcium	7440-70-2	1	mg/L	207	200	3.4	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	455	438	3.9	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	4300	4170	3.1	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	24	23	0.0	0% - 20%
EM2214202-003	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	55	57	3.9	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	436	468	7.2	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	2240	2410	7.3	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	33	35	6.3	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 4482408)									
EM2214210-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	303	301	0.6	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	756	752	0.6	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1610	1600	0.7	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	116	115	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4482404)									
EM2214208-007	T02	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4482404) - continued									
EM2214208-007	T02	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lithium	7439-93-2	0.001	mg/L	0.041	0.042	0.0	0% - 20%
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.018	0.017	0.0	0% - 50%
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.006	0.008	25.6	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.10	0.10	0.0	No Limit
EM2214202-003	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.021	0.021	0.0	0% - 20%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lithium	7439-93-2	0.001	mg/L	0.075	0.072	4.3	0% - 20%
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.019	0.019	0.0	0% - 50%
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.143	0.146	2.1	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.220	0.227	3.4	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4482405)									
EM2214208-001	GW36866(1)	EG020B-F: Bismuth	7440-69-9	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-F: Silver	7440-22-4	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020B-F: Strontium	7440-24-6	0.001	mg/L	11.2	11.2	0.0	0% - 20%
		EG020B-F: Thorium	7440-29-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-F: Uranium	7440-61-1	0.001	mg/L	0.002	0.001	0.0	No Limit
		EG020B-F: Titanium	7440-32-6	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EM2214208-013	LPSPB03	EG020B-F: Bismuth	7440-69-9	0.001	mg/L	<0.005	<0.005	0.0	No Limit
		EG020B-F: Silver	7440-22-4	0.001	mg/L	<0.005	<0.005	0.0	No Limit
		EG020B-F: Strontium	7440-24-6	0.001	mg/L	13.4	13.4	0.5	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4482405) - continued									
EM2214208-013	LPSPB03	EG020B-F: Thorium	7440-29-1	0.001	mg/L	<0.005	<0.005	0.0	No Limit
		EG020B-F: Uranium	7440-61-1	0.001	mg/L	<0.005	<0.005	0.0	No Limit
		EG020B-F: Titanium	7440-32-6	0.01	mg/L	<0.05	<0.05	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4482406)									
EM2214208-001	GW36866(1)	EG020D-F: Zirconium	7440-67-7	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EM2214208-013	LPSPB03	EG020D-F: Zirconium	7440-67-7	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 4482397)									
EM2214192-001	Anonymous	EG020B-T: Thorium	7440-29-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-T: Uranium	7440-61-1	0.001	mg/L	0.001	0.001	0.0	No Limit
EM2214192-010	Anonymous	EG020B-T: Thorium	7440-29-1	0.001	mg/L	0.005	0.005	0.0	No Limit
		EG020B-T: Uranium	7440-61-1	0.001	mg/L	0.002	0.002	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 4482399)									
EM2214202-002	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.004	0.003	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.002	0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.004	0.003	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.012	0.013	0.0	0% - 50%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.028	0.028	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.38	0.36	5.1	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 4482400)									
EM2214208-011	RB2	EG020B-T: Thorium	7440-29-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-T: Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4482407)									
EM2214208-001	GW36866(1)	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EM2214208-013	LPSPB03	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4482734)									
EM2214207-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	0.0002	0.0002	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 4485857)									
EM2213981-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EM2213981-011	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 4485858)									
EM2214208-004	GW36673(1)	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EM2214208-017	T01	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 4482971)									
EM2213937-021	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	3.5	3.5	0.0	0% - 20%
EM2213937-043	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	29.9	30.5	2.0	0% - 20%
EK040P: Fluoride by PC Titrator (QC Lot: 4482979)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK040P: Fluoride by PC Titrator (QC Lot: 4482979) - continued									
EM2214208-013	LPSPB03	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.3	0.3	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 4482977)								
EA005-P: pH Value	----	----	pH Unit	----	9 pH Unit	100	98.8	101
				----	7 pH Unit	100	99.3	101
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 4482436)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	98.8	91.0	110
				<10	2460 mg/L	98.9	81.7	118
				<10	293 mg/L	95.6	91.0	110
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 4482440)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	101	91.0	110
				<10	2460 mg/L	101	81.7	118
ED037P: Alkalinity by PC Titrator (QCLot: 4482976)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	92.0	85.0	116
ED037P: Alkalinity by PC Titrator (QCLot: 4482978)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	92.4	85.0	116
ED038: Acidity (QCLot: 4482974)								
ED038-P: Acidity as CaCO3	----	----	mg/L	----	20 mg/L	85.6	70.0	130
				----	100 mg/L	89.1	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4482662)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	100	85.8	117
				<1	500 mg/L	106	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4482664)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	99.8	85.8	117
				<1	500 mg/L	105	80.0	120
ED045G: Chloride by Discrete Analyser (QCLot: 4482661)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	101	85.0	115
				<1	1000 mg/L	104	85.0	122
ED045G: Chloride by Discrete Analyser (QCLot: 4482663)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	101	85.0	115
				<1	1000 mg/L	104	85.0	122
ED093F: Dissolved Major Cations (QCLot: 4482403)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	100	80.0	120
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	105	80.0	120
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	101	80.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	98.5	80.0	120

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
ED093F: Dissolved Major Cations (QCLot: 4482408)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	97.3	80.0	120
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	101	80.0	120
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	97.8	80.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	95.2	80.0	120
EG020F: Dissolved Metals by ICP-MS (QCLot: 4482404)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	102	90.4	111
EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	0.02 mg/L	99.3	82.4	109
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	104	89.0	111
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	103	85.0	112
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	98.8	83.5	111
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	99.8	83.2	109
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	102	84.3	110
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	97.2	83.1	107
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	104	84.6	108
EG020A-F: Lithium	7439-93-2	0.001	mg/L	<0.001	0.1 mg/L	102	80.2	112
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	101	84.8	110
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	104	88.3	112
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	102	84.3	110
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	101	82.3	113
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	101	83.7	110
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	109	86.3	112
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	101	91.8	112
EG020F: Dissolved Metals by ICP-MS (QCLot: 4482405)								
EG020B-F: Bismuth	7440-69-9	0.001	mg/L	<0.001	0.1 mg/L	97.4	84.0	112
EG020B-F: Silver	7440-22-4	0.001	mg/L	<0.001	0.02 mg/L	107	83.2	119
EG020B-F: Strontium	7440-24-6	0.001	mg/L	<0.001	0.1 mg/L	104	87.3	114
EG020B-F: Thorium	7440-29-1	0.001	mg/L	<0.001	0.1 mg/L	112	90.2	114
EG020B-F: Titanium	7440-32-6	0.01	mg/L	<0.01	0.1 mg/L	111	81.7	114
EG020B-F: Uranium	7440-61-1	0.001	mg/L	<0.001	0.1 mg/L	102	85.2	113
EG020F: Dissolved Metals by ICP-MS (QCLot: 4482406)								
EG020D-F: Zirconium	7440-67-7	0.005	mg/L	<0.005	0.1 mg/L	87.2	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 4482397)								
EG020B-T: Thorium	7440-29-1	0.001	mg/L	<0.001	0.1 mg/L	109	87.5	117
EG020B-T: Uranium	7440-61-1	0.001	mg/L	<0.001	0.1 mg/L	106	89.1	114
EG020T: Total Metals by ICP-MS (QCLot: 4482399)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	103	90.8	115
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	114	89.2	115
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	99.3	86.4	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020T: Total Metals by ICP-MS (QCLot: 4482399) - continued								
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	102	86.9	112
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	108	86.9	111
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	104	88.3	112
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	112	87.9	113
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	112	86.7	117
EG020T: Total Metals by ICP-MS (QCLot: 4482400)								
EG020B-T: Thorium	7440-29-1	0.001	mg/L	<0.001	0.1 mg/L	108	87.5	117
EG020B-T: Uranium	7440-61-1	0.001	mg/L	<0.001	0.1 mg/L	103	89.1	114
EG035F: Dissolved Mercury by FIMS (QCLot: 4482407)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	97.0	71.6	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4482734)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	92.9	73.4	119
EG050F: Dissolved Hexavalent Chromium (QCLot: 4485857)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	105	80.0	120
EG050F: Dissolved Hexavalent Chromium (QCLot: 4485858)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	106	80.0	120
EK040P: Fluoride by PC Titrator (QCLot: 4482971)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	100	80.8	118
EK040P: Fluoride by PC Titrator (QCLot: 4482979)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	103	80.8	118

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4482662)							
EM2214134-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	89.8	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4482664)							
EM2214208-009	WB5	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4482661)							
EM2214134-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	73.8	70.0	142
ED045G: Chloride by Discrete Analyser (QCLot: 4482663)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED045G: Chloride by Discrete Analyser (QCLot: 4482663) - continued							
EM2214208-009	WB5	ED045G: Chloride	16887-00-6	400 mg/L	# Not Determined	70.0	142
EG020F: Dissolved Metals by ICP-MS (QCLot: 4482404)							
EM2214202-003	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	107	76.6	124
		EG020A-F: Beryllium	7440-41-7	0.2 mg/L	94.4	73.0	120
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	90.7	74.6	118
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	99.7	71.0	135
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	104	78.0	132
		EG020A-F: Copper	7440-50-8	0.2 mg/L	101	76.0	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	97.0	75.0	133
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	98.3	64.0	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	104	73.0	131
		EG020A-F: Vanadium	7440-62-2	0.2 mg/L	101	73.0	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	107	75.0	131
EG020F: Dissolved Metals by ICP-MS (QCLot: 4482406)							
EM2214208-001	GW36866(1)	EG020D-F: Zirconium	7440-67-7	0.2 mg/L	95.3	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 4482399)							
EM2214202-002	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	117	82.0	123
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	102	81.8	123
		EG020A-T: Chromium	7440-47-3	1 mg/L	101	78.9	119
		EG020A-T: Copper	7440-50-8	1 mg/L	111	80.4	118
		EG020A-T: Lead	7439-92-1	1 mg/L	102	80.5	121
		EG020A-T: Nickel	7440-02-0	1 mg/L	114	80.0	118
		EG020A-T: Zinc	7440-66-6	1 mg/L	114	74.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 4482407)							
EM2214208-002	WBGT3	EG035F: Mercury	7439-97-6	0.01 mg/L	76.6	70.0	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4482734)							
EM2214207-002	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	# 41.2	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 4485857)							
EM2213981-002	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	85.5	80.0	120
EG050F: Dissolved Hexavalent Chromium (QCLot: 4485858)							
EM2214208-005	T03	EG050G-F: Hexavalent Chromium	18540-29-9	0.5 mg/L	93.6	80.0	120
EK040P: Fluoride by PC Titrator (QCLot: 4482971)							
EM2213937-022	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	96.0	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 4482979)							
EM2214208-014	WB7	EK040P: Fluoride	16984-48-8	10 mg/L	73.7	70.0	130

Bore	Groundwater level (mbrp)	Field iron measurement (mg/L)	Specific conductivity (us/cm)	TDS (mg/L)	pH	ORP (mV)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Temperature (C)	Comments
Shepparton Formation										
WB1	18.72	5.0	32,959	21,424	6.33	91.7	0.49	6.0	19.89	Clear, slight sulfur odour
WB42	15.09	1.9	50,257	32,667	6.59	106.7	0.90	12.3	21.34	Clear, no odour
SHOB03	13.03	3.4	49,972	32,482	6.37	64.9	0.27	3.8	22.57	Clear, no odour
GW036866(1)	11.78	0.4	32,508	21,130	6.66	53.8	0.61	7.7	21.51	Brown, cloudy, no odour
GW036673(1)	14.88	0.4	60,293	39,190	6.58	116.8	1.01	15.3	24.54	Cloudy grey, no odour
Loxton-Parilla Sands										
WBGT3	13.23	2.0	59,264	38,521	6.62	-54.2	0.25	3.6	21.78	Cloudy grey, sulfur odour
LPSPB03	12.61	0.2	53,251	34,613	6.66	49.2	0.41	5.8	22.15	Cloudy grey, sulfur odour
WB2	17.57	0.05	32,840	21,346	6.61	-42.9	2.42	30.5	20.79	Clear, strong sulfur odour
WB5	16.96	0.18	33,311	21,652	6.6	-74.6	2.78	35.1	20.73	Clear, no odour
WB7	12.24	2.3	57,030	37,070	5.85	8.2	0.59	8.3	21.66	Clear, no odour
WB41	14.84	2.8	46,627	30,308	6.73	76.8	0.82	11.0	20.83	Clear, no odour
GW036866(2)	11.36	0.21	21,414	13,919	6.84	95.0	0.48	5.9	21.64	Brown, cloudy, no odour
Lower Renmark Group										
Karra Homestead	-	0.25	8,708	5,660	6.7	205.0	4.1	48.0	21.18	Clear, no odour
HD1	-	0.14	6,514	4,234	7.58	6.4	0.34	4.6	29.00	Clear, no odour, unable to be dipped due to infrastructure
T01	-	0.22	8,258	5,368	7.33	75.5	1.51	19.8	27.14	Clear, no odour. Unable to be dipped
T02	-	0.025	6,432	4,181	7.33	76.8	1.27	16.5	27.27	Clear, no odour. Unable to be dipped
T03	-	0.2	5,668	3,683	7.2	75.8	1.18	15.5	27.66	Clear, no odour. Unable to be dipped

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A-1.2 Appendix B: Annual Rehabilitation Report 2023

NSW GOVERNMENT

NSW Resources Regulator

ARR0001169

BALRANALD MINERAL SANDS PROJECT ANNUAL REHABILITATION REPORT

Sunday 1 January 2023 to Sunday 31 December 2023

Contents

Summary table

DETAIL	
Mine	Balranald Mineral Sands Project
Reference	ARR0001169
Annual report period commencement date	Sunday 1 January 2023
Annual report period end date	Sunday 31 December 2023
Forward program	FWP0001121
Mining leases	ML 1855 (1992), ML 1736 (1992)
Lease holder(s)	ILUKA RESOURCES LIMITED
Contact	Brendan Isaacs
Date of submission	Monday 26 February 2024

Important

The department may make the information in your report and any supporting information available for inspection by members of the public, including by publication on its website or by displaying the information at any of its offices. If you consider any part of your report to be confidential, please communicate this to the department via the message function on this submission within the NSW Resources Regulator Portal.

Mine details

Project description

Iluka have approval to develop a mineral sands mine in south-western NSW, known as the Balranald Mineral Sands Project. It includes construction, open-cut mining, primary processing, and rehabilitation of two linear mineral sand deposits, known as the West Balranald and Nepean deposits, located approximately 12 kilometres (km) and 66 km north-west of the town of Balranald, respectively. The Balranald Project also included undertaking an approved bulk sampling activity at the West Balranald deposit to trial the use of underground mining methods. On 21 December 2022, Iluka were granted approval to modify the consent (MOD1) to expand the underground mining trial which includes an additional area of disturbance to the approved Balranald Project area to enable primary processing of the ore into heavy mineral concentrate (HMC) and transport of HMC offsite for secondary processing at Iluka's facilities in Victoria and/or WA.

Life of mine

10 years

Current development consents, leases and licences

Development consents granted under the *Environmental Planning and Assessment Act 1979*

SSD-5285
SSD-5285
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SSD-5285

Authorisations covering the mining area granted under the *Mining Act 1992*

ML 1855 (1992), ML 1736 (1992)

Any other approvals, licences, or authorities issued by government agencies that are relevant to the progress of mining operation and rehabilitation activities

EPBC Act Approval (2012/6509)
Environmental Protection Licence (20795)

Summary of the scope and/or purpose of the new applications or modifications to existing approvals (if applicable)

road construction was added to the licence as well as other ancillary activities (sewage treatment, chemical storage and concrete works). A number of air quality, noise and water monitoring points were updated to align with the Environmental Management Plans approved under SSD-5285. EPBC Act Approval 2012/6509 was varied on 1 August 2023 for minor amendments to conditions to reflect the current status of the project. =

Changes to land ownership and land use

Surface disturbance and rehabilitation activities during the reporting period

Surface disturbance and rehabilitation activities that were conducted and an analysis of the progress against the rehabilitation schedule

Construction of the West Balranald Mine officially commenced on 7 August 2023. Approximately 9Ha of native vegetation was cleared within ML1736 for the future mine access road. The previous Forward Program estimated that 108.24Ha of vegetation would be cleared in 2023, a delay in the project schedule has led to this discrepancy. Air core drilling (AC) was completed at West Balranald to define the strand geometry over two areas impacted by faulting at depth. At total of 36 AC drill holes completed for 2,795m. Re-interpretations of the strand were completed followed by a review by the Mining Engineers which confirmed that the new strand geometry in the faulted areas can be mined with the proposed underground techniques. The drilling program required the clearing of approximately 2Ha within ML1736 of Chenopod shrubland for drill rig access. No rehabilitation activities took place during the reporting period.

Rehabilitation planning activities that were conducted, including any specialist studies

Iluka consulted and engaged with RAPs to undertake an Aboriginal Cultural Heritage surface collection program in May 2023 within the additional disturbance area approved under MOD1 Consent. A closure risk assessment workshop was held on 6 December 2023 with Iluka personnel from a range of disciplines. The workshop mapped out key closure risks to inform proposed completion criteria to be included in the Rehabilitation Management Plan.

Overview of subsidence repair and/or remediation works undertaken

No subsidence repair or remediation works took place during the reporting period.

Overview of rehabilitation management and maintenance activities

No rehabilitation undertaken to date.

Details of any rehabilitation actions taken as required by any letters, notices or directions issued by government agencies, including the NSW Resources Regulator

No rehabilitation undertaken to date.

Details of any rehabilitation areas that have achieved the final land use

No rehabilitation undertaken to date.

Key production milestones

MATERIAL	UNIT	FWP0001121 YEAR 1	THIS REPORT
Stripped topsoil (if applicable)	(m^3)	10,000	12,642
Rock/overburden	(m^3)	0	0
Ore	(Mt)	0	0
Reject material[1]	(Mt)	0	0
Product	(Mt)	0	0

[1] This includes coarse rejects, tailings and any other wastes resulting from beneficiation.

Disturbance and rehabilitation statistics

Current disturbance and rehabilitation progression

	ELEMENT	UNIT	THIS REPORT
A	**Total surface disturbance footprint**	(ha)	38.9
B	**Total active disturbance**	(ha)	38.9
C	**Land prepared for rehabilitation**	(ha)	0
D	**Ecosystem and land use establishment**	(ha)	0
E	**Ecosystem and land use development**	(ha)	0
F	**Rehabilitation completion**	(ha)	0

Rehabilitation key performance indicators (KPIs)

	ELEMENT	UNIT	THIS REPORT
G	**Total new active disturbance area**	(ha)	NA - this value will display after 2nd year ARR submission as calculation relies on comparison between sequential yearly ARR data
H	**New rehabilitation commenced during annual reporting period**	(ha)	NA - this value will display after 2nd year ARR submission as calculation relies on comparison between sequential yearly ARR data
I	**Established rehabilitation**	(ha)	0
J	**Annual rehabilitation to disturbance ratio**	%	NA - this value will display after 2nd year ARR submission as calculation relies on comparison between sequential yearly ARR data
K	**Rehabilitated land to total mine footprint**	%	0

Progressive achievement of established rehabilitation

	ELEMENT	UNIT	THIS REPORT
L	Established rehabilitation - agricultural final land uses	%	0
M	Established rehabilitation - native ecosystem final land uses	%	0
N	Established rehabilitation - other/non-vegetated final land uses	%	0

Variation to the rehabilitation schedule

Identify the components of the most recent forward program that were not achieved

N/A

Key factors that delayed progressive rehabilitation

N/A

Outline actions that will be included in the forward program and carried out to minimise disturbance and undertake progressive rehabilitation as far as reasonably practical

N/A

Rehabilitation monitoring and research findings

Rehabilitation monitoring

The rehabilitation monitoring carried out in the annual reporting period

The site has remained in care & maintenance and no rehabilitation has been undertaken at the site and therefore no monitoring of rehabilitation sites or analogue site has commenced. Inspections were carried out for declared weeds during the reporting period and control measures implemented where required. Inspections of water storages and drainage infrastructure were undertaken during the reporting period to ensure stormwater runoff and sediment is being captured and not being discharged offsite.

Status of performance against rehabilitation objectives and rehabilitation completion criteria

The monitoring program that has been implemented

No rehabilitation undertaken to date.

Are all rehabilitation areas in Landform Establishment phase or higher represented in the monitoring program to assess performance against the rehabilitation objectives and approved or, if not yet approved rehabilitation completion criteria and final landform and rehabilitation plan?

0

Year rehabilitation areas will be included as part of the monitoring program

2028

An appraisal of whether rehabilitation is moving towards achieving the proposed rehabilitation objectives, approved or, if not yet approved, rehabilitation completion criteria and final landform and rehabilitation plan as soon as reasonably practicable.

