Rasp Mine

Modification 13

Prepared for Broken Hill Operations Pty Ltd

March 2026

Rasp Mine

Modification 13

Broken Hill Operations Pty Ltd

E250352 RP1

March 2026

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Approved by

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13 March2026

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Executive Summary

ES1 Background

The Rasp Mine is an operating lead, zinc and silver mine which is located within the City of Broken Hill, in the far west of New South Wales (NSW). Rasp Mine has operated since 1885, and it is owned and operated by Broken Hill Operations Pty Limited (BHO), a wholly owned subsidiary of Broken Hill Mines Pty Limited (BHM).

Rasp Mine is regulated under Project Approval 07_0018 pursuant to the *Environmental Planning and Assessment Act 1979* (EP&A Act). The approval allows ore mining, processing, ore concentrate transportation and waste emplacement operations. The project approval has been modified 12 times since it was granted in 2011.

ES2 Proposed modification

BHO has made a modification request (07_0018 Mod 13) to the Minister for Planning and Public Spaces under section 4.55(2) of the EP&A Act to:

- extend underground mining operations into the British deposit (Mining Lode Block 16)
- develop a tailings dewatering system
- install an additional emergency egress ladderway from underground workings to the surface
- receive and process up to 100,000 tonnes per annum of ore from the nearby Pinnacles Mine
- increase the total amount of ore permitted to be extracted from 8,450,000 tonnes to 12,200,000 tonnes over the life of the project, and
- extend the approved mine life from 31 December 2026 to 31 December 2031
- update the figure in the project approval showing the 'free areas' at the site.

Consultation

BHO has consulted with a number of NSW Government agencies and Broken Hill City Council to discuss the proposed modification. Issues raised in consultation have been taken into consideration in the assessments undertaken for the proposal.

ES3 Assessment of impacts

This Modification Report has been prepared in accordance with the *State Significant Development Guidelines – Preparing a Modification Report.* The report is supported by a suite of specialist technical assessments.

The technical assessments demonstrate that the proposed modification would not result in significant adverse environmental or social impacts and that potential impacts can be effectively managed through existing approval conditions and management plans.

Key outcomes include:

- **Noise and vibration:** Construction and operational noise and vibration impacts would comply with the applicable criteria. Existing monitoring and management frameworks are sufficient to manage potential impacts.
- **Air quality and lead:** Air quality impacts, including lead-related risks, would remain within acceptable limits. Existing lead management and monitoring programs would continue for the proposed modification.

- **Water resources:** The proposed modification would not materially alter surface water or groundwater conditions and would not adversely affect water availability or quality.
- **Greenhouse gas emissions and climate change:** The project would not be classified as a large emitter under the NSW Guide for Large Emitters. The proposed modification would not materially increase emissions or hinder achievement of NSW or Commonwealth climate targets.
- **Social impacts:** The Social Impact Assessment concludes that the modification would result in an overall neutral to positive social outcome, with benefits associated with continued employment, economic stability and community investment.
- **Geotechnical:** The geotechnical assessment concludes that the proposed extension of mining into the British deposit and associated underground infrastructure can be undertaken safely and within acceptable risk levels, and with no impact on surface infrastructure. The proposed mining methods and design controls are consistent with existing approved operations at the Rasp Mine and would not result in any new or increased geotechnical risks.
- **Geochemical:** Geochemical testing indicates that tailings from the Pinnacles Mine and Rasp Mine deposits exhibit similar geochemical characteristics. Co-disposal of Pinnacles Mine tailings within the existing Rasp tailings storage facilities would not introduce additional risks. These findings also support the geotechnical assessment undertaken for the ladderway, which will be located in the British deposit.
- **Cumulative impact:** Cumulative impacts have been considered across environmental, climate and social factors. The assessment confirms that Mod 13 represents a continuation of existing approved operations and would not result in unacceptable cumulative impacts when considered alongside other current or reasonably foreseeable developments in the region.

ES4 Justification

The proposed modification is consistent with the objects of the *Environmental Planning and Assessment Act 1979* and the principles of ecologically sustainable development. Environmental impacts have been avoided or minimised where possible, and residual impacts can be effectively managed through established mitigation and monitoring measures.

The extension of mine life would provide ongoing economic and social benefits to the Broken Hill community while maintaining compliance with relevant environmental standards and climate change policy objectives.

ES5 Conclusion

On the basis of the assessment presented in this Modification Report and the supporting technical studies, the proposed modification is not expected to result in significant environmental, social or climate-related impacts. The proposal represents a logical and justified continuation of an established mining operation and is considered suitable for approval.

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1 Introduction

1.1 Background

Rasp Mine is an operating zinc, lead and silver mine which is located centrally within the City of Broken Hill, in the far west of New South Wales (NSW) (Figure 1.1). Rasp Mine produces zinc, lead and silver concentrates which are dispatched via rail to Port Pirie and Port Adelaide in South Australia (SA).

Rasp Mine has operated since 1885. Broken Hill Operations Pty Ltd (BHO), owned by CBH Resources at the time, purchased the mine in 2001 and commenced works at the site in 2007 with the installation of an exploration decline. Underground mining re-commenced at the site in 2011 with ore processing recommencing in 2012. Broken Hill Mines Pty Ltd (BHM) has owned the mine since November 2024.

Rasp Mine operates in accordance with project approval 07_0018 which was granted under delegation by the (then) Minister for Planning on 31 January 2011 under the since repealed Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Under clause 6 of Schedule 2 of the Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017, the project approval was transitioned to State significant development (SSD) by order, which took effect by publication in the NSW Government Gazette on 4 July 2018.

Rasp Mine is authorised by 07_0018 to:

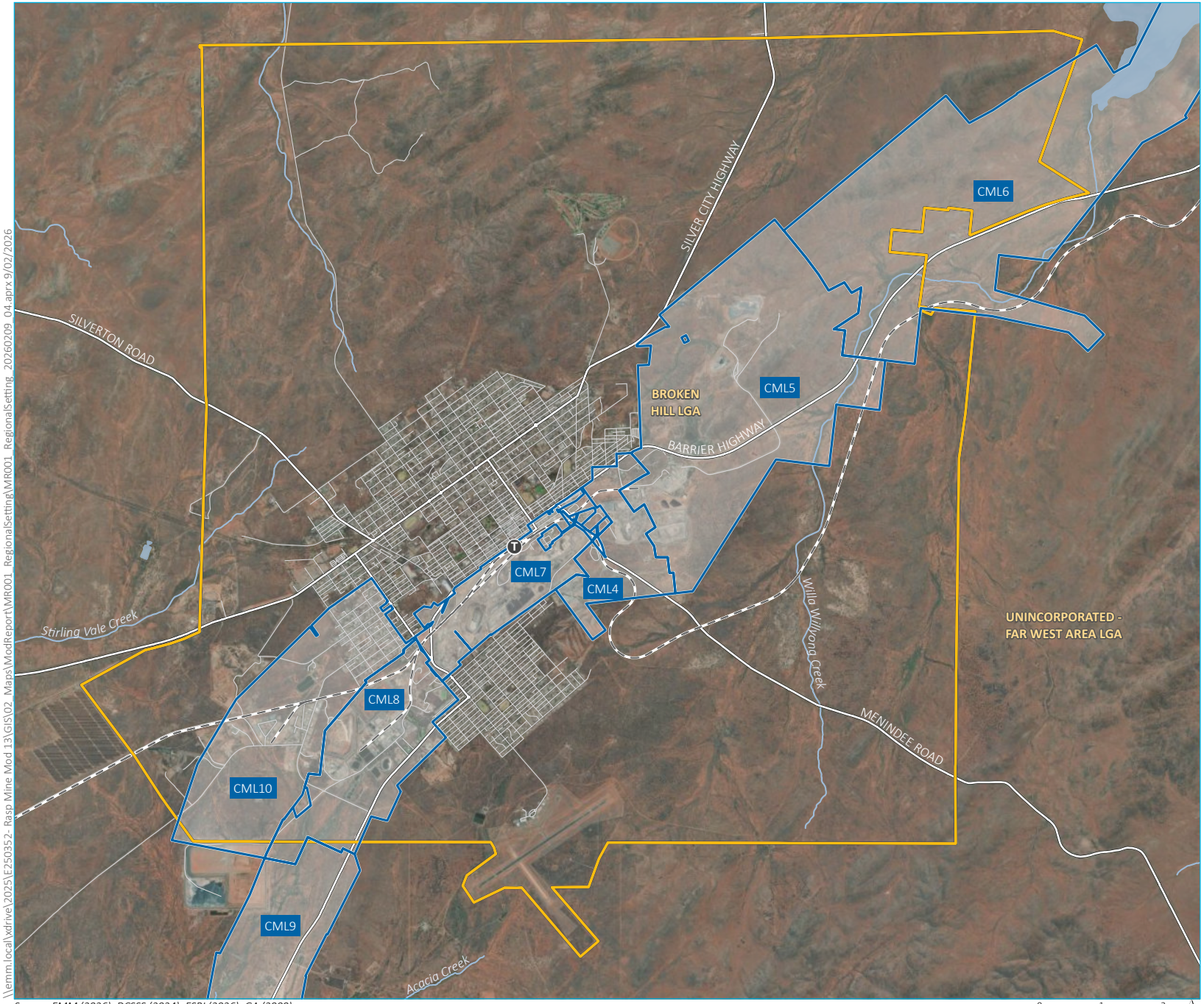
- extract up to 8.45 Million tonnes (Mt) of ore from the mine at a rate of 500,000 tonnes per annum (tpa), which can be increased to up to 750,000tpa in accordance with Schedule 2 Condition 6A[1].
- carry out mining operations until 31 December 2026
- process ore at the on-site processing plant
- operate three tailings storage facilities (TSF)
- backfill underground voids with tailings and waste rock
- conduct crushing and screening activities in the Kintore Pit or the BHP Pit
- use stored waste rock to increase the capacity of TSF3
- use waste rock material for various construction and rehabilitation activities on site
- transport ore concentrate off-site via rail to Port Pirie and Port Adelaide in SA.

Operations at the Rasp Mine are supported by a range of on-site facilities, including a crushing and processing plant, tailings backfill plant, rail siding facilities, as well as administration offices, workshops and a storage warehouse.

Mining activities are also regulated under Consolidated Mining Lease CML7. Rasp Mine is also permitted to mine a small section within Mining Lease ML1249 under a sublease arrangement Perilya Limited, which operates the adjacent Perilya Mine.

[1] Note: No additional work has yet been undertaken to increase ore extraction in accordance with Schedule 2 Condition 6A. All assessments undertaken to support this modification have been based on an ore extraction rate of 500,000tpa.

Since 07_0018 was granted, the project approval has been modified on 12 occasions. An overview of the Rasp approval history is summarised in Table 1.1 and Table 1.2, and a consolidated project description as approved under 07_0018, including the changes proposed under Modification 13, is provided in Appendix B.



KEY

- Mining lease

Existing environment

- Train station
- Rail line
- Major road
- Minor road
- Named watercourse
- Waterbody
- Local government area

INSET KEY

- NPWS reserve
- State forest

Source: EMM (2026); DCSSS (2024); ESRI (2026); GA (2009)

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Regional context

RASP Mine Mod 13
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Figure 1.1

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Table 1.1 Rasp Mine approval history overview

Approval	Details
07_0018	Granted 31 January 2011 under the now repealed Part 3A of the EP&A Act, to: • extract up to 8.45 Mt of ore over a 15-year mine life, at an average rate of 750,000 tpa • crush and process ore to produce ore concentrates containing approximately 44,000 t of lead (73% lead and 985 grams per tonne of silver) and 87,000 t of zinc annually • transport the crushed ore from the site by road during the first 18 months of the project, until processing facilities have been constructed, after which time crushed ore concentrate would be transported from the site by rail to domestic smelter and port customers (for export) • rehabilitate the site.
07_0018 (Mod 1)	Granted 15 March 2012 under section 75W of the EP&A Act to authorise the relocation of the ventilation shaft and associated exhaust fans.
07_0018 (Mod 2)	Granted 29 August 2014 under section 75W of the EP&A Act to change the approved operating hours of the crusher to 24 hours a day.
07_0018 (Mod 3)	Granted 17 March 2015 under section 75W of the EP&A Act to: • expand underground mining operations into Main Lode (ML) Block 7 • increase employment at the mine to 166 total full-time equivalents (FTEs) • install four new ventilation fans in ML Block 7.
07_0018 (Mod 4)	Granted 6 September 2017 under section 75W of the EP&A Act to increase the Blackwood Pit (TSF2) capacity from 4 Mt to 5 Mt and constructing an on-site concrete batching plant.
07_0018 (Mod 5)	Granted 2 November 2018 under section 4.55(1A) of the EP&A Act to construct a cement silo, import 5,000 t of cement to the site, extend an existing warehouse and update the mine's air quality monitoring requirements to be consistent with the Environment Protection Licence (EPL).
07_0018 (Mod 6)	Granted 16 March 2022 under section 4.55(2) of the EP&A Act to use the Kintore Pit as a new tailing storage facility (TSF3), relocate the current mine portal, provide for future waste rock emplacement areas (currently stored in Kintore Pit), and provide for associated service facilities
07_0018 (Mod 7)	Granted 29 July 2019 under section 4.55(1A) of the EP&A Act to utilise rock fill material stored in BHP Pit for Blackwood Pit (TSF2) embankment construction and conduct crushing and screen activities within BHP Pit.
07_0018 (Mod 8)	Granted 15 April 2021 under section 4.55(1A) of the EP&A Act to extend underground mining across CML7 to mine a predefined region of ML1249 under a sub-lease arrangement with Perilya Broken Hill Limited.
07_0018 (Mod 9)	Granted 23 December 2021 under section 4.55(1A) of the EP&A Act to extend underground exploration in ML Blocks 13 to 15 within CML7, and install an emergency egress ladder way from Stockpile 1 (SP1) underground to the surface
07_0018 (Mod 10)	Granted 13 December 2022 under section 4.55(1A) of the EP&A Act to permit the temporary stacking and storage of additional tailings within the mine's TSF2 facility
07_0018 (Mod 11)	Granted 15 March 2024 under section 4.55(1A) of the EP&A Act to install and use a new ventilation intake and further extend underground exploration in the ML to Blocks 13 to 15 within CML7.
07-0018 (Mod 12)	Granted 18 November 2025 under section 4.55(2) of the EP&A Act for extension of mining into ML Blocks 13 to 16.