No rehabilitation undertaken to date.

Appraisal description

Rehabilitation is moving towards achieving the final land use as soon as reasonably practicable.

Rehabilitation monitoring program findings

No rehabilitation undertaken to date.

Performance issues and their causes including identification of any knowledge gaps that must be addressed

Nil

Outcomes of rehabilitation research and trials

RRT NUMBER	PROJECT/TRIAL NAME	OBJECTIVE OF TRIAL/PROJECT	METHODOLOGY	EXPECTED DATE OF COMPLETION	STATUS	ON TRACK?
RRT0001115	Lime dosing optimisation	The objective of this study is to identify the minimum limestone addition rate that meets Iluka's environmental obligations and maintains low environmental risk into the future.	The following scope of work has been developed to deliver the project objectives: • STAGE 1 – Review and risk assessment. • STAGE 2 – Scope and plan geochemical laboratory work programme. • STAGE 3 – Geochemical laboratory work program, impact assessment, and limestone amendment procedures. • STAGE 4 – Reporting and final limestone requirements.	30 Jun 2024	Ongoing	Yes

Outcomes of completed trials and research

N/A

Attachment 1 – Reporting Definitions

REPORTING CATEGORY		DEFINITION
A1	Total disturbance footprint – surface disturbance	All areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to surface disturbance activities. The total disturbance footprint is the sum of the total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem and land use establishment, ecosystem and land use development and rehabilitation completion (see definitions below). Underground mining operations should not include the footprint of underground mining areas/subsidence management areas in the total disturbance footprint.
A2	Underground Mining Area	Underground mining operations areas/subsidence management areas.
B	Total active disturbance	Includes on-lease exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpile areas, access tracks and haul roads, active mining areas, waste rock emplacements (active/unshaped/in or out-of-pit), tailings dams (active/unshaped/uncapped) and temporary stabilised areas (e.g. areas sown with temporary cover crops for dust mitigation and temporary rehabilitation).
C	Rehabilitation – land preparation	Includes the sum of all disturbed land within a mining lease that have commenced any, or all, of the following phases of rehabilitation – decommissioning, landform establishment and growth medium development. Refer to the glossary of terms in this document for the definition of these phases of rehabilitation.

REPORTING CATEGORY		DEFINITION
D	Ecosystem and land use establishment	Includes the area which has been seeded/planted with the target vegetation species for the intended final land use. However, vegetation has not matured to a stage where it can be demonstrated that it will be sustainable for the long term and or require only a maintenance regime consistent with target reference/analogue sites. Typically, rehabilitation areas would be in this phase for at least two years (and usually more) before rehabilitation can be classified as being in the ecosystem and land use development phase. This phase does not apply to infrastructure areas that are being retained as part of final land use for the site.
E	Ecosystem and Land Use Development	Rehabilitation has matured to a level where target revegetation outcomes are on a trajectory towards meeting the final rehabilitation objectives and rehabilitation completion criteria (as verified by monitoring). This phase includes infrastructure areas that are to be retained for an approved post mining land use, following completion of all necessary measures to render the infrastructure fit for this purpose (for example structural integrity).
F	Rehabilitation Completion	The NSW Resources Regulator has determined in writing that the mining area has achieved the approved rehabilitation objectives and approved rehabilitation completion criteria and final landform and rehabilitation plan following the submission of *Form: ESF2 Rehabilitation completion and/or review of rehabilitation cost estimate and/or notification of mine or petroleum site closure.*
G	New active disturbance area	The area of any new active disturbance that has been created during the annual reporting period (definition A1 in Table 5).
H	New rehabilitation commenced during annual reporting period	The sum of any new rehabilitation commenced in the annual reporting period. These areas may be in the rehabilitation land preparation phase or the ecosystem & land use establishment phase (definitions C and D in Table 5).
I	Established rehabilitation (hectares)	The total area of land that is verified to be within either the ecosystem and land use development phase or the rehabilitation completion phase (definitions E & F in Table 5).

REPORTING CATEGORY		DEFINITION
J	Annual rehabilitation to disturbance ratio	The rehabilitation to disturbance ratio (H/G) indicates how many hectares of new rehabilitation are undertaken for each hectare of land disturbed during the year. A ratio of 1/1 indicates that the area of new rehabilitation and disturbance in that year are the same.
K	% Rehabilitated land to total mine footprint	The proportion of the total mine footprint (area of land that has been disturbed by past or present surface disturbance activities) that has established rehabilitation (I/A1 x 100). For open cut mining, the proportion of the total mine footprint verified to be “established rehabilitation” should substantially increase as an operation progresses towards mine closure.
L	Established rehabilitation for agricultural final land uses (hectares)	The percentage of total area of land that is verified to be within either the ecosystem and land use development phase or the rehabilitation completion phase (definitions E & F in Table 5) that have been returned to an agricultural final land use.
M	Established rehabilitation for native ecosystem final land uses (hectares)	The percentage of total area of land that is verified to be within either the ecosystem and land use development phase or rehabilitation completion phase (definitions E & F in Table 5) that have been returned to native ecosystem final land use.
N	Established rehabilitation for other/non-vegetated final land uses (hectares)	The percentage of total area of land that is verified to be within either the ecosystem and land use development phase or the rehabilitation completion phase (definitions E & F in Table 5) that have been returned to other/non-vegetated final land use.

Attachment 2 – Definitions

WORD	DEFINITION
Active	In the context of rehabilitation, land associated with mining domains is considered 'active' for the period following disturbance until the commencement of rehabilitation.
Active mining phase of rehabilitation	In the context of rehabilitation, the active mining phase of rehabilitation constitutes the rehabilitation activities undertaken during mining operations such as salvaging and managing soil resources, salvaging habitat resources, and native seed collection. This phase also includes management actions taken during operations to manage risks to rehabilitation and enhance rehabilitation outcomes such as selective handling of waste rock and management of tailings emplacements.
Analogue site	In the context of rehabilitation, an analogue site is a 'reference site' that represents an example of the defining characteristics (such as vegetation composition and structure or agricultural productivity) of the final land use. Characteristics of analogue sites can be assessed to develop the rehabilitation objectives and completion criteria for final land use domains.
Annual rehabilitation report and forward program	As described in the Mining Regulation 2016.
Annual reporting period	As defined in the Mining Regulation 2016.
Closure	A whole-of-mine-life process, which typically culminates in the relinquishment of the mining lease. It includes decommissioning and rehabilitation to achieve the approved final land use(s).
Decommissioning	The process of removing mining infrastructure and removing contaminants and hazardous materials.
Decommissioning Phase of Rehabilitation	Activities associated with the removal of mining infrastructure and removal and/or remediation of contaminants and hazardous materials. In the context of the rehabilitation management plan this phase of rehabilitation may also include studies and assessments associated with decommissioning and demolition of infrastructure or works carried out to make safe or 'fit for purpose' built infrastructure to be retained for future use(s) following lease relinquishment.

WORD	DEFINITION
Department	The Department of Regional NSW.
Disturbance	See Surface Disturbance.
Disturbance area	An area that has been disturbed and that requires rehabilitation. This may include areas such as on-licence exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpile areas, access tracks and haul roads, active mining areas, waste emplacements (active/unshaped/in or out-of-pit), tailings dams (active/unshaped/uncapped), and areas requiring rehabilitation that are temporarily stabilised (i.e. managed to minimise dust generation and/or erosion).
Domain	An area (or areas) of the land that has been disturbed by mining and has a specific operational use (mining domain) or specific final land use (final land use domain). Land within a domain typically has similar geochemical and/or geophysical characteristics and therefore requires specific rehabilitation activities to achieve the associated final land use.
Ecosystem and Land Use Development	This phase of rehabilitation consists of the activities to manage maturing rehabilitation areas on a trajectory to achieving the approved rehabilitation objectives and completion criteria. For vegetated land uses this phase may include processes to develop characteristics of functional self-sustaining ecosystems, such as nutrient recycling, vegetation flowering and reproduction, and increasing habitat complexity, and development of a productive, self-sustaining soil profile. This phase of rehabilitation may include specific vegetation management strategies and maintenance such as tree thinning, supplementary plantings and weed management.
Ecosystem and Land Use Establishment	This phase of rehabilitation consists of the processes to establish the approved final land use following construction of the final landform. For vegetated land uses this rehabilitation phase includes establishing the desired vegetation community and implementing land management activities such as weed control. This phase of rehabilitation may also include habitat augmentation such as installation of nest boxes.
Exploration	Has the same meaning as that term under the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.

WORD	DEFINITION
Final landform and rehabilitation plan	As defined in the Mining Regulation 2016.
Final land use	As defined in the Mining Regulation 2016.
Form and way	Means the form and way approved by the Secretary. Approved form and way documents are available on the Department's website.
Growth Medium Development	This phase of rehabilitation consists of activities required to establish the physical, chemical and biological components of the substrate required to establish the desired vegetation community (including short lived pioneer species. This phase may include spreading the prepared landform with topsoil and/or subsoil and/or soil substitutes, applying soil ameliorants to enhance the physical, chemical and biological characteristics of the growth media, and actions to minimise loss of growth media due to erosion.
Habitat	Has the same meaning as that term under the *Biodiversity Conservation Act 2016* and the *Fisheries Management Act 1994* (as relevant).
Indicator	An attribute of the biophysical environment (e.g. pH, topsoil depth, biomass) that can be used to approximate the progression of a biophysical process. It can be measured and audited to demonstrate (and track) the progress of an aspect of rehabilitation towards a desired completion criterion (i.e. defined end point). It may be aligned to an established protocol and used to evaluate changes in a system.
Land	As defined in the *Mining Act 1992.*
Landform Establishment	This phase of rehabilitation consists of the processes and activities required to construct the final landform. In addition to profiling the surface of rehabilitation areas to the approved final landform profile this phase may include works to construct surface water drainage features, encapsulate problematic materials such as tailings, and prepare a substrate with the desired physical and chemical characteristics (e.g. rock raking or ameliorating sodic materials).
Large mine	As defined in the Mining Regulation 2016.
Lease holder	The holder of a mining lease.

WORD	DEFINITION
Life of mine	The timeframe of how long a mine is approved to mine, from commencement to closure.
Mine rehabilitation portal	Means the NSW Resources Regulator's online portal that lease holders must use (via a registered account) to: ■ upload rehabilitation geographical information system (GIS) spatial data ■ develop rehabilitation GIS spatial data (using online tracing functions) ■ generate rehabilitation plans and rehabilitation statistics using the map viewer and Rehabilitation Key Performance Indicator functionalities. Data submitted to the mine rehabilitation portal is collated in a centralised geodatabase for use by the NSW Resources Regulator to regulate rehabilitation performance of lease holders.
Mining area	As defined in the *Mining Act 1992*.
Mining domain	A land management unit with a discrete operational function (e.g. overburden emplacement), and therefore similar geophysical characteristics, that will require specific rehabilitation treatments to achieve the final land use(s).
Mining land	As defined in the *Mining Act 1992.*
Native vegetation	Has the same meaning as that term under section 60B of the *Local Land Services Act 2013.*
Overburden	Material overlying coal or a mineral deposit.
Performance indicator	An attribute of the biophysical environment (for example pH, slope, topsoil depth, biomass) that can be used to demonstrate achievement of a rehabilitation objective. It can be measured and audited to demonstrate (and track) the progress of an aspect of rehabilitation towards a desired completion criterion, that is, a defined end point. It may be aligned to an established protocol and used to evaluate changes in a system.

WORD	DEFINITION
Phases of rehabilitation	The stages and sequences of actions required to rehabilitate disturbed land to achieve the final land use. The phases of rehabilitation are: ■ active mining ■ decommissioning ■ landform Establishment ■ growth medium development ■ ecosystem and land use establishment ■ ecosystem and land use development.
Progressive rehabilitation	The progress of rehabilitation towards achieving the approved rehabilitation completion criteria. This may be described in terms of domains, phases, performance indicators and rehabilitation completion criteria.
Rehabilitation Completion	The final phase of rehabilitation when a rehabilitation area has achieved the approved rehabilitation objectives and rehabilitation completion criteria for the final land use. Rehabilitation areas may be classified as complete when the NSW Resources Regulator has determined in writing that the relevant rehabilitation obligations have been fulfilled following submission of *Form ESF2 Rehabilitation completion and/or review of rehabilitation cost estimate* application by the lease holder.
Rehabilitation Completion criteria	As defined in the Mining Regulation 2016.
Rehabilitation cost estimate	As defined in the Mining Regulation 2016.
Rehabilitation management plan	As defined in the Mining Regulation 2016.
Rehabilitation objectives	As defined in the Mining Regulation 2016.
Rehabilitation risk assessment	As defined in the Mining Regulation 2016.
Rehabilitation schedule	The defined timeframes for progressive rehabilitation set out in the forward program.

WORD	DEFINITION
Relevant stakeholders	Means any persons or bodies who may be affected by the mining operations, including rehabilitation, carried out on the lease land, and includes: ■ the relevant development consent authority ■ the local council ■ the relevant landholder(s) ■ community consultative committee (if required under the development consent) or equivalent consultative group ■ affected land holder(s) ■ government agencies relevant to the final land use ■ affected infrastructure authorities (electricity, telecommunications, water, pipeline, road, rail authorities) ■ local Aboriginal communities, and ■ any other person or body determined by the Minister to be a relevant stakeholder in relation to a mining lease.
Risk	The effect of uncertainty on objectives. It is measured in terms of consequences and likelihood (AS/NZS ISO 31000:2009).
Secretary	The Secretary of the Department.
Security deposit	An amount that a mining lease holder is required to provide and maintain under a mining lease condition, to secure funding for the fulfilment of obligations under the lease (including obligations that may arise in the future).
Surface disturbance	Includes activities that disturb the surface of the mining area, including mining operations, ancillary mining activities and exploration.
Tailings	A combination of the fine-grained solid material remaining after the recoverable metals and minerals have been extracted from the mined ore, and any process water[2].
Waste	Has the same meaning as that term under the *Protection of the Environment Operations Act 1997*.

[2] Commonwealth of Australia (DITR), 2007. *Tailings Management*.

Attachment 3 – Rehabilitation Complaints

DATE	COMPLAINANT	COMPLAINT DETAILS	RESPONSE DETAILS	STATUS OF RESPONSE	DATE RESPONSE COMPLETED (IF APPLICABLE)

Attachment 4 – Stakeholder consultation

DATE	STAKEHOLDER	CONSULTATION ACTIVITIES AND FORMS	MATTERS SUBJECT TO CONSULTATION	ACTIONS TAKEN
23 Jan 2023	NSW Resources Regulator	Teams meeting	Discuss Final Landuse Rehabilitation Plan (FLRP0001062) and Rehabilitation Objectives (ROBJ0001063) resubmissions.	Re-submit rehabilitation outcome documents for assessment.
22 Sep 2023	NSW Resources Regulator	Team meeting	Submission of Final Landform and Rehabilition Plan and Rehabilition Objectives. Discussion on outstanding matters with spatial data submitted and mining domains.	Amend spatial data and re-submit via the Rehabilitation Portal.

Attachment 5 – Plans

Plan 1A Current status of mining and rehab.pdf

Plan 1BC Current landform contours.zip

A-1.3 Appendix C: Three Year Forward Program 2024-2026

NSW GOVERNMENT

NSW Resources Regulator

FWP0001280

BALRANALD MINERAL SANDS PROJECT FORWARD PROGRAM

Monday 1 January 2024 to Thursday 31 December 2026

Contents

Summary

DETAIL	
Mine	Balranald Mineral Sands Project
Reference	FWP0001280
Forward program commencement date	Monday 1 January 2024
Forward program end date	Thursday 31 December 2026
Forward program revision (if applicable)	
Contact	Brendan Isaacs
Mining leases	ML 1855 (1992), ML 1736 (1992)
Project location	ILUKA RESOURCES LIMITED
Date of submission	Wednesday 28 February 2024

Important

The department may make the information in your program and any supporting information available for inspection by members of the public, including by publication on its website or by displaying the information at any of its offices. If you consider any part of your program to be confidential, please communicate this to the department via the message function on this submission within the NSW Resources Regulator Portal.

Three-year forecast – surface disturbance activities

Project description

Iluka have approval to develop a mineral sands mine in south-western NSW, known as the Balranald Mineral Sands Project. It includes construction, open-cut mining, primary processing, and rehabilitation of two linear mineral sand deposits, known as the West Balranald and Nepean deposits, located approximately 12 kilometres (km) and 66 km north-west of the town of Balranald, respectively. The Balranald Project also included undertaking an approved bulk sampling activity at the West Balranald deposit to trial the use of underground mining methods. On 21 December 2022, Iluka were granted approval to modify the consent (MOD1) to expand the underground mining trial which includes an additional area of disturbance to the approved Balranald Project area to enable primary processing of the ore into heavy mineral concentrate (HMC) and transport of HMC offsite for secondary processing at Iluka's facilities in Victoria and/or WA.

Description of surface disturbance activities

Exploration activities

Prior to mining the northern faulted area, a grade control drill program consisting of between 10 to 16 AC drill holes will be required to refine the strand geometry and this is proposed to be completed in late 2025 or 2026. Further Sonic drilling will be required in 2025 – 2026 to support conversion of Indicated Resources to Measured Resource classification in advance of mining.

Construction activities

Construction of the Balranald Minerals Sands Underground Mining operation commenced on 7 August 2023. Construction will continue in 2024 and involves the clearing of native vegetation and soil stripping within ML1736 and ML1855, with the following infrastructure proposed to be located within this area: • processing plant infrastructure, comprising wet concentrator plant (WCP), flotation plant and wet high intensity magnetic separation plant (WHIMS); • product and tails pad(s); • process water, potassium amyl xanthate (PAX) and fines dams; • underground mining infrastructure; • temporary stockpiles (topsoil, subsoil and overburden); • timber stockpiles (felled vegetation); • hardstand and laydown areas; • site offices, warehousing, workshops, amenities and carparking; • services and utilities infrastructure; • fuel storage and dispensing area; • telecommunications tower; • mine access road and accommodation camp; and • internal access tracks and roadways.

Mining schedule

Mining development method and sequencing and general mine features.

Mineral ore will be extracted to surface by utilising underground bore hole mining technology developed during previous bulk sampling activities. The predicted processing rate is anticipated to be between 50 and 200 tph, consistent with the previous bulk sampling activity. Mining stopes and drill pads will be developed at strategic locations within the mining panels to accommodate the directional drill rigs for the extraction of ore and re-injection of fine tailings and slimes. An underground pillar will be left after every 11th underground stope or approximately 500m to ensure stability and maintain ground monitoring infrastructure. The extension of the underground mining trial has been approved for up to six years with mining operations scheduled to commence during 2025.

Areas identified for emplacements, the sequencing of emplacements, construction, and management.

Some temporary stockpiling of materials will be required, with topsoil stockpiled to a maximum height of 2m to preserve soil biota and minimise compaction. Subsoil will be stockpiled to a maximum height of 10m, dependent on soil properties and condition. Stockpile attributes will be recorded including location, placement date, originating vegetation community, material strip depth, soil type, stripping conditions and volumes. Stockpiles will be managed in accordance with the erosion and sediment control measures outlined in the Water Management Plan. Vehicle access to stockpiles will be controlled to prevent further compaction and erosion. Weeds will be managed on topsoil stockpiles to minimise weed seed accumulation and spread. During mining operations topsoil, subsoil and approximately 2m of overburden will be pre-stripped from the mine path and stockpiled for use in the rehabilitation phase. Sand tailings from ore processing will be placed within the pre-stripped mining voids and the next phase of pre-stripping volumes direct placed. This includes overburden, subsoil and some topsoil from the proceeding mining voids. A temporary landform will be constructed approximately 1-2m above natural surface to account for expected subsidence. Final land form establishment works will be undertaken once subsidence has stabilised according to monitoring results. A direct strip and replace approach will then be adopted as the general mining practice where reasonably practicable.

Processing infrastructure activities and the location of tailings facilities and schedule for emplacement.

The processing plant will have a number of circuits including the screening , wet concentrator plant, flotation plant and wet high intensity magnetic separation plant. The ore will be concentrated through the processing plant to generate two primary product streams, magnetic Heavy Mineral Concentrate (HMC) and non-magnetic HMC. HMC will be temporarily stockpiled on site and transported to an off-site location for processing. Two primary tailings streams will be generated. These are fine particle (slimes) which is combined with floatation plant waste, and courser sand tails. The coarse sand tails will be dewatered and stockpiled

prior to being mechanically placed in the pre-stripped voids ahead of underground mining. The topsoil, subsoil and overburden pre-stripped from these areas prior to the emplacement of the coarse sand tails will be returned in order to achieve a sustainable rehabilitation outcome. The majority of the fine sand and flotation process tails will be reinjected underground in accordance with processes and management measures outlined in the Water Management Plan. Processing is scheduled to commence in 2025 shortly after underground mining commences.

Waste disposal and materials handling operations.

Putrescible waste generation will be disposed of in onsite skip bins, bins will remain covered at all times and replaced on a regular basis by a third party contractor who will dispose of the waste to an appropriately licenced waste facility. There may be an opportunity to manage putrescible waste onsite, this will be identified through potential long-term recycling initiatives developed during the operational phase. Liquid hydrocarbons will be stored within purpose built bunds that can contain 120% of the largest container to fully contain any leakage. Other hydrocarbon waste such as oil filters, fuel filters, oily rags and spill absorbents will be stored separately in plastic bins to prevent leakage of hydrocarbons. Hydrocarbon waste will be collected by a licenced third party contractor and disposed of at an appropriately licenced waste facility. Soils contaminated with hydrocarbons will be collected by scraping up the minimum amount of soil necessary and storing in plastic bins or 1000L shuttles for collection by a licenced third party contractor and disposal to an appropriately licenced waste facility. For larger amounts of contaminated soil, a lined sump may be used to temporarily store contaminated soil for either onsite remediation and disposal in pit below the overburden layer or disposal offsite to an appropriately licenced facility.

Key production milestones

MATERIAL	UNIT	YEAR 1	YEAR 2	YEAR 3
Stripped topsoil (if applicable)	(m^3)	355,000	120,000	60,000
Rock/overburden	(m^3)	155,000	475,000	265,000
Ore	(Mt)	0	0.18	1.04
Reject material[1]	(Mt)	0	0.09	0.54
Product	(Mt)	0	0.09	0.5

[1] This includes coarse rejects, tailings and any other wastes resulting from beneficiation.

Three-year rehabilitation forecast

Rehabilitation planning schedule

Rehabilitation planning schedule

Planning for the initial resource recovery (topsoil, subsoil and timber) will occur during 2024 prior to the commencement of clearing and stripping works. A mine plan will be developed to depict where temporary topsoil, subsoil and timber stockpiles are to be constructed. Prior to the commencement of mining operations in 2025 a direct replacement plan for overburden, subsoil and topsoil will be established that includes sequencing and scheduling of material movements ahead of underground mining. Subsidence monitoring programs will be developed prior to commencement of underground mining in 2025 to monitor areas where underground mining has concluded to understand the rate of subsidence and when maximum subsidence is reached to allow final land form establishment to be undertaken.

Stakeholder consultation

Balranald Shire Council will be consulted in 2024 to finalise the Voluntary Planning Agreement and Road Maintenance Agreement required under condition 18 of Schedule 2 and condition 25 of Schedule 3 for the Balranald Mineral Sands Project Development Consent (SSD-5285). Balranald Shire Council and Transport for NSW will be consulted during 2024 regarding the required public road upgrades required under Condition 22 of Schedule 3 for the Balranald Mineral Sands Project Development Consent (SSD-5285). Consultation with RAPs will continue to maintain the Aboriginal Cultural Heritage Working Group. The group will meet at least twice per year, and will be an advisory committee which Iluka will work with in relation to ongoing management of Aboriginal heritage associated with the project. Community consultation will be undertaken over the next three years, including attending community events, providing project updates and responding to queries or complaints during the construction phase.

Rehabilitation studies, risk assessments and/or design work

A risk assessment will be conducted to identify risks associated with preparing a landform ahead of underground mining. Monitoring results and studies from previous underground mining trials will be used to better understand subsidence behavior and stability issues after the extraction of mineral sands at depth. The outcome of the studies will inform how the final landform will present and any re-work required prior to ecosystem establishment. The land prepared in front of underground mining operations will be constructed approximately 1-3m above natural surface and be informed by these studies and local geology.

NSW Resources Regulator

Rehabilitation research and trials

RRT NUMBER	PROJECT/TRIAL NAME	OBJECTIVE OF TRIAL/PROJECT	METHODOLOGY	EXPECTED DATE OF COMPLETION	STATUS
FWP0001280					

Rehabilitation maintenance and corrective actions

No rehabilitation activities were undertaken during the last reporting period due to the site being in care & maintenance and therefore no rehabilitation maintenance or corrective actions are planned to be carried out during the current reporting period. Inspections and control of declared weeds will continue at the site during care & maintenance as will erosion and sediments controls. The site will be inspected after significant rain events to ensure drainage structures are working effectively and there is no significant erosion occurring to land or stockpiled materials. Maintenance of drainage and erosion control infrastructure will be undertaken as necessary.

Rehabilitation schedule

During the construction period resource recovery including felled vegetation, topsoil and subsoil will be implemented for later use in rehabilitation phases. During 2024 and 2025 rehabilitation (prehab) will be undertaken ahead of the underground mining operations to ensure there is 50m between underground mining and surface disturbance activities. Topsoil, subsoil and overburden will be removed ahead of mining to create a shallow void (approx. 2.5m) and stockpiled adjacent the mine path. Sand tailings from the processing plant will be returned to the mining pits for encapsulation. Once there is a sufficient buffer, soil will be stripped and direct replaced onto the pre-prepared mining pits approximately 1-3m above natural surface to encapsulate the tailings that have been returned to the void. The final landform once underground mining is completed will be allowed to subside with any final land forming to be completed when a risk assessment informs it is safe to do so. Final land forming may involve minor shaping and contour ripping of batter slopes as required to create a safe, stable and non-polluting landform. Seeding methodologies may include dozer seeding, drone seeding or hand seeding native species onto prepared topsoil.

Subsidence remediation for underground operations

Monitoring of pre-prepared areas ahead of underground mining will be undertaken from 2025 to establish the rate of subsidence and expected maximum subsidence. This will inform the timing of final landform establishment and the extent of re-work required for ecosystem establishment.

Progressive mining and rehabilitation statistics

Three-yearly forecast cumulative disturbance and rehabilitation progression

	FORECAST	UNIT	YEAR 1	YEAR 2	YEAR 3
A	**Total surface disturbance footprint**	(ha)	215.96	254.5	283.32
B	**Total active disturbance**	(ha)	215.96	254.5	283.32
P	**Total new area of land proposed for active rehabilitation**	(ha)	0	0	0

Rehabilitation key performance indicators (KPIs)

	FORECAST	UNIT	YEAR 1	YEAR 2	YEAR 3
O	**Total new active disturbance area**	(ha)	177.06	38.54	28.81
P	**Total new area of land proposed for active rehabilitation during the reporting period**	(ha)			
Q	**Annual rehabilitation to disturbance ratio**				

Attachment 1 – Reporting Definitions

REPORTING CATEGORY		DEFINITION
A	Total disturbance footprint – surface disturbance	All areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to surface disturbance activities. The total disturbance footprint is the sum of the total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem and land use establishment, ecosystem and land use development and rehabilitation completion (see definitions below). Underground mining operations should not include the footprint of underground mining areas/subsidence management areas in the total disturbance footprint.
B	Total active disturbance	Includes on-lease exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpile areas, access tracks and haul roads, active mining areas, waste rock emplacements (active/unshaped/in or out-of-pit), tailings dams (active/unshaped/uncapped) and temporary stabilised areas (e.g. areas sown with temporary cover crops for dust mitigation and temporary rehabilitation).
C	Rehabilitation – land preparation	Includes the sum of all disturbed land within a mining lease that have commenced any, or all, of the following phases of rehabilitation – decommissioning, landform establishment and growth medium development. Refer to the glossary of terms in this document for the definition of these phases of rehabilitation.
D	Ecosystem and land use establishment	Includes the area which has been seeded/planted with the target vegetation species for the intended final land use. However, vegetation has not matured to a stage where it can be demonstrated that it will be sustainable for the long term and or require only a maintenance regime consistent with target reference/analogue sites. Typically, rehabilitation areas would be in this phase for at least two years (and usually more) before rehabilitation can be classified as being in the ecosystem and land use development phase. This phase does not apply to infrastructure areas that are being retained as part of final land use for the site.

REPORTING CATEGORY	DEFINITION
O	The area of any new active disturbance that will be created during the next three years, as defined under definition A1 (definition A1 Table 5).
P	The sum of any new rehabilitation to be commenced in the next three years. These areas may be in the phases "Rehabilitation - Land Preparation" or the "Ecosystem & Land Use Establishment" (definitions C & D in Table 5).
Q	The rehabilitation to disturbance ratio (S / R) indicates how many hectares of new rehabilitation are undertaken for each hectare of land disturbed during the three years. A ratio of 1/1 indicates that the area of new rehabilitation and disturbance in that period are the same.

Attachment 2 – Definitions

WORD	DEFINITION
Active	In the context of rehabilitation, land associated with mining domains is considered 'active' for the period following disturbance until the commencement of rehabilitation.
Active mining phase of rehabilitation	In the context of rehabilitation, the active mining phase of rehabilitation constitutes the rehabilitation activities undertaken during mining operations such as salvaging and managing soil resources, salvaging habitat resources, and native seed collection. This phase also includes management actions taken during operations to manage risks to rehabilitation and enhance rehabilitation outcomes such as selective handling of waste rock and management of tailings emplacements.
Analogue site	In the context of rehabilitation, an analogue site is a 'reference site' that represents an example of the defining characteristics (such as vegetation composition and structure or agricultural productivity) of the final land use. Characteristics of analogue sites can be assessed to develop the rehabilitation objectives and completion criteria for final land use domains.
Annual rehabilitation report and forward program	As described in the Mining Regulation 2016.
Annual reporting period	As defined in the Mining Regulation 2016.
Closure	A whole-of-mine-life process, which typically culminates in the relinquishment of the mining lease. It includes decommissioning and rehabilitation to achieve the approved final land use(s).
Decommissioning	The process of removing mining infrastructure and removing contaminants and hazardous materials.
Decommissioning Phase of Rehabilitation	Activities associated with the removal of mining infrastructure and removal and/or remediation of contaminants and hazardous materials. In the context of the rehabilitation management plan this phase of rehabilitation may also include studies and assessments associated with decommissioning and demolition of infrastructure or works carried out to make safe or 'fit for purpose' built infrastructure to be retained for future use(s) following lease relinquishment.

WORD	DEFINITION
Department	The Department of Regional NSW.
Disturbance	See Surface Disturbance.
Disturbance area	An area that has been disturbed and that requires rehabilitation. This may include areas such as on-licence exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpile areas, access tracks and haul roads, active mining areas, waste emplacements (active/unshaped/in or out-of-pit), tailings dams (active/unshaped/uncapped), and areas requiring rehabilitation that are temporarily stabilised (i.e. managed to minimise dust generation and/or erosion).
Domain	An area (or areas) of the land that has been disturbed by mining and has a specific operational use (mining domain) or specific final land use (final land use domain). Land within a domain typically has similar geochemical and/or geophysical characteristics and therefore requires specific rehabilitation activities to achieve the associated final land use.
Ecosystem and Land Use Development	This phase of rehabilitation consists of the activities to manage maturing rehabilitation areas on a trajectory to achieving the approved rehabilitation objectives and completion criteria. For vegetated land uses this phase may include processes to develop characteristics of functional self-sustaining ecosystems, such as nutrient recycling, vegetation flowering and reproduction, and increasing habitat complexity, and development of a productive, self-sustaining soil profile. This phase of rehabilitation may include specific vegetation management strategies and maintenance such as tree thinning, supplementary plantings and weed management.
Ecosystem and Land Use Establishment	This phase of rehabilitation consists of the processes to establish the approved final land use following construction of the final landform. For vegetated land uses this rehabilitation phase includes establishing the desired vegetation community and implementing land management activities such as weed control. This phase of rehabilitation may also include habitat augmentation such as installation of nest boxes.
Exploration	Has the same meaning as that term under the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.

WORD	DEFINITION
Final landform and rehabilitation plan	As defined in the Mining Regulation 2016.
Final land use	As defined in the Mining Regulation 2016.
Form and way	Means the form and way approved by the Secretary. Approved form and way documents are available on the Department's website.
Growth Medium Development	This phase of rehabilitation consists of activities required to establish the physical, chemical and biological components of the substrate required to establish the desired vegetation community (including short lived pioneer species. This phase may include spreading the prepared landform with topsoil and/or subsoil and/or soil substitutes, applying soil ameliorants to enhance the physical, chemical and biological characteristics of the growth media, and actions to minimise loss of growth media due to erosion.
Habitat	Has the same meaning as that term under the *Biodiversity Conservation Act 2016* and the *Fisheries Management Act 1994* (as relevant).
Indicator	An attribute of the biophysical environment (e.g. pH, topsoil depth, biomass) that can be used to approximate the progression of a biophysical process. It can be measured and audited to demonstrate (and track) the progress of an aspect of rehabilitation towards a desired completion criterion (i.e. defined end point). It may be aligned to an established protocol and used to evaluate changes in a system.
Land	As defined in the *Mining Act 1992.*
Landform Establishment	This phase of rehabilitation consists of the processes and activities required to construct the final landform. In addition to profiling the surface of rehabilitation areas to the approved final landform profile this phase may include works to construct surface water drainage features, encapsulate problematic materials such as tailings, and prepare a substrate with the desired physical and chemical characteristics (e.g. rock raking or ameliorating sodic materials).
Large mine	As defined in the Mining Regulation 2016.
Lease holder	The holder of a mining lease.

WORD	DEFINITION
Life of mine	The timeframe of how long a mine is approved to mine, from commencement to closure.
Mine rehabilitation portal	Means the NSW Resources Regulator's online portal that lease holders must use (via a registered account) to: ■ upload rehabilitation geographical information system (GIS) spatial data ■ develop rehabilitation GIS spatial data (using online tracing functions) ■ generate rehabilitation plans and rehabilitation statistics using the map viewer and Rehabilitation Key Performance Indicator functionalities. Data submitted to the mine rehabilitation portal is collated in a centralised geodatabase for use by the NSW Resources Regulator to regulate rehabilitation performance of lease holders.
Mining area	As defined in the *Mining Act 1992*.
Mining domain	A land management unit with a discrete operational function (e.g. overburden emplacement), and therefore similar geophysical characteristics, that will require specific rehabilitation treatments to achieve the final land use(s).
Mining land	As defined in the *Mining Act 1992.*
Native vegetation	Has the same meaning as that term under section 60B of the *Local Land Services Act 2013.*
Overburden	Material overlying coal or a mineral deposit.
Performance indicator	An attribute of the biophysical environment (for example pH, slope, topsoil depth, biomass) that can be used to demonstrate achievement of a rehabilitation objective. It can be measured and audited to demonstrate (and track) the progress of an aspect of rehabilitation towards a desired completion criterion, that is, a defined end point. It may be aligned to an established protocol and used to evaluate changes in a system.

WORD	DEFINITION
Phases of rehabilitation	The stages and sequences of actions required to rehabilitate disturbed land to achieve the final land use. The phases of rehabilitation are: ■ active mining ■ decommissioning ■ landform Establishment ■ growth medium development ■ ecosystem and land use establishment ■ ecosystem and land use development.
Progressive rehabilitation	The progress of rehabilitation towards achieving the approved rehabilitation completion criteria. This may be described in terms of domains, phases, performance indicators and rehabilitation completion criteria.
Rehabilitation Completion	The final phase of rehabilitation when a rehabilitation area has achieved the approved rehabilitation objectives and rehabilitation completion criteria for the final land use. Rehabilitation areas may be classified as complete when the NSW Resources Regulator has determined in writing that the relevant rehabilitation obligations have been fulfilled following submission of *Form ESF2 Rehabilitation completion and/or review of rehabilitation cost estimate* application by the lease holder.
Rehabilitation Completion criteria	As defined in the Mining Regulation 2016.
Rehabilitation cost estimate	As defined in the Mining Regulation 2016.
Rehabilitation management plan	As defined in the Mining Regulation 2016.
Rehabilitation objectives	As defined in the Mining Regulation 2016.
Rehabilitation risk assessment	As defined in the Mining Regulation 2016.
Rehabilitation schedule	The defined timeframes for progressive rehabilitation set out in the forward program.

WORD	DEFINITION
Relevant stakeholders	Means any persons or bodies who may be affected by the mining operations, including rehabilitation, carried out on the lease land, and includes: ■ the relevant development consent authority ■ the local council ■ the relevant landholder(s) ■ community consultative committee (if required under the development consent) or equivalent consultative group ■ affected land holder(s) ■ government agencies relevant to the final land use ■ affected infrastructure authorities (electricity, telecommunications, water, pipeline, road, rail authorities) ■ local Aboriginal communities, and ■ any other person or body determined by the Minister to be a relevant stakeholder in relation to a mining lease.
Risk	The effect of uncertainty on objectives. It is measured in terms of consequences and likelihood (AS/NZS ISO 31000:2009).
Secretary	The Secretary of the Department.
Security deposit	An amount that a mining lease holder is required to provide and maintain under a mining lease condition, to secure funding for the fulfilment of obligations under the lease (including obligations that may arise in the future).
Surface disturbance	Includes activities that disturb the surface of the mining area, including mining operations, ancillary mining activities and exploration.
Tailings	A combination of the fine-grained solid material remaining after the recoverable metals and minerals have been extracted from the mined ore, and any process water[2].
Waste	Has the same meaning as that term under the *Protection of the Environment Operations Act 1997*.

[2] Commonwealth of Australia (DITR), 2007. *Tailings Management*.

Attachment 3 – Plans

Plan 2A_Forecast Data Year 1_2024.pdf

Plan 2B_Forecast Data Year 2_2025.pdf

Plan 2C_Forecast Data Year 3_2026.pdf

A-1.4 Appendix D: Malleefowl and raptor pre-disturbance survey report 2023

Balranald Mineral Sands Project

Malleefowl and raptor pre-disturbance survey report

Prepared for Iluka Resources Limited

October 2023

Balranald Mineral Sands Project

Malleefowl and raptor pre-disturbance survey report

Iluka Resources Limited

E230962 RP1

October 2023

Version	Date	Prepared by	Reviewed by	Comments
V1	29 September 2023	Jamie Barney	Sarah Perry	Draft
V2	10 October 2023	Jamie Barney	Sarah Perry	Final

Approved by

Sarah Perry
Associate Ecologist
10 October 2023

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Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was commissioned by Iluka Resources Limited (Iluka) to undertake pre-disturbance surveys for the Balranald Mineral Sands Project (the project) in order to:

- satisfy the Commonwealth approval (EPBC 2012/6509) requirements for Malleefowl outlined in the Commonwealth Biodiversity Management Plan (EMM 2023a)
- satisfy the New South Wales (NSW) State approval (SSD-5285) requirements for raptors outlined in the NSW Biodiversity Management Plan (EMM 2023b).

1.1 Purpose of this report

This report focuses on the following pre-clearance surveys undertaken by EMM in accordance with the Iluka's Commonwealth and State Biodiversity Management Plans:

- Map Malleefowl mounds in MOD1 disturbance areas previously mapped as moderate, high and very high Malleefowl habitat (Niche 2016).
- Assess nesting sites for listed raptor species including Black falcon (*Falco subniger*), Grey Falcon (*Falco hypoleucos*), Little Eagle (*Hieraaetus morphnoides*), Spotted Harrier (*Circus assimilis*) and White-bellied Sea-Eagle (*Haliaeetus leucogaster*).