Table 1.2 Modifications to 07_0018

Application	Determination date	Mine life	Mining rate and total production	Mining methods	Waste rock management	Processing rate	Processing methods	Concentrate production	Tailings disposal	Water supply	Employment numbers	Other
EA	31/01/2011	15 years from 2011 to 2026	750,000 tpa Total production over life of Project: 8,450,000 t	Underground mining using various methods including long hole, benching, modified Avoca, room and pillar or uphole retreat.	Underground: Backfill Surface: Inert material to be used for road repair and bunding and rehabilitation at closure. Permitted storage in Kintore Pit and BHP Pit.	250 tph crushing plant 93.8 tph grinding plant	Crushing, grinding, flotation, thickening and filtration at on-site processing facilities.	Lead: 44,000 tpa (concentrate 73% Pb and 985 g/t Ag) Zinc: 87,000 tpa (concentrate 50% Zn)	Fine tailings disposal (approximately 320,000 tpa): • TSF1 (10 m raise) • TSF2 Blackwood Pit Coarse tailings disposal (approx. 320,000 tpa) as underground stope back fill.	Potable 9 million litres per annum (ML/a) Raw 139 ML/a Reclaimed/ Recycled 300 ML/a Extraction up to 370 ML/a	143	
PPR		No change	No change	No change	No change	No change	No change	No change	No change	No change	No change	Relocation of processing plant with concentrate trucked to new Rail Loadout, Removed secondary and tertiary crushers and screens from the crushing circuit.
MOD1	16/03/2012	No change	No change	No change	No change	No change	No change	No change	No change	No change	No change	Relocation of ventilation shaft and installation of ventilation fans U/G.
MOD2	29/08/2014	No change	No change	No change	No change	No change	No change	No change	No change	No change	No change	Allow crusher to be operated at any time (24 hours per day 7 days per week).
MOD3	17/03/2015	No change Replacement tonnes.	No change Replacement tonnes	No change	No change	No change	No change	No change	No change	No change	No change	Extension of underground mining to include Block 7 (also included the Zinc Lodes).
MOD4	06/09/2017	No change	No change	No change	Material <0.5% lead would be used in TSF2 embankment construction	No change	No change	No change	No change	No change	195 (updated 2 additional related to MOD4)	Cement silo, Concrete Batching Plant.
MOD5	02/11/2018	No change	No change	No change	No change	No change	No change	No change	No change	No change	No change	Cement silo, and warehouse extension

Application	Determination date	Mine life	Mining rate and total production	Mining methods	Waste rock management	Processing rate	Processing methods	Concentrate production	Tailings disposal	Water supply	Employment numbers	Other
MOD6	16/03/2022	No change	500,000 tonnes, can be increased to 750,000 tonnes with approval from the Environment Protection Authority	No change	Excess waste rock to be: • Co-placed with tailings in TSF3. • Used for rehabilitation capping where material <0.5% lead. Permanently stored in Little Kintore Pit and BHP Pit (all material from construction of the boxcut and new decline development from surface).	No change	No change	No change	Establish a tailings storage facility at Kintore Pit as TSF3 with an approximate 14-year life. Utilise the surface of TSF2 to naturally dry tailings which would be harvested and transferred to TSF3.	Changes to • Potable/ treated water 10 ML/a. • Raw untreated water 324 ML/a. Reclaim/ recycled water 525 ML/a.	No change	A new access portal and decline to the underground mine, to be located within a boxcut. Land disturbance in MOD6 activities is 40.2 Ha, increasing land disturbance (from Rasp Mine activities) to 70 Ha.
MOD7	29/07/2019	No change	No change	No change	Material <0.5% lead would be used in TSF2 embankment construction	No change	No change	No change	No change	No change	No change	Mobile crushing in BHP Pit for embankment construction.
MOD8	15/04/2021	No change	No change Tonnes exchange with Perilya	No change	No change	No change	No change	No change	No change	No change	No change	U/G mining extension (20x250 m) across Perilya Lease ML1249.
MOD9	23/12/2021	No change	No change	No change	No change	No change	No change	No change	No change	No change	No change	The establishment of two development drives and an emergency egress ladderway.
MOD10	13/12/2022	No change	No change	No change	No change	No change	No change	No change	Temporary storage of tailing in stockpile at TSF2	No change	No change	Temporarily emplace harvested tailing produced during interim period in a stockpile at the south-western end of TSF2, until TSF3 is operational.
MOD11	15/03/2024	No change	No change	No change	No change	No change	No change	No change	No change	No change	No change	An extension of the development workings within blocks ML 13, ML 14 and ML 15 and the addition of a ventilation intake.
MOD12	18/11/2025	No change	No change	No change	No change	No change	No change	No change	No change	No change	No change	Mining extension into ML 13, ML 14, ML 15 and ML 16.

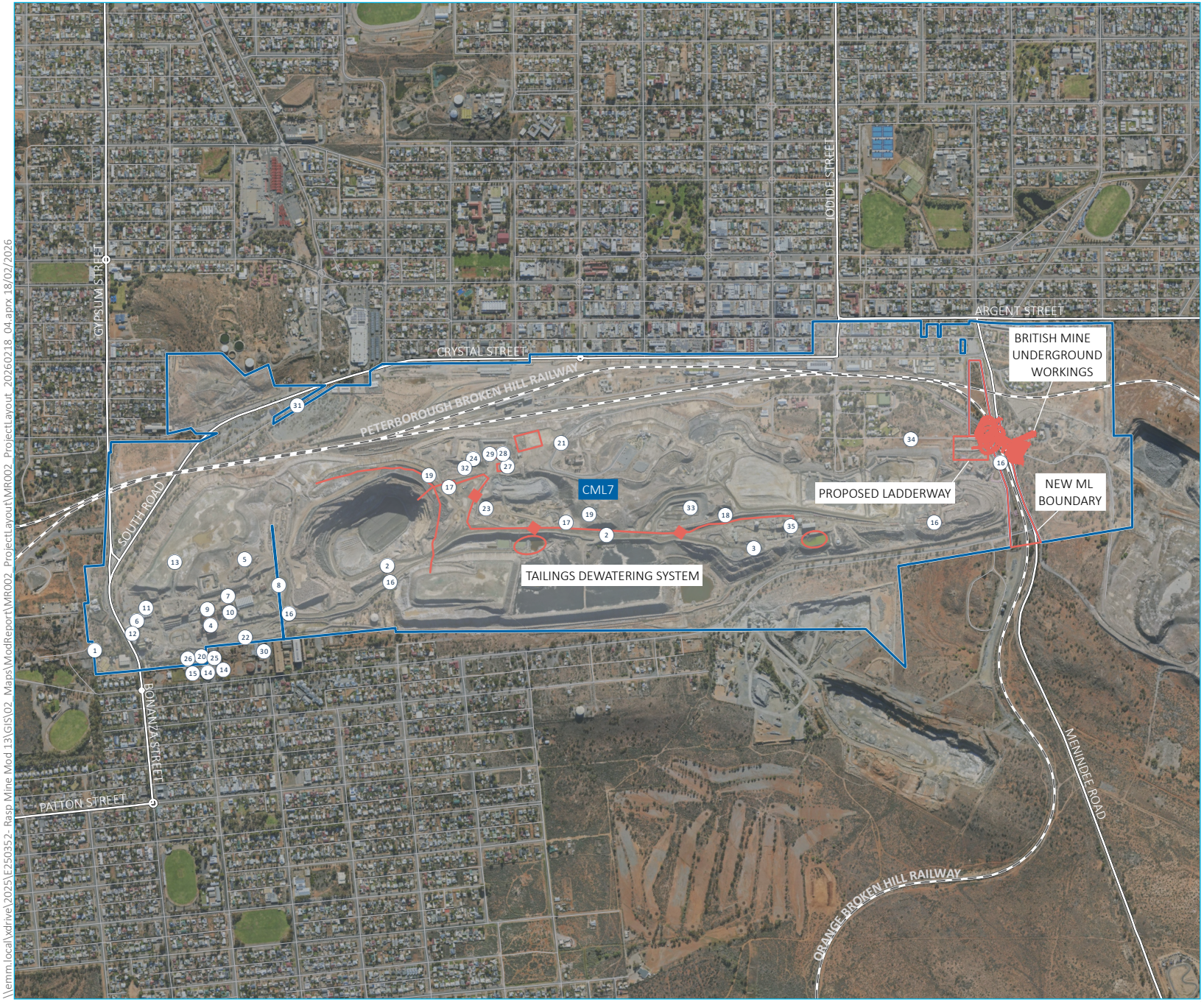
Application	Determination date	Mine life	Mining rate and total production	Mining methods	Waste rock management	Processing rate	Processing methods	Concentrate production	Tailings disposal	Water supply	Employment numbers	Other
MOD13	TBD	Extension of five years from 2026 to 2031	Receiving 100,000 t of ore from Pinnacles Mine for processing No change to mining rate	No change	No change	No change. Ore received from Pinnacles Mine would be included in the total 500,000 tpa processing limit.	No change	No change	Incorporating a tailings dewatering system	No change	No change	Mining extension into ML 16 (British deposit). A boundary change to CML7 is required to facilitate this mining and will be completed under a separate parallel process. Construction of an emergency egress ladderway in ML 16 for the extension of mining into the British deposit.

1.2 Approved activities

The key activities authorised by 07_0018 (as modified) are summarised in Table 1.3 and illustrated in Figure 1.2.

Table 1.3 Rasp Mine activities

Activity	Details
Mine life	• To 31 December 2031.
Ore extraction	• 500,000 tpa (or up to 750,000 tpa with approval of the EPA). • Total of 12.2 Mt over the life of the mine.
Ore processing	• On-site ore processing of ore extracted from Rasp mine, including processing of up to 100,000tpa of ore received from Pinnacles Mine.
Ore concentrate transport	• By rail to Port Pirie and Port Adelaide
Underground mine access	• Via a box-cut and portal
Tailing emplacement	Tailing stored in: • Tailing Storage Facility (TSF1) • Blackwoods TSF (TSF2) • Kintore Pit (TSF3) • Underground voids as backfill. Tailings management supported by tailings dewatering infrastructure and filtration plant to produce filtered tailings for emplacement in TSF3.
Waste rock	• Mostly placed in underground voids and in surface storage (Little Kintore Pit). • Waste rock material with less than 0.5% lead content used for road repair, TSF2 embankment construction and bunding within the project area, and for rehabilitation of the site.
Ancillary infrastructure	Ancillary infrastructure includes: • crushing and processing plant, tailings dewatering plant and filtration plant • emergency egress ladders • tailing backfill plant • water management systems • rail siding facilities • internal roads • ventilation systems • administration offices • workshops • storage warehouse • core shed



KEY

- Broken Hill Operations mining lease
- Proposed modification

Project layout

1. CML7 boundary
2. Haul road (paved)
3. ROM pad
4. Old concentrator building (not used)
5. Old sand fill plant (not used)
6. Old No7 shaft (water pump)
7. Old No6 shaft (sealed)
8. Old No6 shaft (U/G intake air)
9. Electrical workshop
10. Maintenance workshop
11. Core shed
12. Old No7 underground offices (not used)
13. Telecommunications compound (not BHOP)
14. Administration offices
15. Former bowling green
16. Access road (paved)
17. Pipe corridor
18. Decant pond
19. Proposed 22kV power supply
20. Eyre St 22kV power supply
21. Federation Way access to cafe
22. Vehicle wash
23. Surface magazines
24. Primary ventilation exhaust rise
25. Change rooms and laundry
26. Car park
27. Backfill plant
28. Cement silo
29. Concrete batching plant
30. Extension to warehouse
31. Sublease region with Periyla
32. Surface escape ladderway
33. Box cut location
34. Ventilation intake
35. Processing plant

Existing environment

- Rail line
- Major road
- Minor road

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Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

0 0.5 1 km

GDA2020 MGA Zone 54

Project layout

RASP Mine Mod 13
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Figure 1.2

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1.3 Proposed modification overview

BHO is seeking to modify 07_0018 (Mod 13) pursuant to section 4.55(2) of the EP&A Act to:

- Extend underground mining operations into the British deposit in Main Lode (ML) Block 16
- install an additional emergency egress ladderway from the underground workings to the surface
- develop a tailings dewatering system
- receive and process up to 100,000 tpa of ore from the Pinnacles Mine
- increase the total volume of ore allowed to be extracted to 12,200,000 tonnes of ore over the life of the project
- extend the life of 07_0018 to 31 December 2031.

The proposed modifications are shown in Figures 3.1, 3.2, 3.3, and 3.4, and the changes in free areas are shown in Figure 3.5 and igure 3.6. Further details are presented in Chapter 3.

1.4 Purpose of this report

This modification report has been prepared on behalf of BHO by EMM Consulting Pty Ltd (EMM) to support the modification application and assess the environmental economic, , and social impacts of the proposed modification.

This modification report has been prepared in accordance with *State significant development guidelines – preparing a modification report* (DPE 2022) and the requirements of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation).

1.5 Applicant details

BHO is the applicant for the proposed modification. The applicants' details are summarised in Table 1.4.

Table 1.4 Applicant details

Specifications	Detail
Applicant	Broken Hill Operations Pty Ltd
Site address	130 Eyre Street, Broken Hill NSW 2880
ABN	58 054 920 893
Contact	Joel Sulicich, jsulicich@brokenhillmines.com

2 Strategic context

2.1 Site and surrounds

Rasp Mine is located within the City of Broken Hill and is surrounded by transport infrastructure, areas of commercial and industrial development and some residential areas. Mining has been undertaken at the Rasp Mine site for over 140 years. The mine has and continues to be a strategic asset for Broken Hill and its community.

The site contains numerous heritage buildings and structures associated with its rich mining history. There are 74 heritage listed items of high, exceptional or outstanding significance within the Rasp Mine precinct. Most of the site has been highly disturbed from mining activities with very little topsoil and native vegetation remaining on-site.