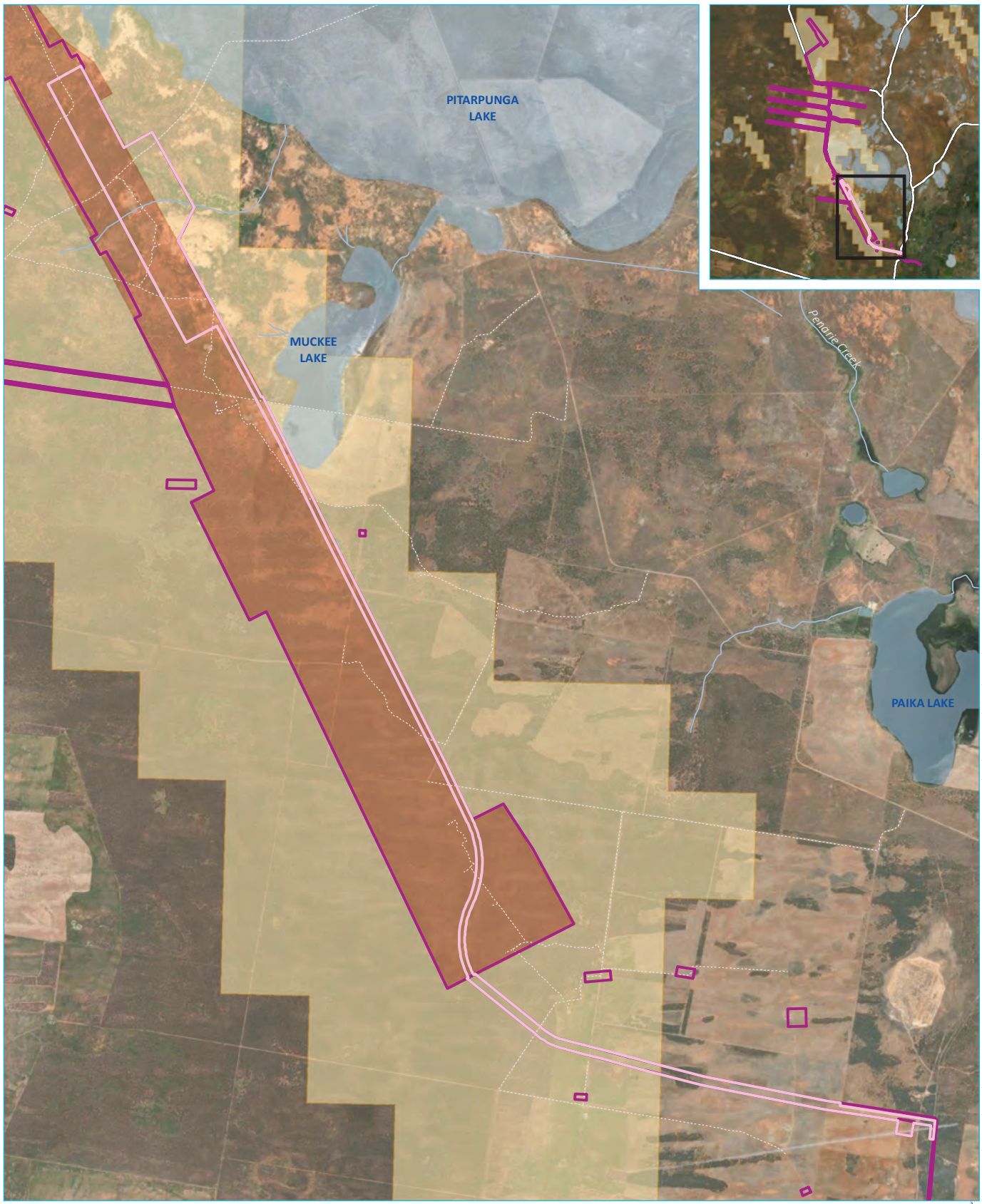
1.2 Project background

Iluka has approval to develop a mineral sand mine in south-western (NSW), known as the Balranald Project. It includes construction, mining, primary processing, and rehabilitation of two linear mineral sand deposits, known as the West Balranald and Nepean deposits, located approximately 12 kilometres (km) and 66 km north-west of the town of Balranald (Balranald town), respectively.

Development consent (SSD-5285) was granted for the Balranald Project by a delegate of the NSW Minister for Planning under the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 5 April 2016 (herein referred to as the consent). Approval was also granted under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2012/6509) by a delegate of the Commonwealth Minister for the Environment on 6 January 2017 (herein referred to as the Commonwealth approval). The project EIS was supported by a Biodiversity Assessment prepared by Niche Environment and Heritage Pty Limited in 2016 (Niche 2016).

Since the consent was granted, Iluka undertook some of the approved bulk sampling activity between 2016 and 2020, involving the extraction of the mineral ore from depth using trial underground mining within the approved disturbance area of the West Balranald deposit. On 21 December 2022, Iluka were granted approval to modify the consent (MOD1; Figure 1.1) to expand the underground mining trial which includes an additional area of disturbance to the approved Balranald Project area to enable primary processing of the ore into heavy mineral concentrate (HMC) and transport of HMC offsite for secondary processing at Iluka's facilities in Victoria and/or Western Australia (WA).

In accordance with Commonwealth and State approval requirements Biodiversity Management Plans (BMPs) have been approved with this report satisfying the Pre-disturbance requirements for EPBC 2012/6509 and SSD-5285 respectively.



Source: EMM (2023); Iluka Resources (2021); ESRI (2023); DFSI (2017); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 54

N

\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR004_SiteLayout_20230929_01.mxd 9/10/2023

KEY

- Revised project area
- MOD1

Existing environment

- Existing track
- Watercourse/drainage line
- Waterbody
- Exploration Licence (EL7450)
- Mining Lease (ML1736)

Project conceptual layout

Balranald Mineral Sands Project
Malleefowl Pre-disturbance
Report Figure 1.1

EMM
creating opportunities

2 Methods

2.1 Field investigation

2.1.1 Hollow bearing trees

A comprehensive hollow bearing tree survey was undertaken by EMM in September 2022 within MOD1 areas mapped as medium, medium-high tree hollow density (Niche 2016) (condition 2(a) EPBC 2012/6509), guided by hollow bearing tree survey methods in the Biodiversity Assessment Method (BAM) (DPIE2020a; DPIE2020b).

Transect surveys were undertaken by two Ecologists up to 20 metres (m) apart, to search for and record hollow bearing trees to determine suitability for Corben's Long-eared Bat. Hollow bearing trees were individually counted, coordinates recorded from a hand-held GPS, tree species (where possible), size of hollow, and count of hollows. Hollows were categorised and counted from small (<5 centimetres (cm)), medium (5–20 cm), large (>20 cm) to very large (>40 cm), to assess the suitability of the hollow for Corben's Long-eared Bat (i.e. small and medium hollows at least 1 m above the ground).

These surveys were not repeated in 2023 as the site conditions remain stable, the approach for vegetation clearance is set out clearly in the Commonwealth and State BMPs.

2.1.2 Malleefowl

Targeted Malleefowl surveys were undertaken by EMM in September 2022 and September 2023 within the MOD1 disturbance area and a 200 m buffer. The areas surveyed were in habitat mapped as moderate, high and very high suitability for Malleefowl (Niche 2016) (condition 2(a) EPBC 2012/6509). Survey methods were conducted in accordance with the Commonwealth Guidelines for Australia's threatened birds (DEWHA 2010). Suitable Malleefowl habitat includes PCT 170 – Chenopod sandplain mallee woodland/shrubland and PCT 171 – Spinifex linear dune mallee.

Transect surveys were undertaken by two personnel including at least one ecologist, searching for direct sightings, nest mounds, footprint tracks, feathers, and listening for calls. When Malleefowl nest mounds were identified, they were recorded as being either active, with signs of recent use including a well-established mound, footprint tracks and recent leaf litter, or inactive, being weathered down, and lacking signs of recent use. The location of each Malleefowl mound was recorded from coordinates obtained from a hand-held GPS.

2.1.3 Raptor nest

In September 2023, EMM conducted surveys to identify potential active raptor nests. This survey involved two individuals, including an ecologist, who conducted transect surveys across all vegetation zones within the MOD1 disturbance area. During these surveys, handheld GPS devices were used to accurately record the locations of each nest. Additionally, photographs were taken of each nest, documenting whether the nest was currently in use by raptors and the condition of the nest.

2.2 Limitations

Condition 2aii of the approval (EPBC 2012/6509) requires pre-disturbance surveys for Corben's Long-eared Bat. The approval defines pre-disturbance surveys as surveys in strict accordance with Survey guidelines for Australia's threatened bats (DEWHA 2010a), which require 20 trap nights over a minimum of five nights in areas <50 hectares (ha), or another method approved by the Department. The purpose of the surveys conducted in September 2022 was to collect detailed information regarding the number and suitability of hollows for Corben's Long-eared Bat to inform clearing processes for the Commonwealth BMP. Iluka will undertake all clearance activities in accordance with the requirements of Commonwealth and State BMPs.

3 Results

3.1 Hollow bearing trees

A total of 278 hollow bearing trees were identified within MOD1 during the 2022 survey in areas mapped as medium or medium-high tree hollow density (Figure 3.1). Most hollow bearing trees identified had small and medium hollows, often with several hollows on single trees. All trees with small and medium hollows above 1 m from the ground were considered to be suitable for Corben's Long-eared Bat. Figure 3.1 shows the location of hollow bearing trees identified within MOD1, and Appendix A details the survey results for the 278 hollow bearing trees recorded.

3.2 Malleefowl

Nine Malleefowl mounds were discovered during the 2022 and 2023 surveys within the MOD1 disturbance area and 200 m buffer Figure 3.2). During August 2023, four mounds were removed by Iluka Resources Limited to avoid Malleefowl usage during the 2023 breeding season. Five Mounds now remain within the disturbance area and 200 m buffer, with only one confirmed as active as of 7 September 2023. One direct observation of Malleefowl and two indirect sighting of Malleefowl footprints were recorded during the 2023 surveys; no sightings or footprint records were made during the 2022 surveys.

Table 3.1 Malleefowl Mounds

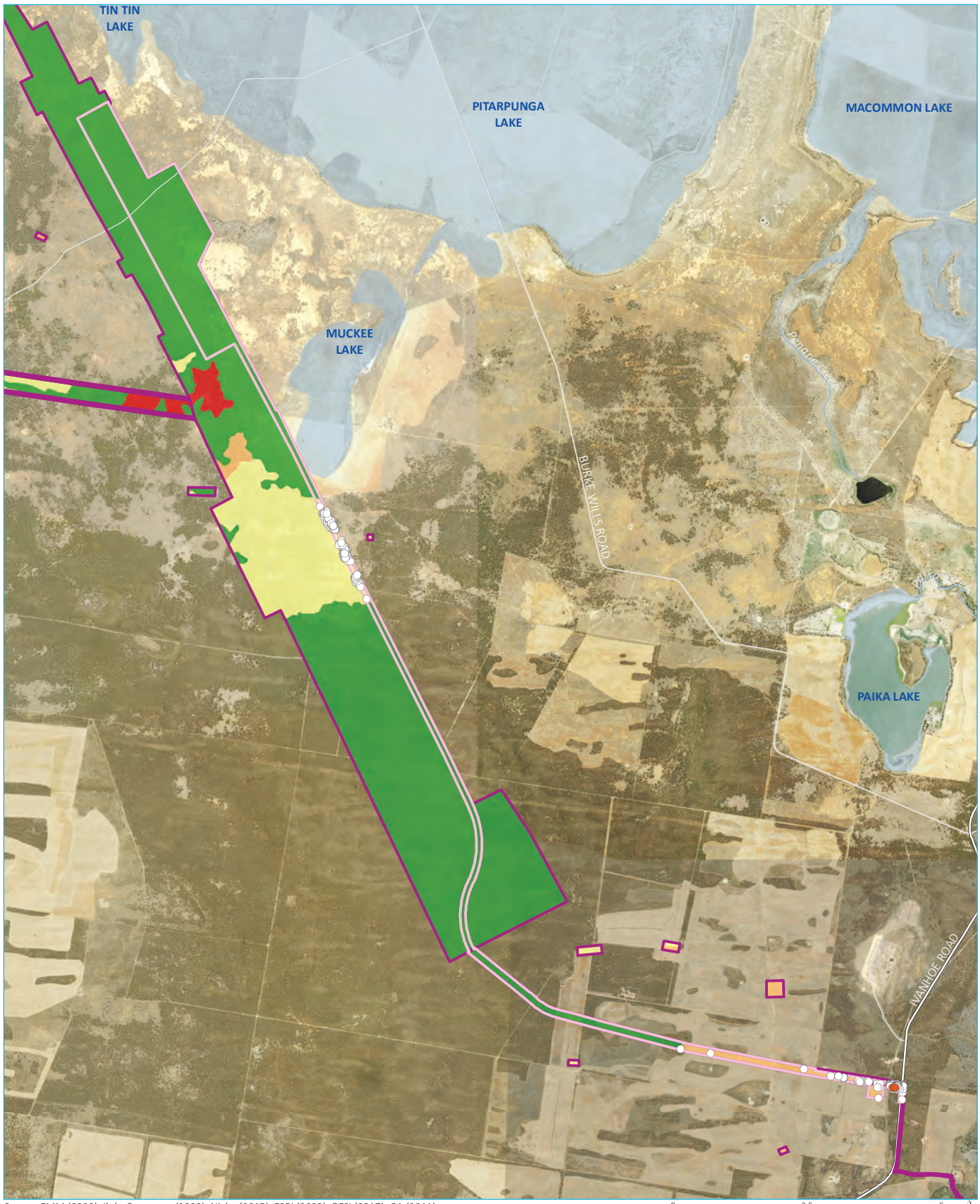
ID	Malleefowl Usage (September 2023)	Coordinates (GDA 2020 Zone 54)	Location
BWM1	Inactive - destroyed	-34.530922, 143.499518	Within MOD 1 disturbance area
BWM2	Active – Malleefowl observed on mound	-34.508701, 143.495671	Within 200 m buffer of MOD1
BWM3	Inactive - Destroyed	-34.504774, 143.495877	Within MOD 1 disturbance area
BWM4	Inactive - Destroyed	-34.493365, 143.488701	Within MOD 1 disturbance area
BWM5	Inactive - Destroyed	-34.492144, 143.487345	Within MOD 1 disturbance area
BWM6	Likely Inactive - Malleefowl footprints on Mound, no other signs of usage.	-34.482771, 143.482957	Within 200 m buffer of MOD1
BWM7	Unchecked during September 2023 surveys as the mound falls outside of the MOD1 disturbance area and buffer	-34.525461, 143.504630	Outside of MOD 1 disturbance area and 200 m buffer
BWM8	Inactive – Long unused mound	-34.532278, 143.501611	Within MOD 1 disturbance area
BWM9	Likely Inactive – woody debris present across whole mound	-34.487121, 143.481600	Within 200 m buffer of MOD1
BWM10	Likely Inactive – Herbs growing on mound	-34.480365, 143.481311	Within 200 m buffer of MOD1

3.3 Raptor nests

One small nest was located within MOD1 with four more located just outside MOD1 (Figure 3.3).

Table 3.2 Nest trees

ID	Comment	Location	Impact
NT1	Small nest	Within MOD1 disturbance area	Tree to be removed
NT2	Small nest	Within 200 m buffer of MOD1	Avoided
NT3	Larger nest, likely raptor nest, however, no signs of use and in a state of deterioration.	Within 200 m buffer of MOD1	Avoided
NT4	Small nest	Within 200 m buffer of MOD1	Avoided (just outside MOD1 boundary)
NT5	Larger nest, likely raptor nest, however, no signs of use	Within 200 m buffer of MOD1	Avoided



Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 54

N

\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR005_HBT_StudyAreaOverview_20230929_01.mxd 9/10/2023

KEY

- Revised Balranald project area
- MOD1

Existing environment

- Major road
- Minor road
- Named watercourse
- Named waterbody

Hollow bearing trees (HBT)

- HBT with no potential for Corben's long-eared bat
- HBT with potential for Corben's long-eared bat

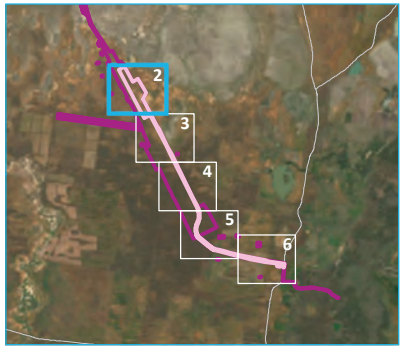
Tree hollow density

- High
- Medium/High
- Medium
- Low

Hollow bearing trees
Map 1 of 6

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.1

EMM creating opportunities



KEY

- Revised Balranald project area
- MOD1
- Avoidance area

Existing environment

- Minor road
- Vehicular track
- Watercourse/drainage line
- Named waterbody

Tree hollow density

- Medium/High
- Low

Hollow bearing tree
Map 2 of 6

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.1

EMM
creating opportunities

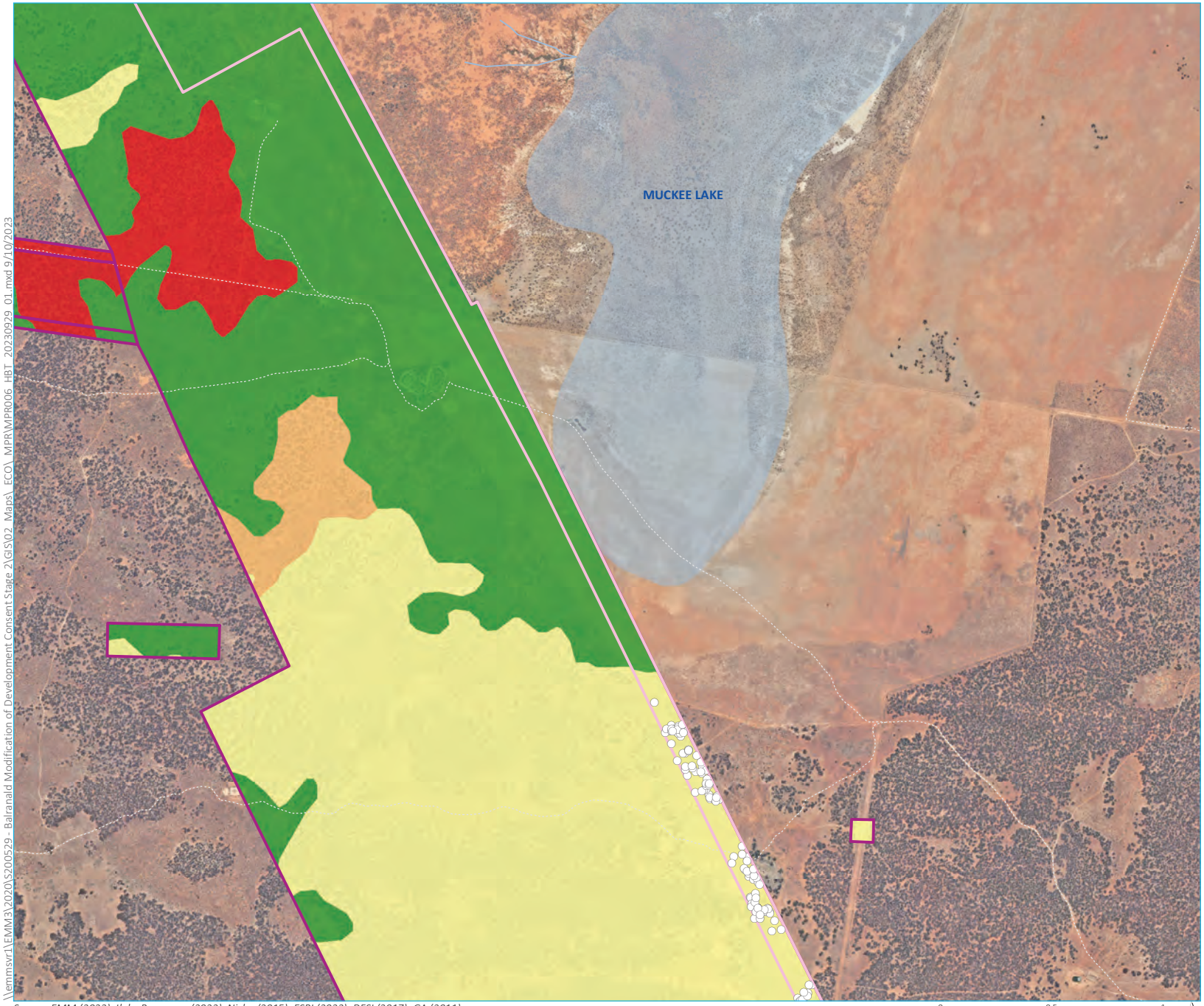
\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR006_HBT_20230929_01.mxd 9/10/2023

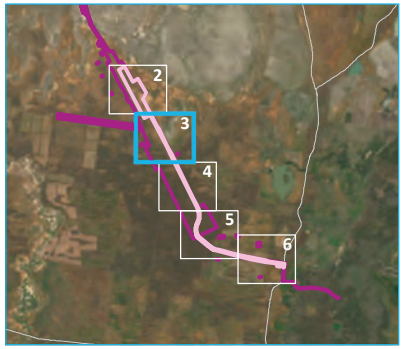
Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 54

N





KEY

- Revised Balranald project area
- MOD1

Existing environment

- Vehicular track
- Watercourse/drainage line
- Named waterbody

Hollow bearing trees (HBT)