The proposed modification will not change the strategic context of the existing Rasp Mine. The proposed modification would occur within the existing disturbed areas of the mine, and it would facilitate the extension of mining for a further five years.

The Rasp Mine will continue to support economic prosperity in the Broken Hill Local Government Area (LGA). Rasp Mine continues to provide significant local jobs, investment, purchase of goods and services and taxes to the local and regional economy. Compared to its physical impact, Rasp Mine has a disproportionately large beneficial economic influence in the region.

2.2 Strategic planning framework

2.2.1 Far West Regional Plan 2036

The *Far West Regional Plan 2036* acknowledges and promotes a sustainable mining sector in Broken Hill, Cobar, Wentworth and Balranald. The plan recognises that the mining industry is the primary economic driver in Broken Hill, which generates direct employment and provides flow-on benefits to communities. The continuation of mining operations at Rasp Mine supports the Plan's objectives to maximise the economic potential of regional NSW while managing environmental impacts.

2.2.2 Broken Hill Community Strategic Plan 2040

The *Broken Hill Council Community Strategic Plan "Your Broken Hill 2040"* sets a vision for Broken Hill over the next two decades. The plan recognises Broken Hill as Australia's longest lived mining city, with mining greatly contributing to the local economy and employment. Rasp Mine is integral to the delivery of the community strategic plan given its close links with Council and the local funding opportunities and partnerships it has with community organisations. Mod 13 would support the strategic objectives of the Plan by enabling the continuation of mining operations, maintaining employment and supporting ongoing investment in the Broken Hill region.

2.2.3 Broken Hill Local Strategic Planning Statement 2020-2040

The *Broken Hill Local Strategic Planning Statement 2020–2040* lists Broken Hill as one of the world's great "mineralogical rainforests," where mining revenues are vital to Broken Hill and the rest of Australia. The plan also acknowledges mining as a major employer and primary driver of the Broken Hill economy.

2.3 Justification for the modification

The proposed modification supports the strategic context of the existing Rasp Mine. The continued success of Rasp Mine would help ensure that Broken Hill remains a vibrant town and an important mining hub, providing ongoing employment, skills development, and economic stability for the community. In turn, this would support growth in other sectors such as retail, housing, and infrastructure, ultimately benefiting the entire region.

By incorporating the tailings dewatering system BHO would significantly increase the amount of water recycled from tailings back into the operation and reduce the water content of the tailings to below the threshold for liquification, reducing the risk of inrush into the mine and mitigating the related safety risks.

There are no proposed changes to the rehabilitation or final land use for the tailings dewatering system dams, or broader site.

The inclusion ore from Pinnacles Mineas an additional ore source for the Rasp Mine processing plant is a key factor in extending the life of the Rasp operations. Diversifying the ore source feed with a high-grade resource will optimise production, reduce costs, and create greater operational stability. The ability to transport ore from the Pinnacles Mine to the Rasp Mine would safeguard existing jobs and stimulate new employment opportunities, contributing to both direct and indirect economic activity in the area. This would ensure a financially sustainable and profitable asset with the ability to weather external market fluctuations and economic shifts.

Broken Hill Local Government Area (LGA) is a well-established mining region, and the proposed extension of time modification will allow for the continuation of mining and processing operations at the mine, which supports economic benefits and employment opportunities in the region. Compared to its physical impact, Rasp Mine has a disproportionately large beneficial economic influence in the region.

3 Proposed modification

3.1 Overview

BHO is approved to conduct mining operations at Rasp Mine until 31 December 2026. BHO is seeking to extend operations until 31 December 2031, supported by the following proposed activities:

- extending mining operations into the British deposit in ML block 16
- developing a tailings dewatering system
- establishment of an emergency egress ladderway to surface in ML block 16
- receiving and processing of 100,000 tpa of ore from the nearby Pinnacles Mine
- increase the total volume of ore allowed to be extracted to 12,200,000 tonnes
- update the figure in the project approval to correctly show the 'free areas' at the site.

The proposed modifications to onsite infrastructure are shown in Figure 3.2 to Figure 3.4. The correct free areas are shown in Figure 3.6. Each component of the proposed modification has been designed to integrate with existing operations and would be managed in accordance with existing conditions of approval and approved management plans.

3.2 Extension of mining into the British deposit

BHO is seeking to extend mining operations into the British deposit. British deposit sits within ML block 16 (see Figure 1.2). This area has historically been mined, first in the 1880s and again in the 1970s.

Underground mining would be conducted in the British deposit using approved methods and occur 24 hours per day, seven days a week.

Parallel to this modification application, BHO has applied for a new mining lease from EL5818 for the small portion of land outside of Consolidated Mining Lease (CML) 7 in which the British deposit also sits (see Figure 3.2).

KEY

- Broken Hill Operations mining lease
- Proposed ladderway
- British Mine underground workings

Tailings dewatering system

- Tie-in
- Electrical
- Infrastructure
- Process water
- Tailings line

Existing environment

- Rail line
- Major road
- Minor road

Proposed modification

Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

0 0.5 1 km

GDA2020 MGA Zone 54

RASP Mine Mod 13
Modification Report
Figure 3.1

EMM
creating opportunities

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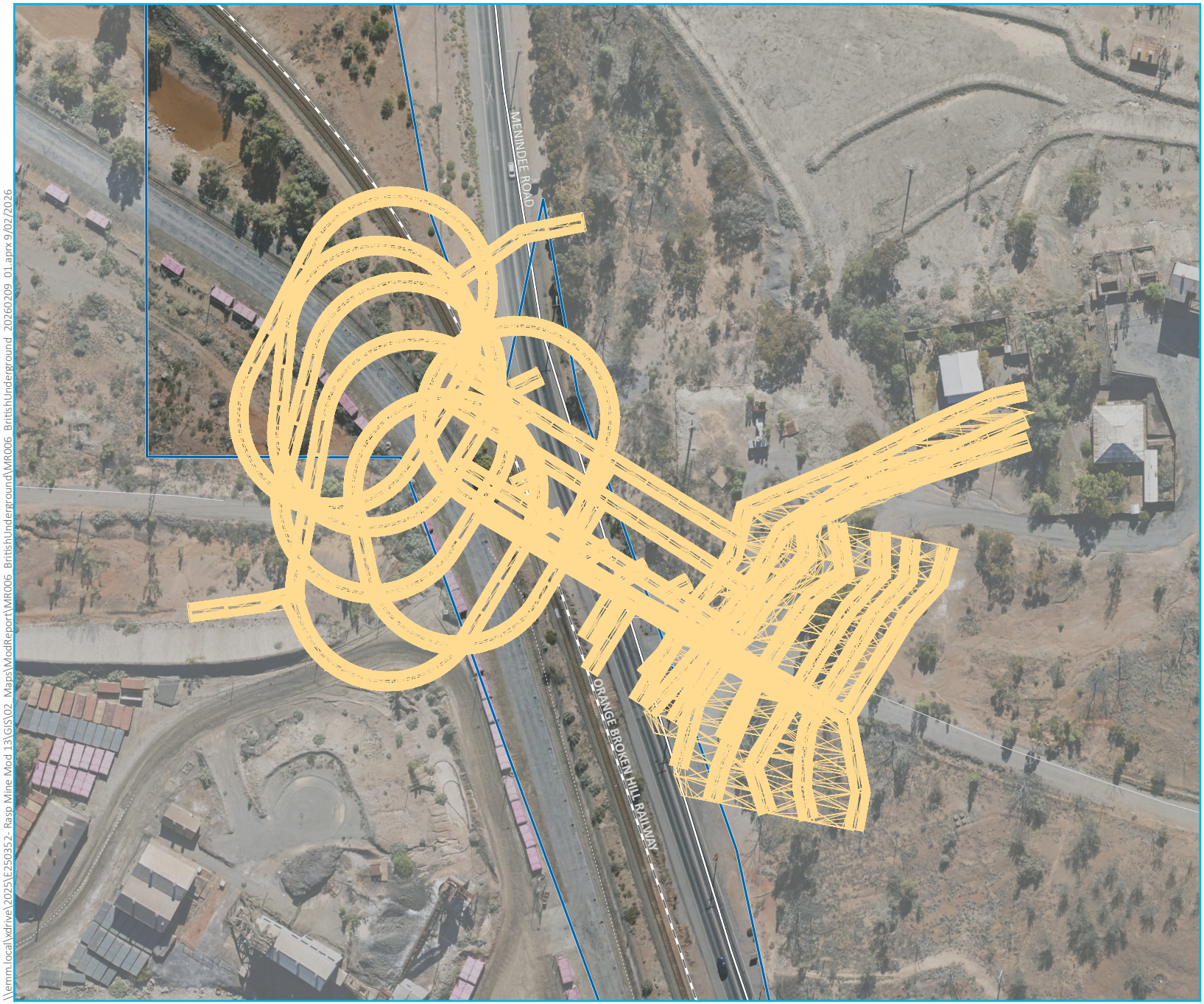