- HBT with potential for Corben's long-eared bat

Tree hollow density

- High
- Medium/High
- Medium
- Low

Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 54

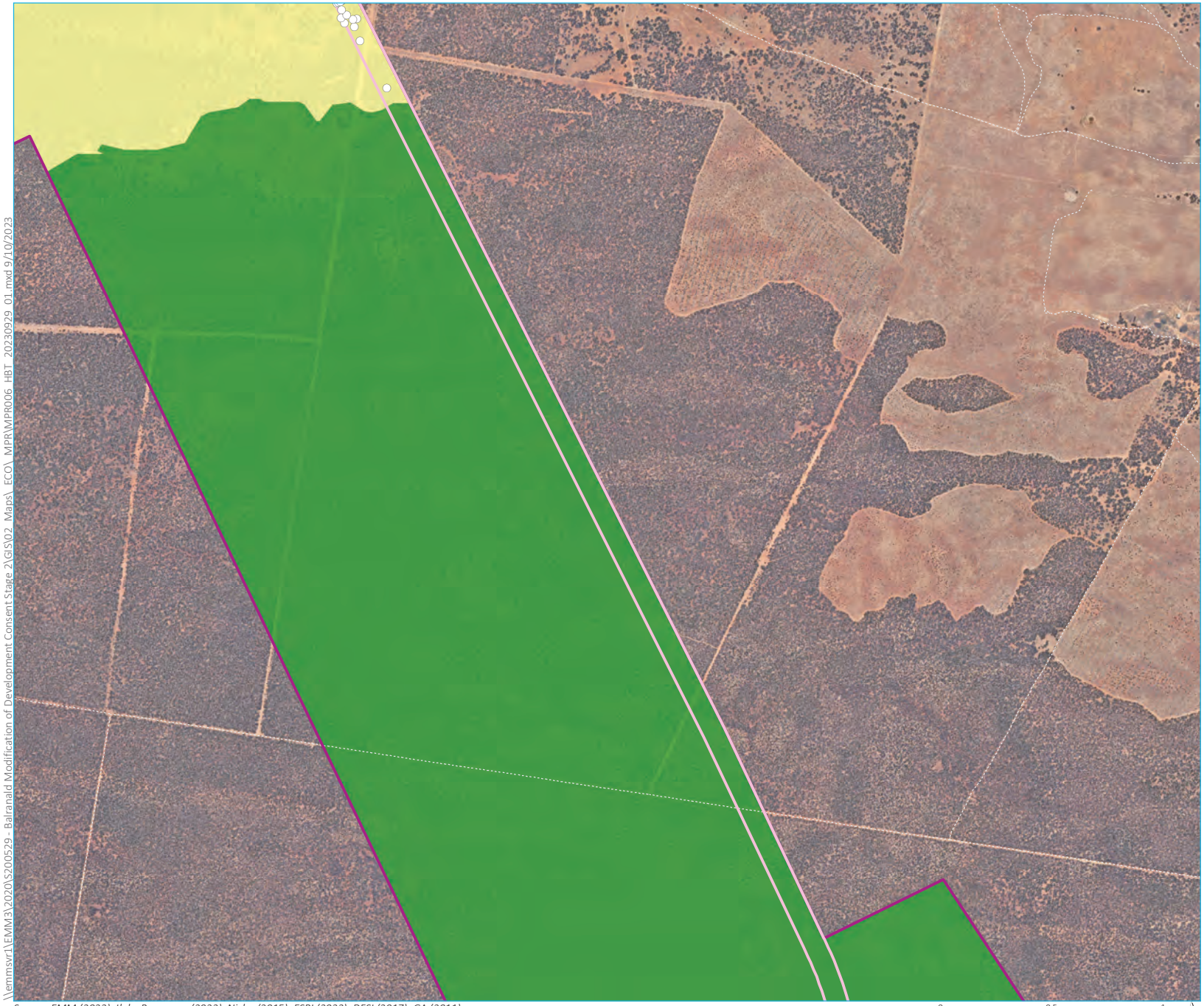
N

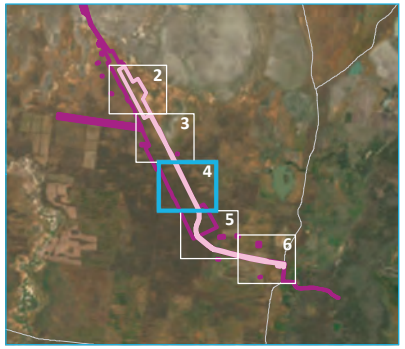
\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR006_HBT_20230929_01.mxd 9/10/2023

Hollow bearing tree
Map 3 of 6

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.1

EMM
creating opportunities





KEY

- Revised Balranald project area
- MOD1

Existing environment

- Vehicular track
- Named waterbody

Hollow bearing trees (HBT)

- HBT with potential for Corben's long-eared bat

Tree hollow density

- Medium
- Low

Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 54

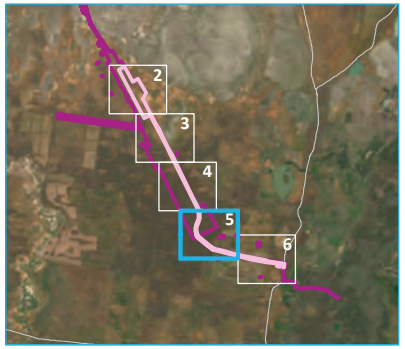
N

\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR006_HBT_20230929_01.mxd 9/10/2023

Hollow bearing tree
Map 4 of 6

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.1

EMM
creating opportunities



KEY

- Revised Balranald project area
- MOD1

Existing environment

- Vehicular track
- Named waterbody

Tree hollow density

- Medium/High
- Medium
- Low

Hollow bearing tree
Map 5 of 6

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.1

EMM
creating opportunities

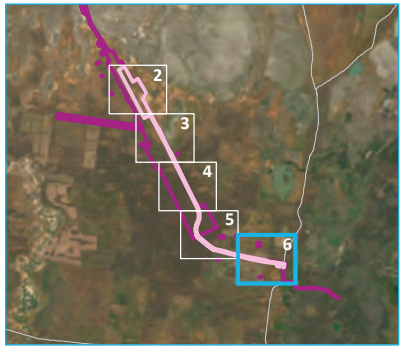
Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 54

N

\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR006_HBT_20230929_01.mxd 9/10/2023



KEY

- Revised Balranald project area
- MOD1

Existing environment

- Major road
- Minor road
- Vehicular track
- Named waterbody

Hollow bearing trees (HBT)

- HBT with no potential for Corben's long-eared bat
- HBT with potential for Corben's long-eared bat

Tree hollow density

- Medium/High
- Medium
- Low

Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 54

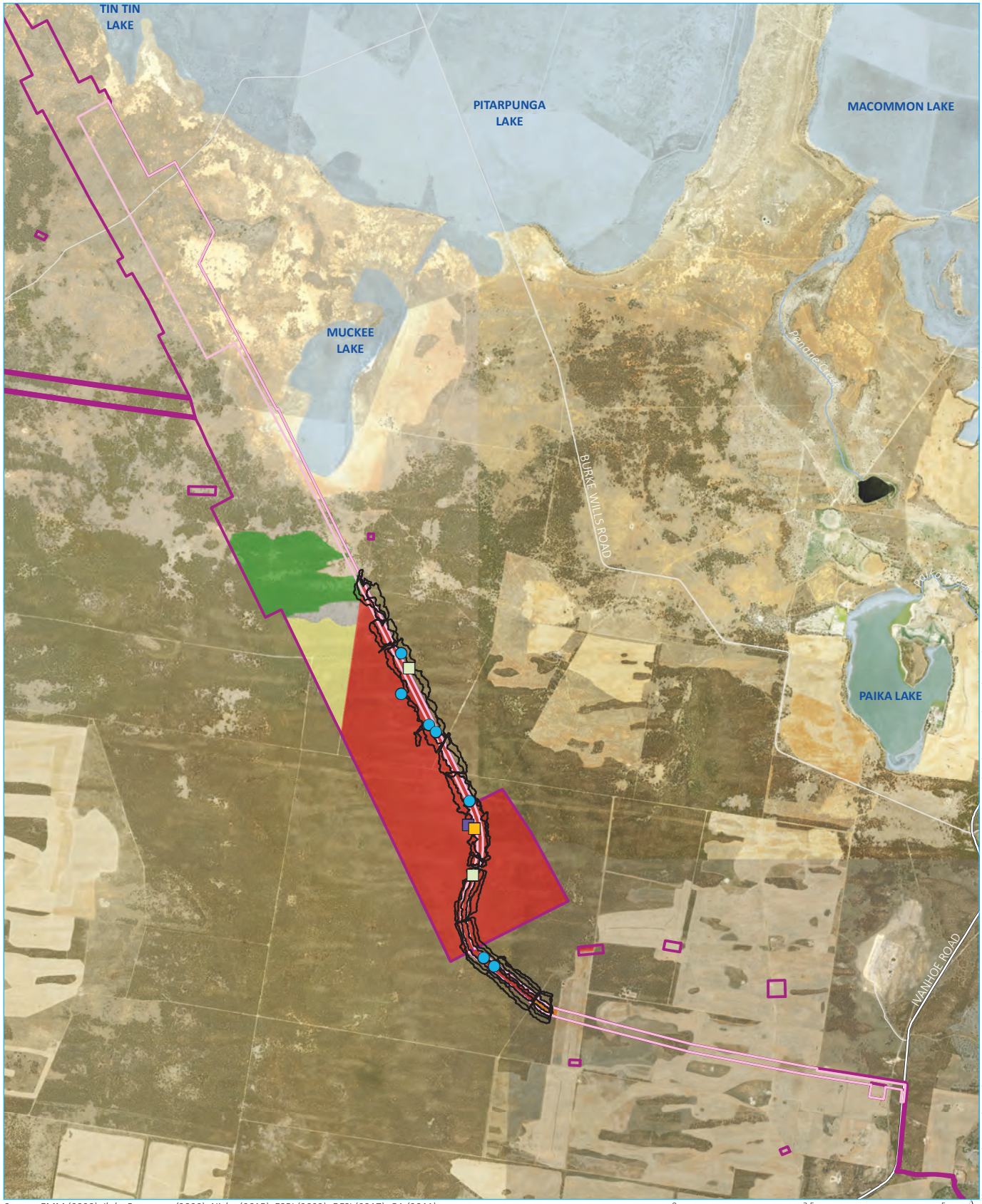
N

\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR006_HBT_20230929_01.mxd 9/10/2023

Hollow bearing tree
Map 6 of 6

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.1

EMM
creating opportunities



Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 54

N

\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR001_MFMoundPresenceOverview_20230926_01.mxd 9/10/2023

KEY

- Revised Balranald project area
- MOD1
- Malleefowl survey track

EMM survey results

- Active Malleefowl mound
- Inactive Malleefowl mound

Malleefowl observation

- Feather
- Footprint
- Sighting

Existing environment

- Major road
- Minor road
- Named watercourse
- Named waterbody

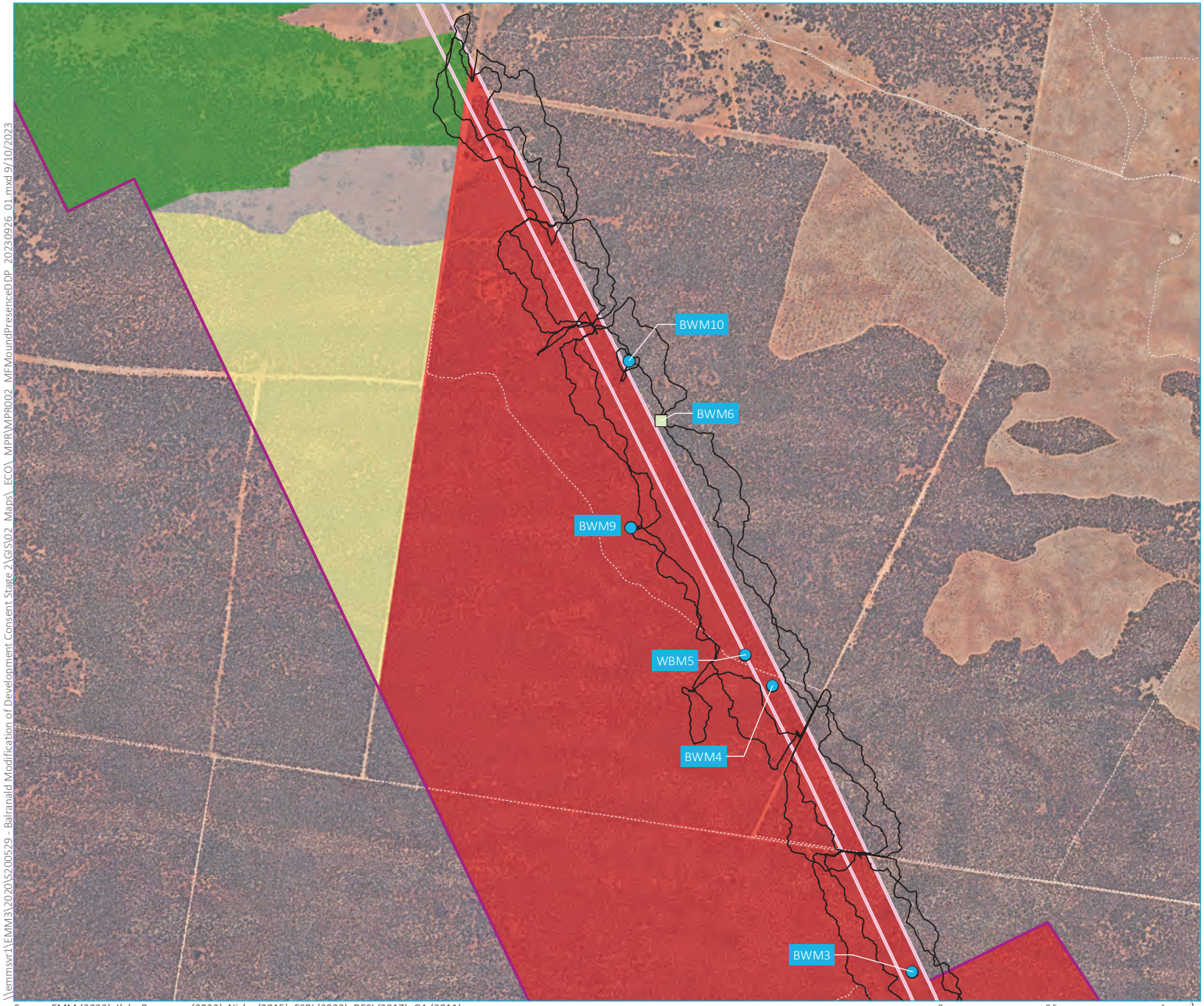
Malleefowl habitat potential

- Unknown
- Very High
- High
- Moderate
- Low

Malleefowl mounds and presence
Map 1 of 3

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.2

EMM
creating opportunities



KEY

MOD1 study area

EIS Approved Balranald Project Area (SSD-5285)

Malleefowl survey track

EMM survey results

Inactive Malleefowl mound

Malleefowl observation

Footprint

Existing environment

Vehicular track

Named waterbody

Malleefowl habitat potential

Unknown

Very High

Moderate

Low

Malleefowl mounds and presence
Map 2 of 3

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.2

\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR002_MFMoundPresenceDPP_20230926_01.mxd 9/10/2023

Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 54

N

EMM creating opportunities

KEY

- MOD1 study area
- EIS Approved Balranald Project Area (SSD-5285)
- Malleefowl survey track

EMM survey results

- Active Malleefowl mound
- Inactive Malleefowl mound

Malleefowl observation

- Feather
- Footprint
- Sighting

Existing environment

- Vehicular track
- Named waterbody

Malleefowl habitat potential

- Very High
- High

\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR002_MFMoundPresenceDDP_20230926_01.mxd 9/10/2023

Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

0 0.5 1 km

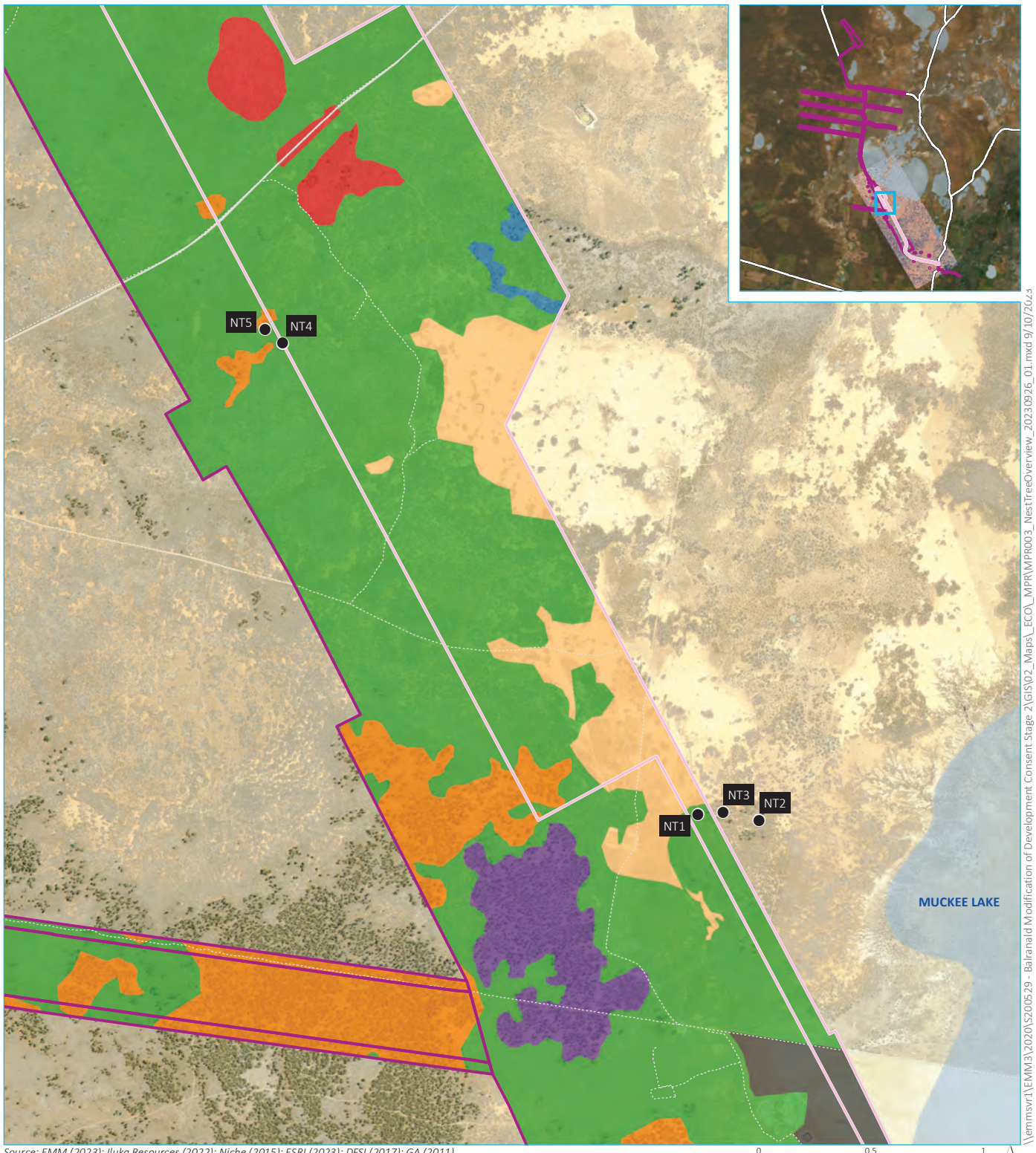
GDA 1994 MGA Zone 54

N

Malleefowl mounds and presence
Map 3 of 3

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.2

EMM
creating opportunities



\\emmsvr1\EMM3\2020\S200529 - Balranald Modification of Development Consent Stage 2\GIS\02_Maps_ECO_MPR\MPR003_NestTreeOverview_20230926_01.mxd 9/10/2023

Source: EMM (2023); Iluka Resources (2022); Niche (2015); ESRI (2023); DFSI (2017); GA (2011)

KEY

- Revised Balranald project area
- MOD1
- Nest tree

Plant community type

- 15 - Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south- western NSW (mainly Riverina Bioregion & Murray Darling Depression Bioregion)
- 154 - Pearl Bluebush low open shrubland of the arid & semi-arid plains
- 159 - Old Man Saltbush shrubland mainly of the semi-arid (warm) climate zone (south western NSW)
- 166 - Disturbed annual saltbush forbland on clay plains & inundation zones mainly of south-western NSW
- 170 - Chenopod sandplain mallee woodland/ shrubland of the arid & semi-arid (warm) zones
- 221 - Black Oak - Pearl Bluebush open woodland of the sandplains of the semi-arid warm & arid climate zones

Existing environment

- Minor road
- Vehicular track
- Named waterbody
- Cleared/developed (towns, buildings, roads)
- Cleared/derived native grassland/shrubland
- Cleared/agricultural (crops, vineyards, weedy fallow)

Nest tree locations

Balranald Mineral Sands Project
Malleefowl Pre-disturbance Report
Figure 3.3

EMM creating opportunities

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EMM 2023b, *Balranald Mineral Sands Project NSW (EPBC 2012/6509)*, prepared for Iluka Limited by EMM Consulting Pty Limited.

Niche 2016. Balranald Mineral Sands Project, *Commonwealth Environmental Impact Statement, EIS Volume 2, Appendix C – Biodiversity Assessment*, prepared for Iluka Limited by Niche Environment and Heritage Pty Limited.