KEY

- Broken Hill Operations mining lease
- British Mine underground workings

Existing environment

- Rail line
- Major road
- Minor road
- Vehicular track

Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

0 25 50 m

GDA2020 MGA Zone 54

British mine underground workings

RASP Mine Mod 13
Modification Report
Figure 3.2

EMM
creating opportunities

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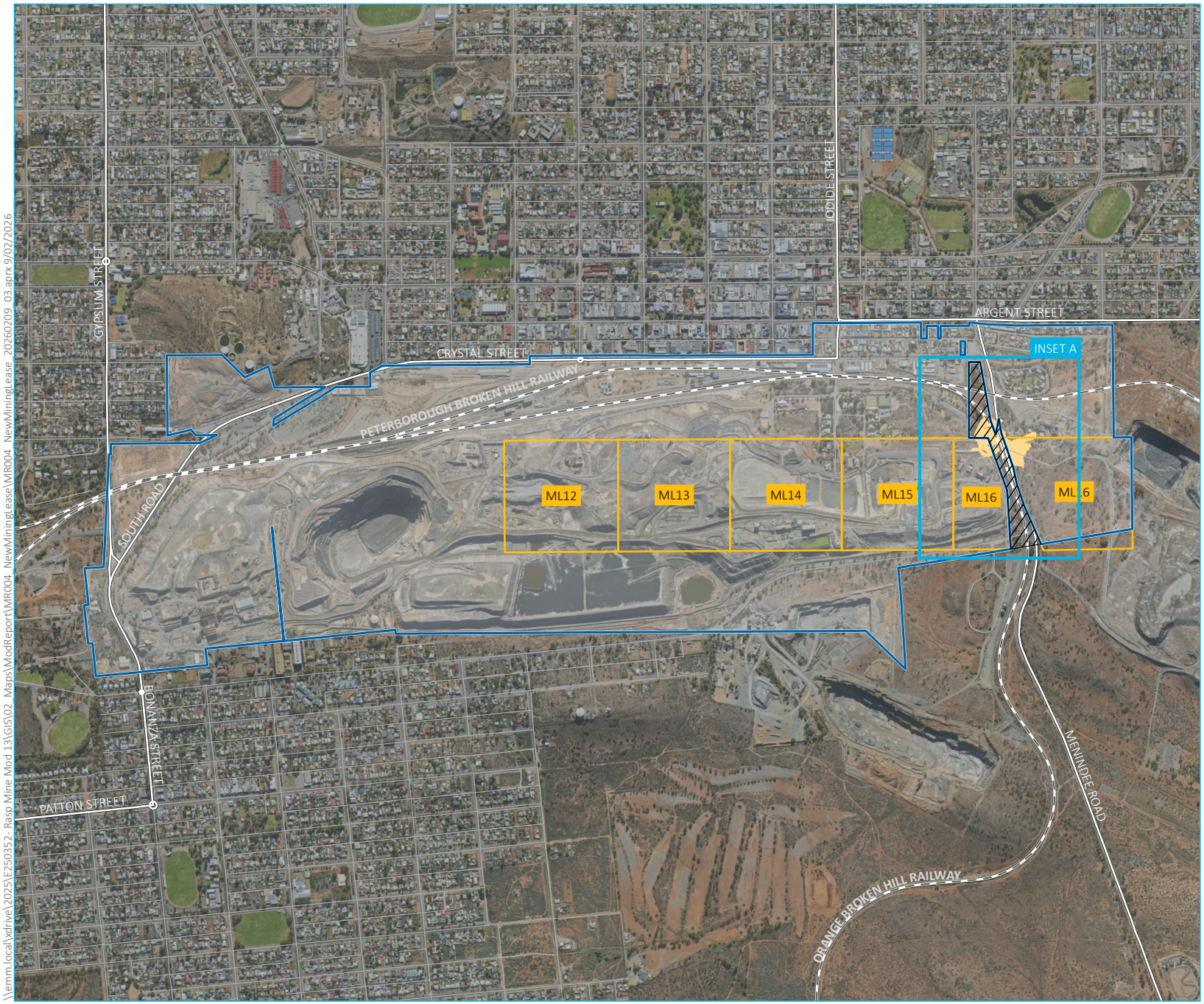

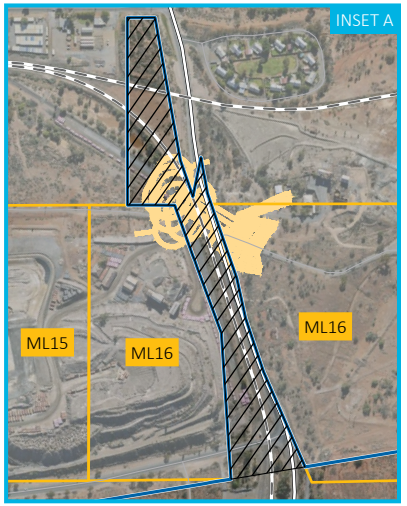

KEY

- Broken Hill Operations mining lease
- New ML boundary
- Mining block
- British Mine underground workings

Existing environment

- Rail line
- Major road
- Minor road

Project area requiring new mining lease

RASP Mine Mod 13
Modification Report
Figure 3.3

EMM
creating opportunities

Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

0 0.5 1 km
GDA2020 MGA Zone 54

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3.3 Installation of an emergency egress ladderway

BHO is seeking to install an emergency egress ladderway from the proposed underground workings to the surface. BHO currently maintains two means of egress from the mine; the main portal and emergency escape egress ladderway from Stockpile 1 underground to the surface (approved by MOD 9). The proposed emergency egress ladderway will ensure that there exists a further suitable means of emergency egress from the northern areas of the mine as mining continues moving north into the British deposit.

The location of the egress ladderway has been determined following a geotechnical review (see Appendix G), and will be located in the north west corner of ML Block 16, with the exact location determined based on:

- distance from the underground location to the surface
- suitable and stable ground, i.e. undisturbed area of the mine (no historic workings)
- surface area is not readily accessible or visible from off-site
- ability to mitigate noise impacts during construction.

3.3.1 Ladderway design

The proposed emergency egress ladderway will be fully enclosed and made of durable polyethylene product (Photograph 3.1). The emergency egress ladderway is designed to withstand water, salt or other mineral deposits, require minimal upkeep and comply with *AS1657 Fixed platforms, walkways, stairways and ladders.* The ladderway surface structure would be contained within a secured 20 foot long shipping container for security reasons, in a similar manner to the escape ladderway installed at the southern part of the Rasp Mine (Photograph 3.2).

Photograph 3.1 Example of emergency egress ladderway currently in use at Rasp Mine

Photograph 3.2 Emergency ladderway egress point currently in use at Rasp Mine

3.3.2 Ladderway installation

A raise borer is a common mining machine used to excavate a circular hole between two levels of a mine without the use of explosives. The raise borer will be set up on the surface on an evenly laid platform, with a pad size of approximately 9 m x 3 m x 200 mm (see Plate 3.1). Concrete will be delivered to the area via trucks (maximum two deliveries) and will ensure a stable footing for the raise bore to operate from, stable ground at the surface breakthrough point, and lastly, a suitable pad to place the shipping container on at competition.

The raise boring process is illustrated in Plate 3.2. A small-diameter hole (typically 230 to 445 millimetres (mm)) for the drill string is drilled to the level required. Once the drill has broken into the opening on the target level, the pilot bit is removed and a reamer head, of the required diameter (1.1 m), is attached to the drill string and raised back towards the machine. The drill cuttings and associated dust from the reamer head fall to the floor of the lower level and will remain underground. The finished raise bore hole has smooth walls and will not require any further work or ground support.

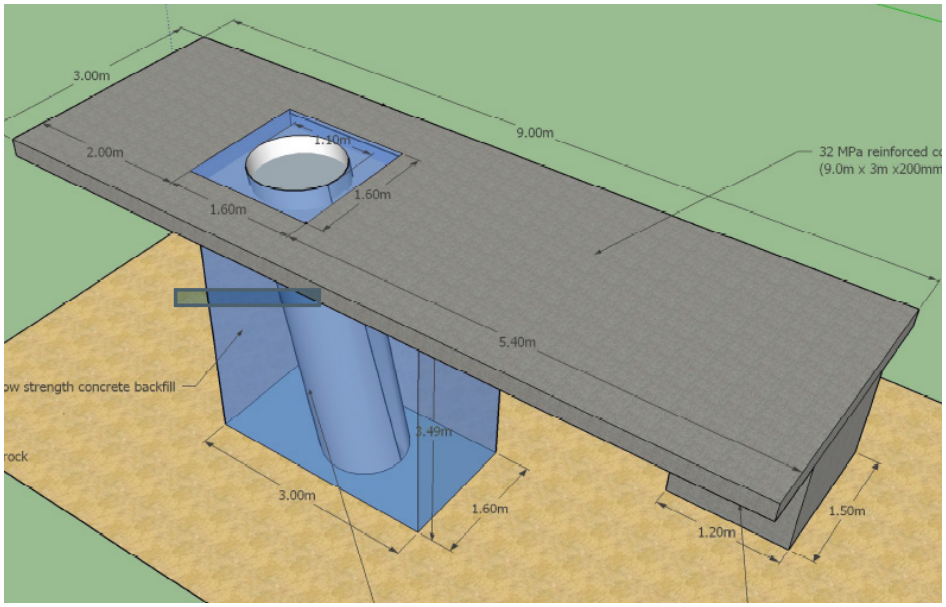
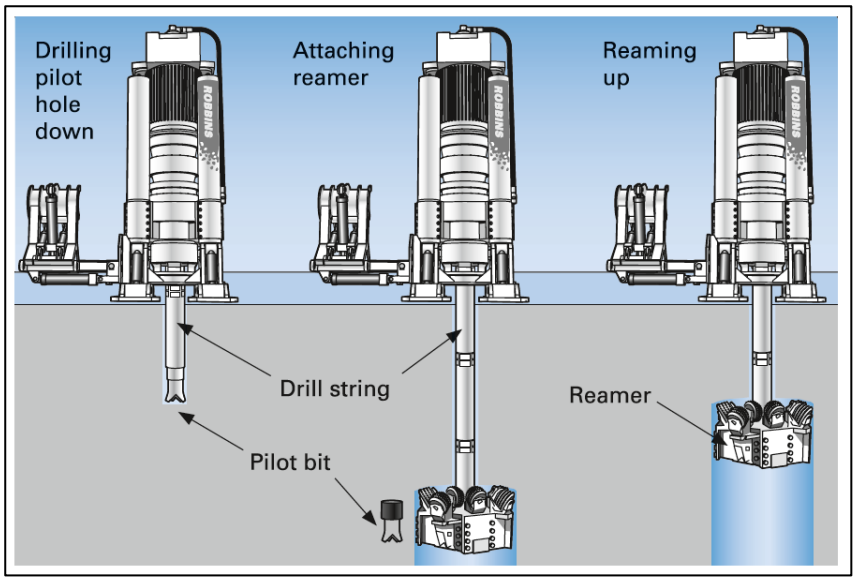


Plate 3.1 Example raisebore pad schematic



Source: Atlas Copco Mining Methods in Underground Mining 2nd 2007

Plate 3.2 Raisebore process

Emergency egress ladderway tubes are approximately 2.1 m in length and fit within the 1.1 m diameter raise bored hole utilising a pulley system. BHO would submit a High Risk Activity (HRA) Notification (Developing a new mine entry) to the Resources Regulator (Safety) for this installation.

3.4 Tailings dewatering system

3.4.1 System overview

BHO is proposing to install a tailings dewatering system to increase water recycling from tailings back into the operation and to decrease geotechnical concerns related to inrush into underground workings. The current approved tailings management procedures are limited to solar and wind desiccation of tailings (to approximately 65% solid and 35% moisture) at TFS2 before transport via truck to Kintore Pit (TSF3). Dried tailings are placed in near horizontal layers at TFS3 and compacted with a roller. TSF3 has a total remaining capacity of 4,679,063m^3, which equates to a capacity of 21 years at the current rate of emplacement.

The tailings dewatering system would significantly increase the amount of water recycled back into the operation. Tailings dewatering will reduce the water content of the tailings to below the threshold for liquification. The dewatering plants, together with ongoing compaction of deposited tailings, the portal plug and placement of rock (as approved in MOD6) will continue to mitigate the risk of inrush into the mine. Dewatering will also achieve a moisture content so the tailings material will not slump or liquefy from seismic events or mining blasting activity.