Appendix A
Survey results

EMM
creating opportunities

A.1 Malleefowl mound monitoring datasheet

Date	Inspected By	Nest Number	Sought (v/x)	Found (v/x)	Staked (v/x)	Tagged (v/x)	Active (Y/N)	Profile (see below)	X sticks (see below)	Scraped (Y/N)	Eggshell (n/s/l)	Fire since last monitored? (Y/N)	Prints				Scats				Outer nest surface (n/s/l)					Inner nest surface (n/s/l)					Dimensions (cms)				Photo taken (Y/N)	X sticks replaced (Y/N)	Notes: - location notes that may help others find the mound - general notes regarding the mound itself - time since and evidence of bushfire (if applicable)
													Malleefowl	Fox	Kangaroo	Other (specify)	Malleefowl	Fox	Kangaroo	Other (specify)	Crust	Moss	Herb	Shrub	Tree	Crust	Moss	Herb	Shrub	Tree	Perimeter	Rim	Height (Nrth)	Height (South)			
17/08/2023	BI	BWM1	Y	Y	N	N	N	1	N/A	N/A	N	N	N	N	N	Y	N	Y	N	N	S	S	N	N	N	N	N	N	N	N	480	240	24	24	Y	N	Mound destroyed by mine development
7/09/2023	JB & BI	BWM2	Y	N	N	N	Y	3	N	Y	S	N	Y	N	N	N	N	Y	Y	Goat	N	N	N	N	N	N	N	N	N	N	560	380	35	28	Y	N	Known Mound
17/08/2023	BI	BWM3	Y	Y	N	N	N	3	N/A	N/A	S	N	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	440	175	50	50	Y	N	Mound destroyed by mine development
17/08/2023	BI	BWM4	Y	Y	N	N	N	2	N/A	N/A	S	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	455	180	38	38	Y	N	Mound destroyed by mine development
17/08/2023	BI	BWM5	Y	Y	N	N	N	3	N/A	N/A	L	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	450	150	41	41	Y	N	Mound destroyed by mine development
7/09/2023	JB & BI	BWM6	Y	N	N	N	N	6	N	N	S	N	Y	N	N	N	N	Y	Y	Goat	N	N	Y	Y	N	N	N	Y	N	N	570	N/A	28	28	Y	Y	Known Mound
6/09/2023	JB & BI	BWM8	N	Y	N	N	N	6	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	Y	N	N	370	N/A	10	15	Y	N	New Mound
7/09/2023	JB & BI	BWM9	N	Y	N	N	N	6	N	N	S	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	S	N	N	450	N/A	40	40	Y	Y	New Mound
7/09/2023	JB & BI	BWM10	N	Y	N	N	N	6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	450	N/A	30	30	Y	Y	New Mound

A.2 Malleefowl mound photos

Malleefowl mound ID: BWM1

Active Malleefowl mound ID: BWM2

Malleefowl mound ID: BWM3

Malleefowl Mound ID: BWM4

Malleefowl Mound ID: BWM5

Malleefowl Mound ID: BWM6

Malleefowl Mound ID: BWM8

Malleefowl Mound ID: BWM9

Malleefowl Mound ID: BWM10

A.3 Malleefowl footprints

Malleefowl footprints 1(Left) / Malleefowl footprints 2 (Right)

A.4 Nest Trees

Nest tree ID: NT1

Nest tree ID: NT2

Nest tree ID: NT3

Nest tree ID: NT4

Nest Tree ID: NT5

A.5 Hollow bearing trees

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	10	3	0	0	0		737169.9561	6173770.107
Eucalyptus sp.	20	2	0	0	0		737159.9376	6173745.83
Eucalyptus sp.	15	1	0	0	0		737175.009	6173755.046
Eucalyptus sp.	10	2	0	0	0		737170.4204	6173774.017
Eucalyptus sp.	10	1	0	0	0		737169.3791	6173775.792
Eucalyptus sp.	10	3	0	0	0		737173.6097	6173772.912
Eucalyptus sp.	15	2	0	0	0		737168.0137	6173775.255
Eucalyptus sp.	15	0	1	0	0		737172.3802	6173735.649
Eucalyptus sp.	30	2	2	0	0		733083.2724	6174440.537
Eucalyptus sp.	15	2	1	0	0	In dead branches	737219.4804	6173737.182
Eucalyptus sp.	40	2	2	0	0	In dead branches. Nesting Chough (*Pyrrhocorax* spp.) in tree.	737156.4595	6173738.395
Eucalyptus sp.	30	1	1	0	0	In dead branches. Nesting Chough (*Pyrrhocorax* spp.) in tree.	737164.0587	6173743.514
Eucalyptus sp.	20	2	1	0	0	In dead branches. Nesting Chough (*Pyrrhocorax* spp.) in tree.	737166.7473	6173759.987
Eucalyptus sp.	40	1	1	0	0	In dead branches. Nesting Chough (*Pyrrhocorax* spp.) in tree.	737163.7106	6173724.318
Eucalyptus sp.	25	1	2	0	0	In dead branches. Nesting Chough (*Pyrrhocorax* spp.) in tree.	737154.2267	6173786.22
Eucalyptus sp.	50	1	1	0	0	In dead branches and live branches	737156.0077	6173711.895
Eucalyptus sp.	25	1	0	0	0	In dead branches	737226.5353	6173763.47
Eucalyptus sp.	20	2	0	0	0	In dead branches and live branches	737215.4822	6173715.415
Eucalyptus sp.	25	2	0	0	0	In dead branches	737222.1844	6173710.178
Eucalyptus sp.	15	2	0	0	0	In dead branches	737227.8697	6173773.254

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	25	2	0	0	0	In dead branches	737226.8041	6173757.339
Eucalyptus sp.	25	1	1	0	0	In dead branches. Nesting Chough (*Pyrrhocorax* spp.) in tree.	737158.9237	6173776.901
Eucalyptus sp.	30	2	1	0	0	In dead branches. Nesting Chough (*Pyrrhocorax* spp.) in tree.	737160.5888	6173753.797
Eucalyptus sp.	50	1	1	0	0	In dead branches and live branches	737147.3938	6173703.494
Eucalyptus sp.	65	2	1	0	0	In dead branches	735381.7367	6174084.29
Eucalyptus sp.	25	2	1	0	0	In dead branches	737223.7086	6173705.359
Eucalyptus sp.	25	1	0	0	0	In dead branches	737224.1381	6173753.076
Eucalyptus sp.	20	6	1	0	0		736115.6602	6173908.399
Stag	15	4	0	0	0		736398.0585	6173833.036
Western Rosewood Alectryon oleifolius	40	4	0	0	0		736575.3925	6173841.738
Eucalyptus sp.	20	0	5	0	0		736125.2587	6173907.3
Eremophila sp.	70	5	0	0	0	Dead tree with cracks	736573.6906	6173853.809
Western Rosewood Alectryon oleifolius	65	5	0	0	0	Dead tree with cracks	736397.9904	6173862.899
Eucalyptus sp.	60	3	0	0	0	In dead branches	736741.5192	6173795.986
Eucalyptus sp.	65	0	1	0	0	In trunk. 1 m above ground.	735878.15	6173940.952
Mulga sp.	70	3	0	0	0	Nearly dead tree with cracks	736764.8183	6173530.318
Eucalyptus sp.	40	2	0	0	0	Live trunk and branches	736119.9718	6173912.258
Eucalyptus sp.	35	3	2	0	0	Live trunk and branches	736122.0056	6173911.854
Western Rosewood Alectryon oleifolius	80	6	0	0	0	Dead tree with cracks	736417.7515	6173834.315

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	50	2	3	0	0	Dead branches	736115.472	6173913.102
Eremophila sp.	70	5	0	0	0	Dead tree with cracks	736591.2732	6173834.535
Eucalyptus sp.	65	1	1	0	0	In dead branches	736798.1997	6173795.15
Western Rosewood Alectryon oleifolius	35	1	0	0	0	Dead branch	733643.4961	6174366.506
Eucalyptus sp.	40	3	3	0	0	In dead branches	736779.7176	6173724.516
Eucalyptus sp.	35	2	3	0	0	Dead branches	736023.4602	6173938.454
Eucalyptus sp.	25	3	1	0	0		736746.3954	6173728.522
Black Box Eucalyptus largiflorens	32	1	0	0	0	Dead branches	726787.5255	6183784.009
Eucalyptus sp.	25	1	0	0	0	Dead stem with hollows	726840.4728	6183619.096
Eucalyptus sp.	25	2	0	0	0	Dead stem with hollows	726878.7307	6183594.278
Eucalyptus sp.	25	2	0	0	0	Live trunk and dead stem with hollows	726606.622	6184141.662
Black Oak Casuarina spp.	60	1	0	0	0	Live trunk with hollow	726520.1394	6184243.608
Eucalyptus sp.	60	2	2	0	0	Dead stem with hollows	727051.1416	6183205.379
Black Box Eucalyptus largiflorens	75	3	0	0	0	Broken live branches and dead stumps	726804.7146	6183751.741
Eucalyptus sp.	15	2	0	0	0	Dead stem with possible hollow	727064.0966	6183105.828
Black Oak Casuarina spp.	55	1	0	0	0	Live trunk with hollow	726526.7622	6184206.193
Black Box Eucalyptus largiflorens	75	3	2	0	0	Broken live branches and dead stumps	726825.3971	6183739.516
Eucalyptus sp.	15	1	0	0	0	Dead stem with hollows	726659.8885	6184113.19
Eucalyptus sp.	25	1	1	0	0	Dead stumps in live tree	726443.2612	6184405.461

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Black Oak Casuarina spp.	60	2	0	0	0	Live trunk with hollow	726565.7557	6184223.095
Stag	55	3	0	0	0	Dead tree	726455.1044	6184432.594
Eucalyptus sp.	25	1	2	0	0	Dead stem with hollow	726517.8467	6184304.534
Stag	55	3	0	0	0	Dead tree	726427.5658	6184398.033
Eucalyptus sp.	30	1	1	0	0	Dead stem with hollows	726828.642	6183566.643
Eucalyptus sp.	35	1	0	0	0	Dead stem with hollow	727023.7437	6183208.624
Eucalyptus sp.	35	1	1	0	0	Dead stem with hollows	726810.8755	6183661.819
Black Oak Casuarina spp.	45	2	1	0	0	Live trunk with hollow	726563.9281	6184132.123
Eucalyptus sp.	30	2	2	0	0	Dead stem with hollows	726812.798	6183656.95
Black Box Eucalyptus largiflorens	65	2	0	0	0	Broken dead branches	726851.0309	6183736.319
Eucalyptus sp.	20	1	1	0	0	Dead stem with hollows	726625.3774	6184121.923
Mulga sp.	55	1	0	0	0	Live trunk with hollow	726483.6227	6184273.942
Eucalyptus sp.	20	1	1	0	0	Live trunk and dead stem with hollows	726610.8637	6184141.978
Eucalyptus sp.	30	0	1	1	0	Dead stem with hollows	726844.3803	6183610.595
Black Box Eucalyptus largiflorens	75	3	1	1	0	Broken live branches and dead stumps	726804.6632	6183768.398
Black Oak Casuarina spp.	50	2	0	0	0	Live trunk and dead branches with hollows	726519.0109	6184233.783
Eucalyptus sp.	20	2	1	0	0	Dead stem with hollows	726668.9593	6184097.443
Eucalyptus sp.	50	1	1	0	0	Live trunk and dead stem with hollows	726600.9116	6184140.167

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	15	1	1	0	0	Dead stem with hollow	726379.9155	6184533.827
Eucalyptus sp.	25	1	0	0	0	Dead stem with hollows	726817.3444	6183631.488
Eucalyptus sp.	65	1	2	0	0	Dead stem with hollows	726899.0469	6183595.4
Eucalyptus sp.	30	0	1	0	0	Dead stem with hollows	726549.8659	6184240.927
Eucalyptus sp.	20	0	1	0	0	Dead stem with hollow	726570.4027	6184296.907
Eucalyptus sp.	30	1	0	0	0	Dead stem with possible hollow	727029.8743	6183194.124
Eucalyptus sp.	35	1	1	0	0	Dead stem with hollows	727035.4191	6183197.828
Stag	15	1	0	0	0	Dead tree	727047.5995	6183130.831
Eucalyptus sp.	15	1	0	0	0	Dead stem with hollows	726813.9819	6183619.341
Black Box Eucalyptus largiflorens	55	2	1	0	0	~ 5 cm wide Hole in trunk shows signs of current use. Chew marks and hair stuck in sap.	726737.3306	6183843.854
Black Oak Casuarina spp.	50	1	1	0	0	Live trunk and dead branches with hollows	726518.0003	6184248.836
Black Box Eucalyptus largiflorens	80	2	1	0	0	Broken live branches and dead stumps	726783.0159	6183790.581
Eucalyptus sp.	30	1	1	0	0	Dead stem with hollows	726853.7394	6183564.737
Eucalyptus sp.	45	2	0	0	0	Dead stumps in live tree	726433.7394	6184414.432
Eucalyptus sp.	75	0	2	1	0	Dead stumps in live tree	726455.2847	6184350.579
Black Box Eucalyptus largiflorens	65	2	2	0	0	Broken live branches	726845.6053	6183727.467
Black Box Eucalyptus largiflorens	70	1	1	0	0	Dead branches	726796.2676	6183777.499

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	45	2	1	0	0	Live trunk and dead stem with hollows	726592.8134	6184136.217
Eucalyptus sp.	45	0	1	0	0	Dead stem with hollows	726898.7568	6183591.255
Eucalyptus sp.	30	1	1	0	0	Dead stem with hollows	726548.0603	6184251.526
Eucalyptus sp.	45	2	0	0	0	Dead stem with hollows	726908.2476	6183508.541
Black Box Eucalyptus largiflorens	32	4	2	0	0	Dead tree	726727.6015	6183813.994
Eucalyptus sp.	20	0	2	0	0	Eucalyptus sp.	726593.0258	6184217.563
Eucalyptus sp.	20	3	0	0	0	Hollow logs at base of tree	727067.3014	6183226.825
Eucalyptus sp.	8	0	1	0	0	Eucalyptus sp.	726629.9803	6184103.691
Eucalyptus sp.	20	3	1	0	0	Eucalyptus sp.	726457.9079	6184405.713
Eucalyptus sp.	8	1	0	0	0	Eucalyptus sp.	727106.6829	6183087.195
Eucalyptus sp.	20	1	0	0	0	Eucalyptus sp.	726469.3113	6184403.841
Black Box Eucalyptus largiflorens	20	0	1	0	0	Black Box	726500.0072	6184424.975
Black Box Eucalyptus largiflorens	10	0	1	0	0	Black Box	726511.2382	6184404.076
Eucalyptus sp.	20	2	0	0	0	Eucalyptus sp.	726466.7995	6184415.708
Eucalyptus sp.	10	1	0	0	0	Eucalyptus sp.	726497.9652	6184382.606
Eucalyptus sp.	10	0	3	0	0	Eucalyptus sp.	727118.0869	6183123.149
Eucalyptus sp.	10	4	0	0	0	Eucalyptus sp.	726595.9366	6184245.583
Eucalyptus sp.	15	0	2	0	0	Eucalyptus sp.	726870.382	6183598.928
Eucalyptus sp.	8	1	0	0	0	Eucalyptus sp.	727101.8793	6183121.523
Eucalyptus sp.	15	2	1	0	0	Eucalyptus sp.	726847.3718	6183599.156
Eucalyptus sp.	10	1	0	0	0	Eucalyptus sp.	726484.262	6184400.212
Eucalyptus sp.	20	3	2	0	0	Eucalyptus sp.	726887.7328	6183612.084
Eucalyptus sp.	30	0	3	0	0	Eucalyptus sp.	726920.9014	6183554.042
Eucalyptus sp.	15	5	0	0	0	Eucalyptus sp.	726632.5607	6184176.974

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	20	3	0	0	0	Hollow logs at base of tree	727053.914	6183229.392
Eucalyptus sp.	15	1	0	0	0	Eucalyptus sp.	726846.5831	6183613.732
Eucalyptus sp.	10	1	1	0	0	Hollow logs at base of tree	726509.0398	6184308.127
Eucalyptus sp.	40	0	1	1	0	Hollow logs at base of tree	726836.6802	6183746.858
Eucalyptus sp.	20	0	1	0	0	Eucalyptus sp.	726486.8349	6184429.968
Black Box Eucalyptus largiflorens	40	3	0	3	0	Black Box	726775.1836	6183890.152
Eucalyptus sp.	8	0	1	0	0	Eucalyptus sp.	726614.1671	6184162.677
Eucalyptus sp.	10	3	0	0	0	Eucalyptus sp.	726487.7798	6184397.181
Eucalyptus sp.	8	1	0	0	0	Eucalyptus sp.	727132.2028	6183026.165
Black Box Eucalyptus largiflorens	8	2	0	0	0	Black Box	726649.7871	6184097.398
Eucalyptus sp.	8	1	0	0	0	Eucalyptus sp.	727074.594	6183141.366
Eucalyptus sp.	15	0	3	0	0	Eucalyptus sp.	726616.2161	6184189.339
Black Box Eucalyptus largiflorens	8	0	1	0	0	Black Box	726629.0379	6184110.159
Eucalyptus sp.	6	1	0	0	0	Hollow logs at base of tree	727050.1849	6183164.745
Eucalyptus sp.	30	0	3	0	0	Hollow logs at base of tree, no hollows in tree	726950.2459	6183515.474
Eucalyptus sp.	10	1	0	0	0	Eucalyptus sp.	726494.9824	6184396.906
Eucalyptus sp.	20	1	0	0	0	Eucalyptus sp.	726891.0428	6183609.032
Eucalyptus sp.	15	0	2	0	0	Eucalyptus sp.	726831.5043	6183639.617
Eucalyptus sp.	20	0	1	0	0	Eucalyptus sp.	726486.3437	6184421.125
Eucalyptus sp.	10	1	0	0	0	Hollow logs at base of tree	726533.5358	6184315.041
Eucalyptus sp.	30	2	3	0	0	Hollow logs at base of tree	727048.2449	6183206.676
Eucalyptus sp.	40	3	1	0	0	Hollow logs at base of tree	726826.0586	6183758.004

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	20	3	0	0	0	Eucalyptus sp.	726611.8825	6184170.025
Eucalyptus sp.	15	2	0	0	0	Eucalyptus sp.	726611.458	6184229.799
Eucalyptus sp.	15	0	1	0	0	Eucalyptus sp.	726588.6723	6184267.397
Eucalyptus sp.	10	2	0	0	0	Eucalyptus sp.	726498.1176	6184410.437
Eucalyptus sp.	10	0	1	0	0	Eucalyptus sp.	726834.8606	6183594.833
Eucalyptus sp.	20	4	1	0	0	Eucalyptus sp.	726458.6319	6184417.947
Eucalyptus sp.	10	0	1	0	0	Hollow logs at base of tree	726534.0852	6184324.633
Eucalyptus sp.	15	3	0	0	0	Eucalyptus sp.	726874.0815	6183604.18
Eucalyptus sp.	40	2	0	0	0	Eucalyptus sp.	726796.0758	6183838.947
Eucalyptus sp.	30	2	0	0	0	Hollow logs at base of tree	727043.7436	6183201.53
Eucalyptus sp.	15	0	3	0	0	Eucalyptus sp.	726843.2882	6183611.317
Eucalyptus sp.	40	2	0	0	0	Eucalyptus sp.	726824.7112	6183787.051
Eucalyptus sp.	40	0	4	0	0	Hollow log at base of tree	726851.7995	6183719.548
Eucalyptus sp.	20	5	0	0	0	Hollow logs at base of tree	727069.5439	6183230.694
Eucalyptus sp.	10	0	1	0	0	Hollow log at base of tree	726832.495	6183676.132
Eucalyptus sp.	10	1	1	0	0	Hollow logs at base of tree	726533.426	6184320.03
Eucalyptus sp.	20	3	0	0	0	Eucalyptus sp.	726483.2548	6184410.438
Eucalyptus sp.	20	1	1	0	0	Eucalyptus sp.	726507.3003	6184436.024
Black Box Eucalyptus largiflorens	8	3	0	0	0	Black Box	726655.7504	6184092.119
Eucalyptus sp.	20	3	1	0	0	Eucalyptus sp.	726588.3319	6184223.069
Eucalyptus sp.	8	1	0	0	0	Eucalyptus sp.	726657.4641	6184109.614
Eucalyptus sp.	20	3	0	0	0	Eucalyptus sp.	726461.8675	6184407.548
Eucalyptus sp.	10	4	0	0	0	Eucalyptus sp.	726510.7805	6184400.008
Eucalyptus sp.	8	1	0	0	0	Eucalyptus sp.	727253.2546	6182814.506
Eucalyptus sp.	40	1	0	0	0	Eucalyptus sp.	726794.9882	6183822.818
Eucalyptus sp.	8	0	1	0	0	Eucalyptus sp.	726623.5092	6184163.937

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Black Box Eucalyptus largiflorens	40	3	1	3	0	Striated Pardolote (*Pardalotus striatus*) using large hollow	726774.1747	6183854.952
Eucalyptus sp.	15	3	0	0	0	Eucalyptus sp.	726627.3731	6184170.772
Eucalyptus sp.	10	0	1	0	0	Hollow log at base of tree	726836.5391	6183658.332
Eucalyptus sp.	10	3	0	0	0	Hollow logs at base of tree	727086.1062	6183267.271
Eucalyptus sp.	30	4	1	0	0	Hollow logs at base of tree	727066.8036	6183217.928
Eucalyptus sp.	60	1	0	0	0	Dead stem with possible hollow	727051.1394	6183236.779
Eucalyptus sp.	70	2	2	0	0	Dead stumps on live branches	727074.6095	6183269.564
Eucalyptus sp.	50	1	1	0	0	In dead branches and live branches	737113.7759	6173713.835
Eucalyptus sp.	40	1	3	0	0	In dead branches and live branches	737070.3419	6173719.979
Eucalyptus sp.	20	1	0	0	0	In dead branches and live branches	737052.6056	6173707.691
Eucalyptus sp.	50	1	1	0	0	In dead branches and live branches	737109.0086	6173696.38
Eucalyptus sp.	40	0	1	0	0	In dead branches and live branches	737074.7437	6173708.517
Eucalyptus sp.	45	1	0	1	0	In dead branches and live branches	737082.6985	6173710.544
Eucalyptus sp.	25	2	1	0	0	In dead branches and live branches	737034.1211	6173709.202
Eucalyptus sp.	40	1	0	0	0	In dead branches and live branches	737044.5096	6173721.735
Eucalyptus sp.	30	1	1	0	0	In dead branches and live branches	737096.5738	6173709.881
Eucalyptus sp.	35	1	1	0	0	In dead branches and live branches	737098.6027	6173706.566
Eucalyptus sp.	40	2	0	0	0	In dead branches and live branches	737065.3394	6173714.856
Eucalyptus sp.	20	1	2	0	0	In dead branches and live branches	737030.4476	6173709.762

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	35	1	2	0	0	In dead branches and live branches	737055.0415	6173714.25
Eucalyptus sp.	35	2	0	0	0	In dead branches and live branches	737045.8638	6173715.712
Eucalyptus sp.	45	2	0	0	0	In dead branches and live branches	737101.572	6173704.729
Eucalyptus sp.	20	0	2	0	0	In dead branches and live branches	737046.3535	6173717.171
Eucalyptus sp.	20	1	1	0	0	In dead branches and live branches	737091.7639	6173703.43
Eucalyptus sp.	65	1	2	0	0	In dead branches and live branches	737135.2788	6173698.193
Eucalyptus sp.	35	2	2	0	0	In dead branches and live branches	737029.1961	6173717.336
Eucalyptus sp.	60	1	0	0	0	In dead branches and live branches	737025.4128	6173727.688
Eucalyptus sp.	30	1	0	0	0	In dead branches and live branches	737021.4701	6173715.969
Eucalyptus sp.	65	0	1	0	0	In dead branches and live branches	736982.7892	6173815.165
Eucalyptus sp.	65	1	1	1	0	In dead branches and live branches	736969.053	6173782.805
Eucalyptus sp.	50	2	4	0	0	In dead branches and live branches	737014.6875	6173807.734
Eucalyptus sp.	20	2	0	0	0	In dead branches and live branches	737006.0393	6173787.723
Eucalyptus sp.	35	5	4	0	0	In dead branches and live branches	736999.2303	6173807.804
Eucalyptus sp.	45	2	1	0	0	In dead branches and live branches	737005.9747	6173807.886
Eucalyptus sp.	65	1	2	0	0	In dead branches and live branches	736987.8602	6173789.55
Eucalyptus sp.	65	0	2	0	0	In dead branches and live branches	736985.1256	6173801.078
Eucalyptus sp.	30	1	1	0	0	In dead branches and live branches	736995.9515	6173797.594
Eucalyptus sp.	45	2	2	0	0	In dead branches and live branches	737008.4696	6173792.328

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	30	2	2	0	0	In dead branches and live branches	736994.2655	6173790.194
Eucalyptus sp.	20	2	0	0	0	In dead branches	737051.2223	6173771.264
Eucalyptus sp.	30	3	1	0	0	In dead branches	736991.2837	6173770.076
Eucalyptus sp.	30	0	3	0	0	In dead branches	736973.6086	6173765.278
Eucalyptus sp.	20	0	1	0	0	In dead branch	737002.0949	6173766.183
Eucalyptus sp.	20	2	0	0	0	In dead branches	737044.6214	6173767.591
Eucalyptus sp.	20	0	3	0	0	In dead branches	737055.2016	6173773.218
Eucalyptus sp.	30	0	2	0	0	In dead branches	736970.848	6173766.266
Eucalyptus sp.	30	0	1	0	0	In dead branches	736999.7961	6173783.129
Eucalyptus sp.	15	0	1	0	0	In dead branches	736975.4132	6173772.277
Eucalyptus sp.	20	1	2	0	0	In dead branches	737011.4958	6173760.357
Eucalyptus sp.	20	0	1	0	0	In trunk	737058.9029	6173756.893
Eucalyptus sp.	20	5	0	0	0	In dead branch	736996.8447	6173763.853
Eucalyptus sp.	20	3	0	0	0	In dead branches	737054.5885	6173776.118
Eucalyptus sp.	20	2	0	0	0	In dead branches	737037.4291	6173771.317
Eucalyptus sp.	20	0	1	0	0	In trunk	737057.6394	6173765.776
Eucalyptus sp.	30	3	0	0	0	In dead branches	736983.9871	6173784.384
Eucalyptus sp.	30	0	3	1	0	In dead branches	736975.198	6173782.772
Eucalyptus sp.	20	2	0	0	0	In dead branches	737028.8516	6173784.5
Eucalyptus sp.	20	1	1	0	0	In dead branches	737018.791	6173771.002
Eucalyptus sp.	30	3	1	0	0	In dead branches	736992.8683	6173775.893
Eucalyptus sp.	20	2	1	0	0	In dead branches	737023.2651	6173785.24
Eucalyptus sp.	15	0	1	0	0	In trunk	737063.7617	6173764.923
Eucalyptus sp.	50	2	2	0	0	In dead branches and live branches	737027.1007	6173805.78
Eucalyptus sp.	25	1	1	0	0	In dead branches and live branches	737027.0873	6173788.611
Eucalyptus sp.	25	1	1	0	0	In dead branches and live branches	737130.7914	6173768.023
Eucalyptus sp.	40	2	0	0	0	In dead branches and live branches	737139.8782	6173782.535

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	50	1	1	0	0	In dead branches and live branches	737069.5505	6173797.493
Eucalyptus sp.	60	0	1	0	0	In dead branches and live branches	737072.2441	6173780.391
Eucalyptus sp.	50	0	1	0	0	In dead branches and live branches	737130.0369	6173787.279
Eucalyptus sp.	45	2	1	0	0	In dead branches and live branches	737095.0692	6173796.013
Eucalyptus sp.	25	1	0	0	0	In dead branches and live branches	737135.2261	6173770.526
Eucalyptus sp.	40	1	1	0	0	In dead branches and live branches	737115.2138	6173786.157
Eucalyptus sp.	45	1	1	0	0	In dead branches and live branches	737116.6259	6173794.502
Eucalyptus sp.	40	0	1	0	0	In dead branches and live branches	737129.521	6173780.192
Eucalyptus sp.	25	2	0	0	0	Dead	737044.0489	6173786.371
Eucalyptus sp.	30	1	2	0	0	In dead branches and live branches	737093.0503	6173779.854
Eucalyptus sp.	55	1	0	0	0	In dead branches and live branches	737103.7919	6173775.976
Eucalyptus sp.	20	1	1	0	0	In dead branches	737086.8026	6173745.519
Eucalyptus sp.	20	2	0	0	0	In dead branches	737094.5701	6173769.233
Eucalyptus sp.	20	1	1	0	0	In dead branch and trunk	737110.7595	6173767.713
Eucalyptus sp.	15	1	0	0	0	In dead branch	737114.9522	6173752.169
Eucalyptus sp.	10	1	0	0	0	In dead branch	737133.513	6173757.118
Eucalyptus sp.	20	2	1	0	0	In dead branches	737077.6318	6173759.377
Eucalyptus sp.	20	2	0	0	0	In dead branches	737135.0553	6173772.402
Eucalyptus sp.	20	1	2	0	0	In dead branches	737130.5269	6173772.914
Eucalyptus sp.	20	0	1	0	0	In dead branch	737124.5046	6173750.05
Eucalyptus sp.	20	2	0	0	0	In dead branches	737123.5976	6173759.287
Eucalyptus sp.	50	1	1	0	0	In dead branches	737121.2992	6173717.874
Eucalyptus sp.	20	1	0	0	0	In dead branches	737037.5066	6173732.892
Eucalyptus sp.	20	1	0	0	0	In dead branch	737060.6533	6173741.611

Table A.1 Hollow bearing trees

Tree Species	DBH (cm)	Small Hollow	Medium Hollow	Large Hollow	Very Large Hollow	Notes	Easting	Northing
Eucalyptus sp.	30	0	3	0	0	In dead branch and live trunk	737054.1865	6173725.114
Eucalyptus sp.	30	1	0	0	0	In dead branch	737123.0998	6173736.193
Eucalyptus sp.	20	2	0	0	0	In dead branches	737039.8894	6173745.197
Eucalyptus sp.	20	3	1	0	0	In dead branch and live trunk	737051.1475	6173748.061
Eucalyptus sp.	30	2	1	0	0	In dead branches and live trunk	737070.0155	6173752.518
Eucalyptus sp.	20	4	1	0	0	In dead branches	737035.31	6173741.322
Eucalyptus sp.	20	1	0	0	0	In dead branch	737127.5847	6173729.555
Eucalyptus sp.	20	2	0	0	0	In dead branches	737065.0576	6173739.835
Eucalyptus sp.	20	2	0	0	0	In dead branch and live trunk	737062.4911	6173740.212
Eucalyptus sp.	20	2	0	0	0	In dead branches	737055.3277	6173745.366
Eucalyptus sp.	20	3	0	0	0	In dead branches	737032.1646	6173741.926
Eucalyptus sp.	20	3	0	1	0	In dead branches	737094.0411	6173736.008
Eucalyptus sp.	20	3	0	0	0	In dead branches	737068.5414	6173734.274
Eucalyptus sp.	28	0	2	0	0	In dead branches	737054.5347	6173740.756
Eucalyptus sp.	40	3	0	0	0	In dead branches and live branches	737165.0443	6173705.363
Eucalyptus sp.	20	1	0	0	0	In dead branch	737110.2974	6173750.436
Stag	28	0	1	0	0	Standing dead tree, chimney hollow	737111.4449	6173720.694
Eucalyptus sp.	30	1	0	0	0	In dead branches	737120.8021	6173724.049
Eucalyptus sp.	20	2	0	0	0	In dead branch	737111.559	6173734.183
Eucalyptus sp.	15	2	0	0	0	In dead branches	736976.5997	6173763.788
Eucalyptus sp.	15	1	0	0	0	In dead branch	736984.5038	6173763.592
Eucalyptus sp.	20	3	0	0	0	In dead branches	737082.7103	6173740.943
Eucalyptus sp.	30	2	0	0	0	In dead branch	737131.0628	6173733.513
Eucalyptus sp.	20	3	0	0	0	In dead branch	737106.894	6173747.2

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A-1.5 Appendix E: Balranald west mine vegetation clearing report 2023

BALRANALD WEST MINE

VEGETATION CLEARING REPORT 2023

Document Number: BVCR001

Revision	Details Of Review Or Changes	Date Created	Document Reference
0	Clearing report for 2023	5/1/2023	BVCR001

Iluka Resources Limited
ABN 34 008 675 018
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INTRODUCTION

1. PURPOSE AND SCOPE

The purpose of this clearing report is to document vegetation clearing activites undertaken from 1 January 2023 to 31 December 2023 in accordance with the Commonweath Biodiversity Management Plan and the NSW Biodiversity Management Plan for the Balranald Mineral Sands West Balranald Mine.

2. BACKGROUND

Iluka has approval to develop a mineral sand mine in south-western (NSW), known as the Balranald Project. It includes construction, mining, primary processing, and rehabilitation of two linear mineral sand deposits, known as the West Balranald and Nepean deposits, located approximately 12 kilometres (km) and 66 km north-west of the town of Balranald, respectively.

Development consent (SSD-5285) was granted for the Balranald Project by a delegate of the NSW Minister for Planning under the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 5 April 2016 (herein referred to as the consent). Approval was also granted under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2012/6509) by a delegate of the Commonwealth Minister for the Environment on 6 January 2017 (herein referred to as the Commonwealth approval). The project EIS was supported by a Biodiversity Assessment prepared by Niche Environment and Heritage Pty Limited in 2016 (Niche 2016).

Since the consent was granted, Iluka undertook some of the approved bulk sampling activity between 2016 and 2020, involving the extraction of the mineral ore from depth using trial underground mining within the approved disturbance area of the West Balranald deposit. On 21 December 2022, Iluka were granted approval to modify the consent (MOD1) to expand the underground mining trial which includes an additional area of disturbance to the approved Balranald Project area to enable primary processing of the ore into heavy mineral concentrate (HMC) and transport of HMC offsite for secondary processing at Iluka's facilities in Victoria and/or Western Australia (WA).

Construction of the West Balranald Mine Underground Mining Operation officially commenced on 7 August 2023. Construction involves the clearing of vegetation for the development of mining infrastructure.

3. METHODS

3.1 Corben's Long-eared Bat habitat

Hollow bearing tree (HBT) surveys were undertaken by EMM Consulting Pty Ltd (EMM) in September 2022 within MOD1 areas mapped as medium, medium-high tree hollow density, findings were reported in the Balranald Mineral Sands Project Modification 1 EPBC Biodiversity Pre-disturbance Survey Report (EMM 2022).

Identified HBTs were located using a hand held GPS and demarcated in the field with flagging tape for identification during clearing. A Site Disturbance Permit (BSDP008) was approved by the Senior Environmental Specialist and issued to the clearing contractor for clearing.

Clearing areas were demarcated in the field by a qualified surveyor with pegs and flagging tape prior to clearing works.

The surrounding vegetation was first cleared using an excavator around the HBTs before clearing the HBTs a minimum of 48 hours later. The felled HBTs were then relocated into stockpiles at least 24 hours after being felled.

Where HBTs were isolated (i.e. no surrounding woodland vegetation) they were pushed over and left in situ for 24 hours before being relocated to stockpiles.

3.2 Malleefowl habitat

Targeted Malleefowl surveys were undertaken by EMM in September 2022 and September 2023 within the MOD1 disturbance area and up to 200m around this area. Both the 2022 and 2023 pre-disturbance reports are included in Appendix 1.

Nine Malleefowl mounds were discovered during the 2022 and 2023 surveys within the MOD1 disturbance area and 200 m buffer. During August 2023 before commencement of the breeding season, four inactive mounds were removed with a skid steer loader to avoid Malleefowl usage during the 2023 breeding season. Five mounds remain within the disturbance area and 200 m buffer, with only one confirmed as active as of 7 September 2023 (Figure 2).

Iluka internal Site Disturbance Permit (BSDP008) was approved by the Iluka Senior Environmental Specialist and issued to the clearing contractor for clearing. A 200m buffer around the active Malleefowl mound was established and shown on clearing plans. No vegetation clearing is permitted within the 200m buffer until breeding has ceased and confirmed by a suitably qualified environmental professional.

Clearing areas were demarcated in the field by a qualified surveyor with pegs and flagging tape prior to clearing works. Disturbance boundaries were demarcated with orange flagged rope where clearing was undertaken less than 10m from the approved development consent boundary.

Clearing of an 8m wide access track was undertaken using a D6 bulldozer fitted with a scrub rake, vegetation was pushed to the adjacent edges of the track and left in situ. Further widening of the track will be undertaken in 2024 to clear to the full width of the road alignment.

3.3 Raptor nests

In September 2023, EMM conducted surveys to identify potential active raptor nests and reported findings in the Balranald Mineral Sands Project Malleefowl and raptor pre-disturbance survey report (EMM 2023). One small nest was located within MOD1 with four more located just outside MOD1, which would not be impacted by development.

Raptor nests were checked for the presence of eggs and chicks using a drone on 21 November 2023 by the Senior Environmental Specialist.

4. RESULTS

4.1 Corben's Long-eared Bat habitat clearing

Clearing of Corben's Long-eared Bat habitat and HBTs in the southern part of the mine access road occurred between the 29 November and 5 of December 2023. These HBTs were situated within cleared agricultural land and one small isolated patch of Spinifex Dune Mallee Woodland. A total of 18.73Ha of vegetation was cleared within Corben's Long-eared Bat habitat mapped as medium and medium-high hollow tree density.

Table 1 shows the dates surrounding vegetation was cleared, dates when HBTs were removed and the dates HBTs were relocated to stockpiles. Figure 1 shows the locations of HBTs.

Table 1- Details of HBTs removed

HBT identification number	Date surrounding vegetation cleared	Date HBTs felled	Date HBTs relocated to stockpiles
90,78,92,84,80,81,71,74,76,83,73,75,87,77,89	No surrounding vegetation	29/11/23	30/11/23
16,3,21	02/12/23	04/12/23	05/12/23

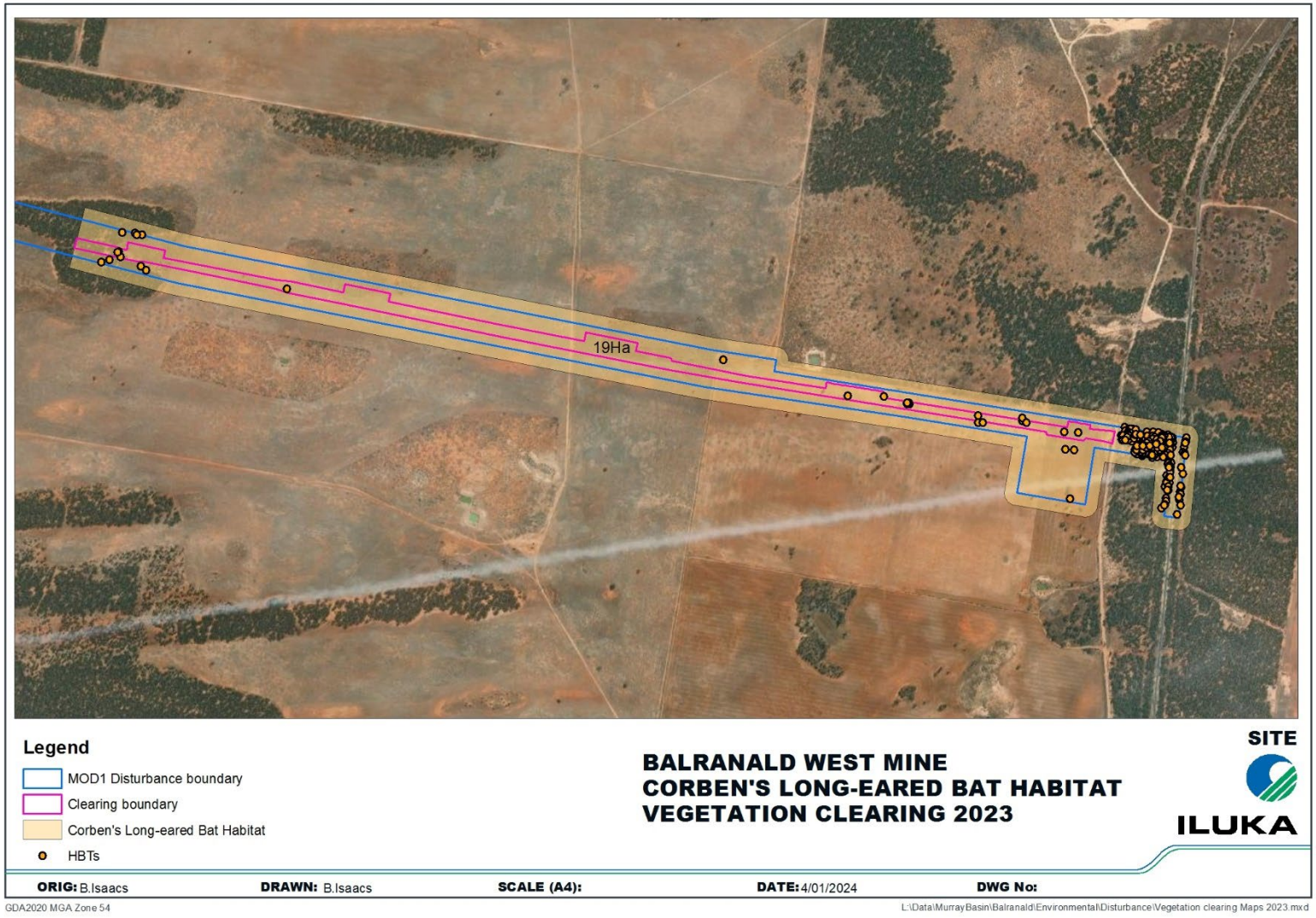


Figure 1- Corben's Long-eared Bat habitat clearing

4.2 Malleefowl habitat clearing

Malleefowl habitat clearing was undertaken between 14 August –21 August 2023. A total of 10.4Ha of vegetation was cleared for the future mine access road, comprising of both Spinifex Dune Mallee and Chenopod Sandplain Mallee (Figure 2). A total of four inactive mounds were destroyed during clearing activities and three mounds were avoided, with one mound (BWM2) later observed to be active during the October 2023 pre-disturbance surveys after vegetation clearing had occurred within 200m of the mound. This mound will continue to be protected until the end of the breeding season (end of February 2024) and any fledglings have left the mound, possibly up to the end of March 2024.

Table 2 shows the status of identified mounds at the end of 2023. Figure 2 shows the location of identified mounds.

Table 2- Malleefowl mound status

Mound identification number	Mound status	Mound active (Y/N)
BWM1	Destroyed	-
BWM2	Protected	Y
BWM3	Destroyed	-
BWM4	Destroyed	-
BWM5	Destroyed	-
BWM6	Protected	N
BWM7	Avoided	N

4.3 Raptor nest bearing trees

No trees were cleared in 2023 that contained rapture nests. One tree containing a raptor nest (NT1) is scheduled to be cleared outside the breeding season in 2024.

4.4 Non-threatened species habitat clearing

A total of 8.55Ha was cleared mainly comprising of cleared agricultural land and cleared-derived native grassland (Figure 3).

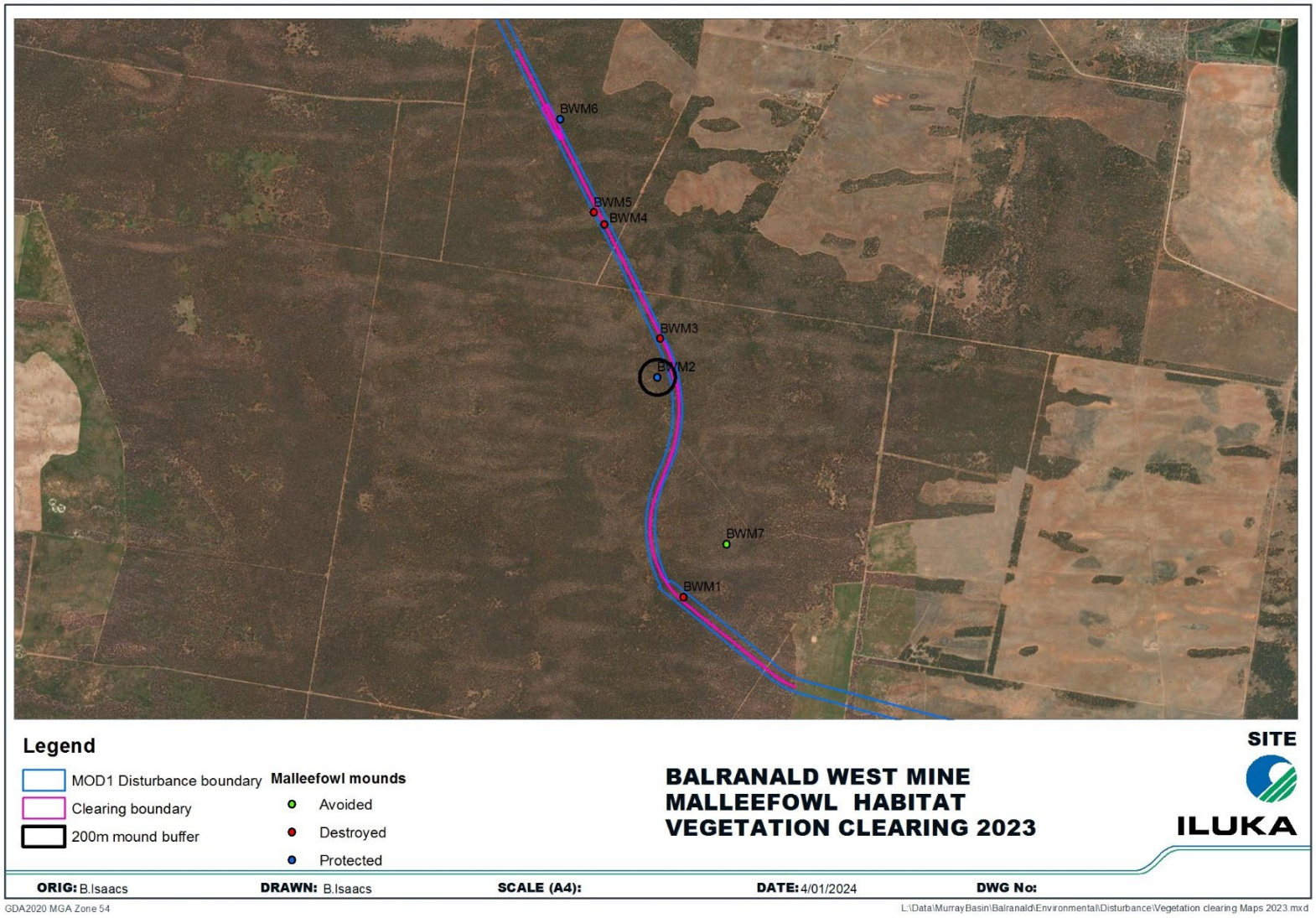


Figure 2- Malleefowl habitat clearing

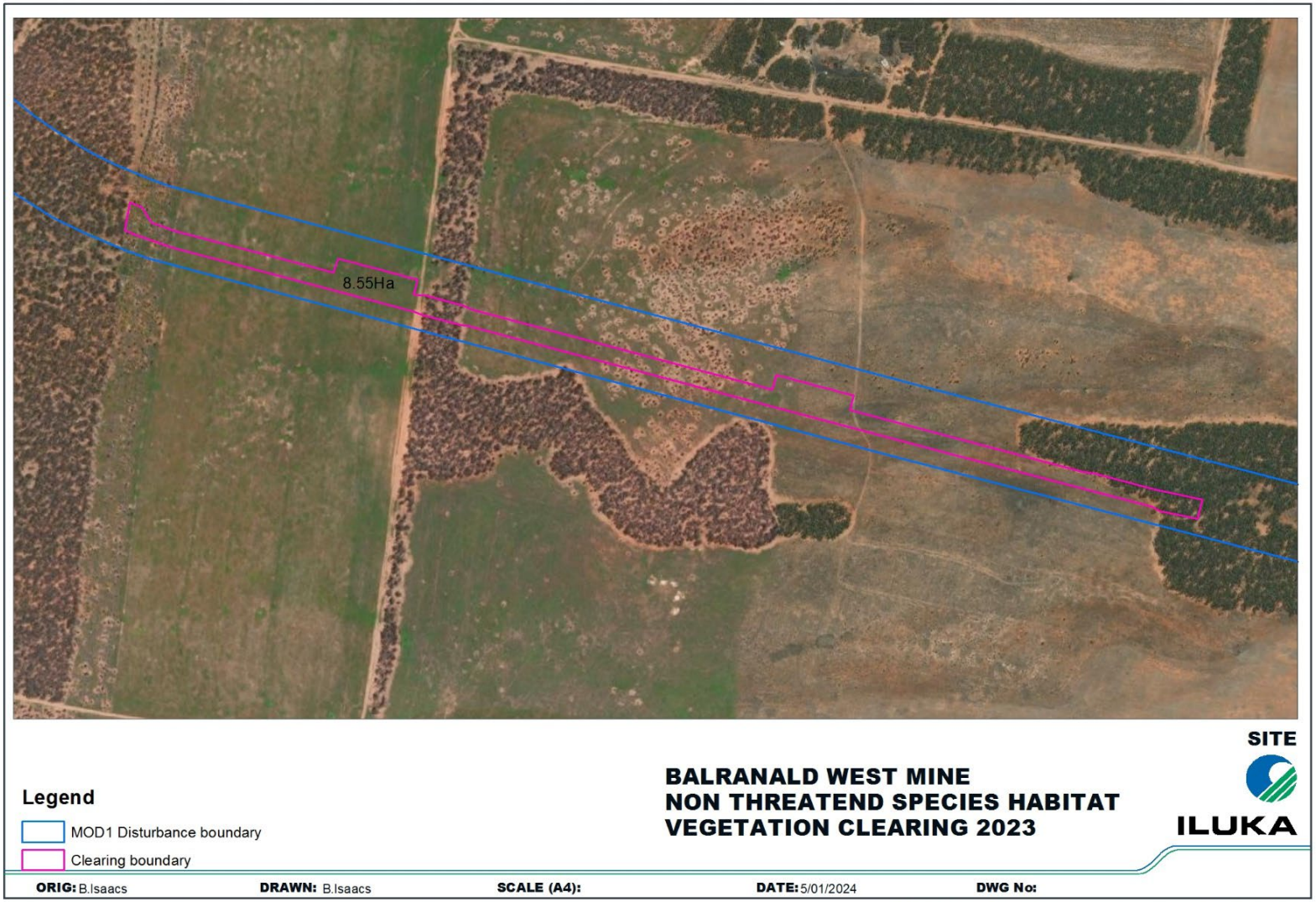


Figure 3- Non-threatened species habitat clearing

5. CONCLUSION

A total of 37.68Ha of vegetation was cleared during 2023 within the alignment of the mine access road, a breakdown of clearing for each habitat type is proved in Table 3. No threatened fauna species were directly impacted during clearing activities.

Table 3- Vegetation clearing summary

Threatened species habitat	Vegetation community(s)	Cleared (Ha)
Corben's Long-eared Bat	Cleared agricultural land	16.90
	Cleared-derived native grassland	1
	Spinifex Dune Mallee	0.83
Sub total		**18.73**
Malleefowl	Spinifex Dune Mallee	3.2
	Chenopod Sandplain Mallee	7.2
Sub total		**10.40**
Non-threatened species	Cleared agricultural land	2.65
	Cleared-derived native grassland	5
	Spinifex Dune Mallee	0.60
	Chenopod Sandplain Mallee	0.30
Sub total		**8.55**
Total area cleared		**37.68**

6. REFERENCES

EMM 2022, *Balranald Mineral Sands Project Modification 1 EPBC Biodiversity Pre-disturbance Survey Report,* EMM Consulting Pty Ltd.

EMM 2023, *Balranald Mineral Sands Project Malleefowl and raptor pre-disturbance survey report,* EMM Consulting Pty Ltd.

7. APPENDICES

Appendix 1 – Pre-disturbance reports 2022-2023

Appendix 2 – Photographs of clearing works

APPENDIX 1- PRE-DISTURBANCE REPORTS 2022-2023

APPENDIX 2- PHOTOGRAPHS OF CLEARING WORKS


POTTER

A-1.6 Appendix F: Plan 1- Current status of mining & rehabilitation and current landform contours.

N

ML1855

T3 Trial Site

ML1736

EL7450

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

Legend

- Project Approval Boundary
- Current Titles
- MOD1 disturbance area

Disturbance

Mining Domain Type

- Beneficiation Facility
- Infrastructure Area
- Other
- Overburden Emplacement Area
- Tailings Storage Facility
- Underground Mining Area (SMP)
- Active Mining Area (Open cut void)
- Water Management Area

BALRANALAD MINERAL SANDS PROJECT

Theme Submission ID Number

PLAN 1A: CURRENT STATUS OF MINING AND REHABILITATION

Current Landform Contours: 6879
Project Approval Boundary: 6138

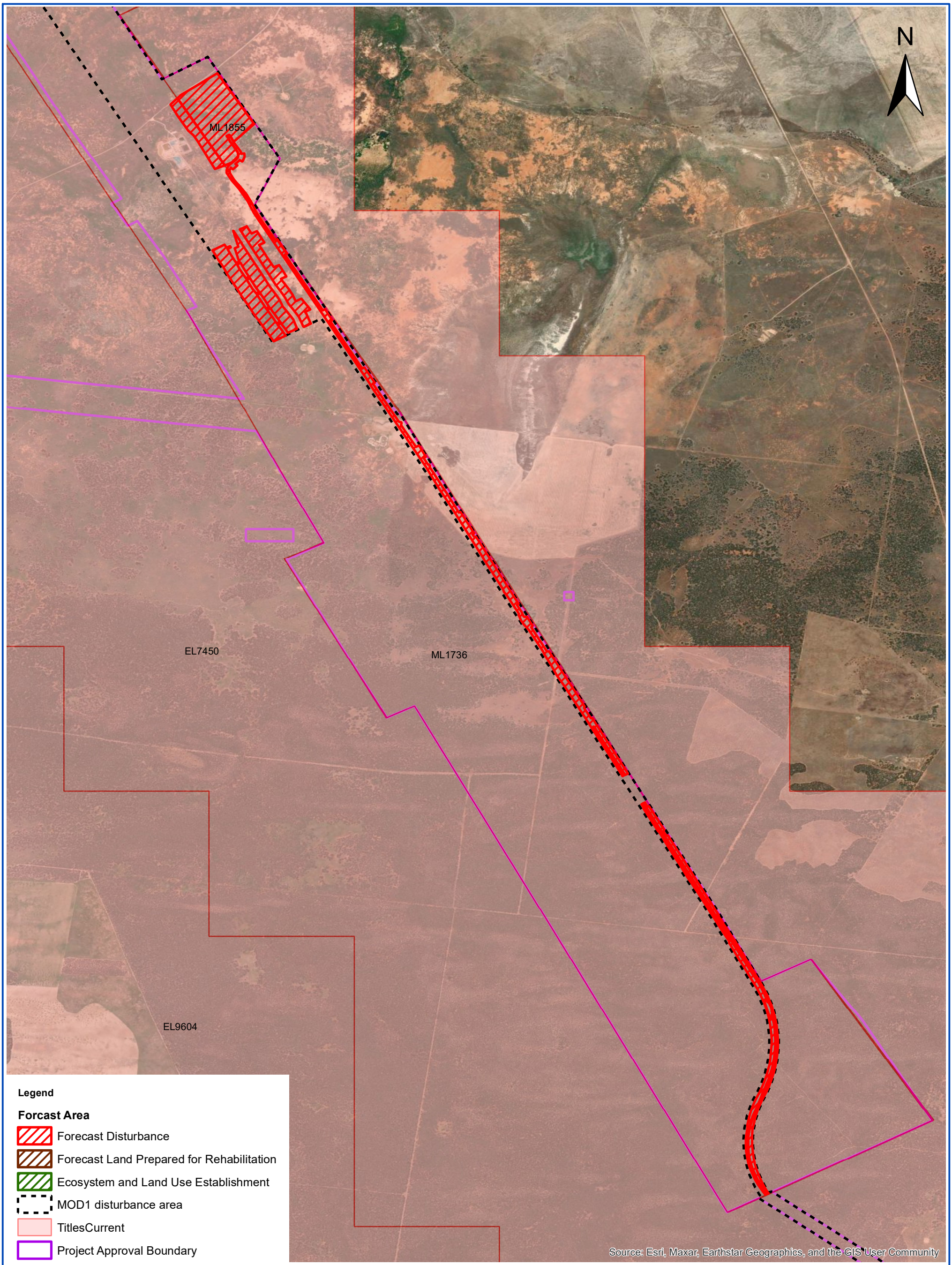
0 Kilometers 1.65

GCS GDA 1994

ILUKA

Plan Date: 17/02/2023

A-1.7 Appendix G: Plan 2- Forecast disturbance and rehabilitation years 2024-2026



BALRANALAD MINERAL SANDS PROJECT

PLAN 2A: MINING AND REHABILITATION- YEAR 1

Theme Submission ID Number

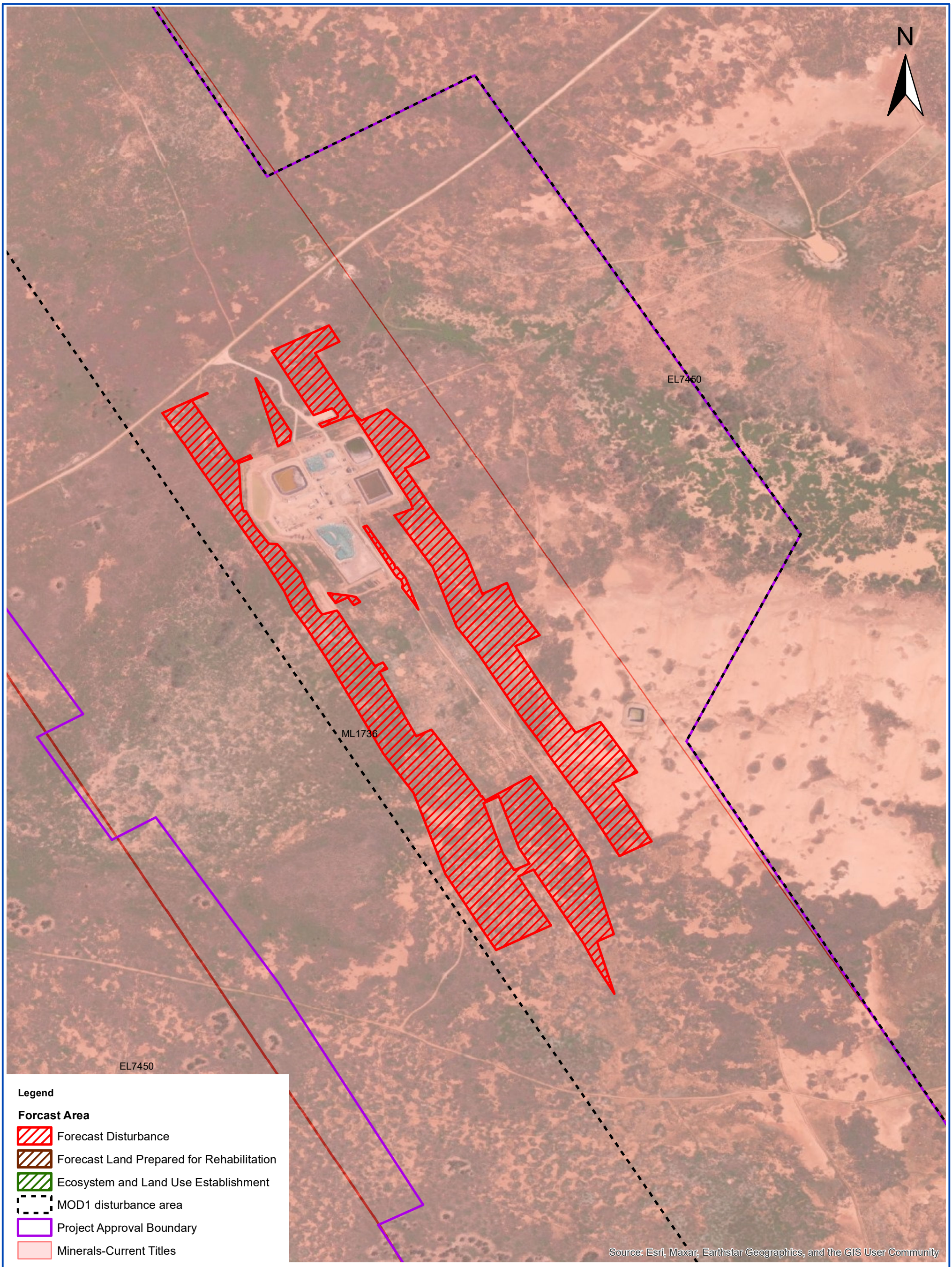
Forecast Data Year 1: 7136
Project Approval Boundary: 6138

0 Kilometers 1.65

GCS GDA 1994

ILUKA

Plan Date: 13/02/2024



Legend

Forcast Area

- Forecast Disturbance
- Forecast Land Prepared for Rehabilitation
- Ecosystem and Land Use Establishment
- MOD1 disturbance area
- Project Approval Boundary
- Minerals-Current Titles

BALRANALAD MINERAL SANDS PROJECT

PLAN 2A: MINING AND REHABILITATION- YEAR 2

Theme Submission ID Number

Forecast Data Year 2: 7107
Project Approval Boundary: 6138

0 Kilometers 0.3

GCS GDA 1994

ILUKA

Plan Date: 13/02/2024

N

EL7450

ML1736

EL7450

Legend

Forcast Area

- Forecast Disturbance
- Forecast Land Prepared for Rehabilitation
- Ecosystem and Land Use Establishment
- MOD1 disturbance area
- Project Approval Boundary
- Minerals-Current Titles

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

BALRANALAD MINERAL SANDS PROJECT

PLAN 2C: MINING AND REHABILITATION- YEAR 3

Theme Submission ID Number

Forecast Data Year 3: 7104
Project Approval Boundary: 6138

0 Kilometers 0.3

ILUKA

GDA2020 MGA Zone 54

Plan Date: 13/02/2024