3.4.2 Tailings dewatering system design

The tailings dewatering system will incorporate both a filtration plant and a tailings slurry line and water return line between the filtration plant and Rasp Mine processing facility. The proposed filtration plant would be located adjacent to the Kintore Pit, in an enclosed building which will also contain a compressor, air dryer and instrument air. Power for the filter plant would be supplied from the existing system, with a new substation established adjacent to the filtration plant. The filtration plant will produce a filter cake which will be deposited in TSF3 via conveyer belt. The tailings dewatering system layout is shown in Figure 3.4.

Process water will be stored in process water ponds at the processing facility.

Tailings will be delivered from the processing facility to a surge tank at the filtration plant via the tailings slurry line pipe. Slurry from the surge tank would be pumped to a chamber where a cake blow compressor will dry the filter cake. Filter cake will then be moved to a long chute and to the conveyor which will direct the tailing into TSF3.

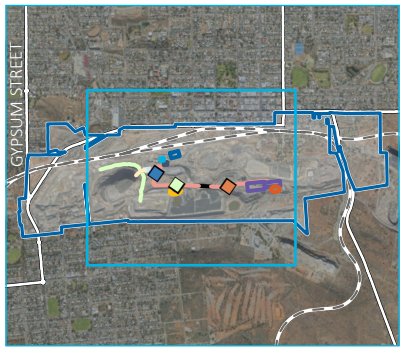
The tailings will be deposited via the conveyor 24 hours per day, then spread using a dozer during daytime hours. The filtrate will then be transferred back via the water pipe to a lined water pond ready for reuse in the processing facility.

3.4.3 Location on 'free area'

Part of the tailings pipeline would be located within a 'free area' at the mine. Free areas are defined in the project approval as '*non-active mining areas within CML7 that are not disturbed by the project but contribute to the wind-blown dust from the project site*'.

While the project approval defines free areas as non-active mining areas, it does not prohibit the future use of these areas for infrastructure with development consent, as was the case when infrastructure was approved to be developed on free areas in 07_0018 Mod 1 and 07_0018 Mod 4.

In this instance, parts of the tailings dewatering system tailings pipeline would be required to use small portions of a free area. This means that these areas would be no longer subject to active rehabilitation until such time as they are decommissioned. This also means that those areas would not have the potential to produce wind-blown lead containing dust while they are actively used. The remaining free areas would continue to be subject to approved progressive rehabilitation and capping, in accordance with the Rehabilitation Management Plan for Rasp (BHO 2022), and managed with dust mitigation measures employed as per the sites' existing Air Quality Management Plan including, but not limited to, use of water carts for dust suppression, and the use of chemical dust suppressants.



KEY

- Broken Hill Operations mining lease

Tailings dewatering system

- Process water tie-in
- Raw water tie-in
- Tails tie-in
- Batching plant
- Electrical substation
- Existing tails thickener & filter plant
- Grasshopper conveyor
- Lochness process water
- Overhead powerline
- Overhead powerline to be buried
- Process water pond- filtrate return
- Proposed Filter plant
- Sand backfill plant- not used
- Tails line
- Tails line to be buried

Existing environment

- Rail line
- Major road
- Minor road
- Vehicular track

Tailings dewatering system layout

Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

0 150 300 m

GDA2020 MGA Zone 54

RASP Mine Mod 13
Modification Report
Figure 3.4

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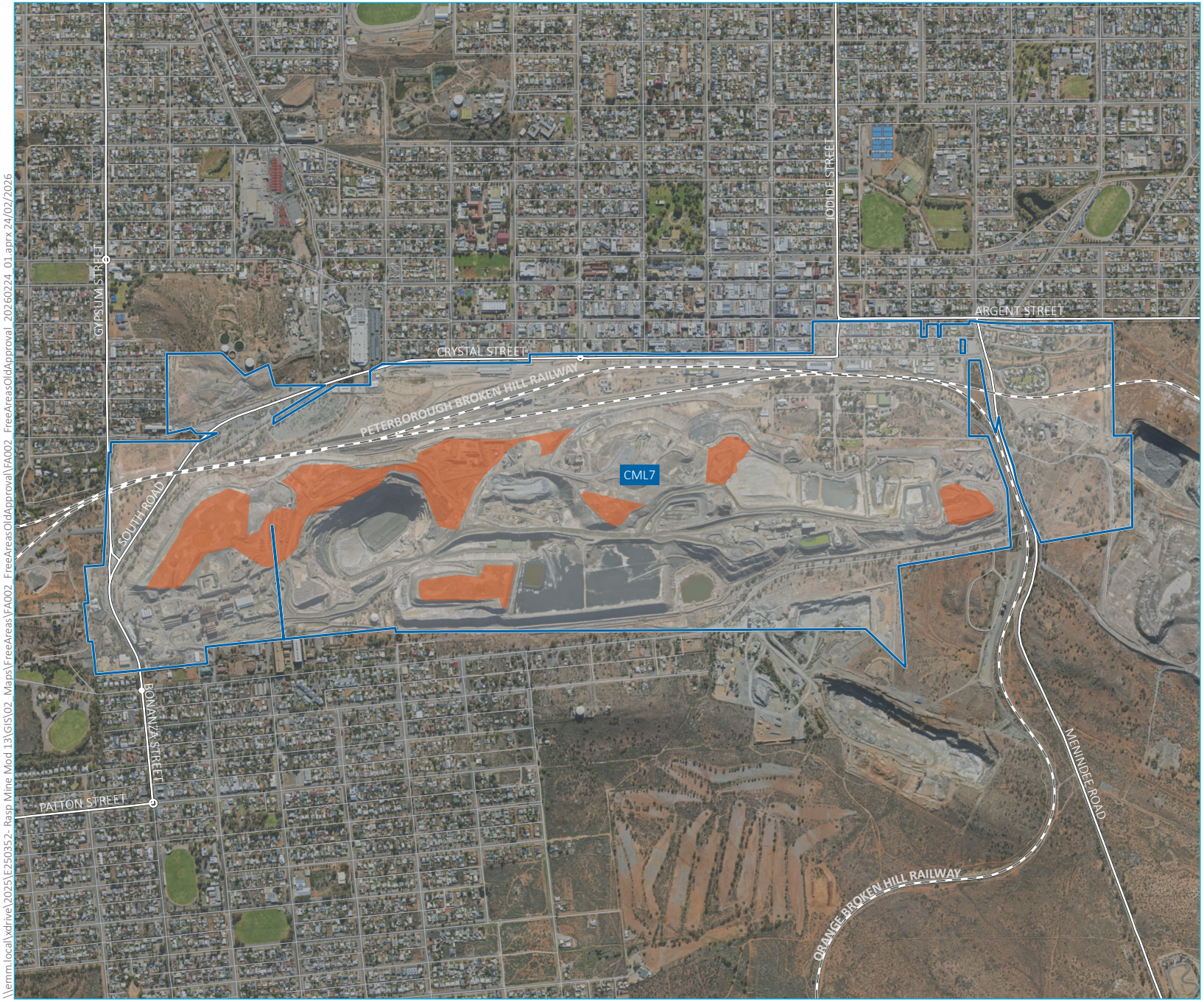

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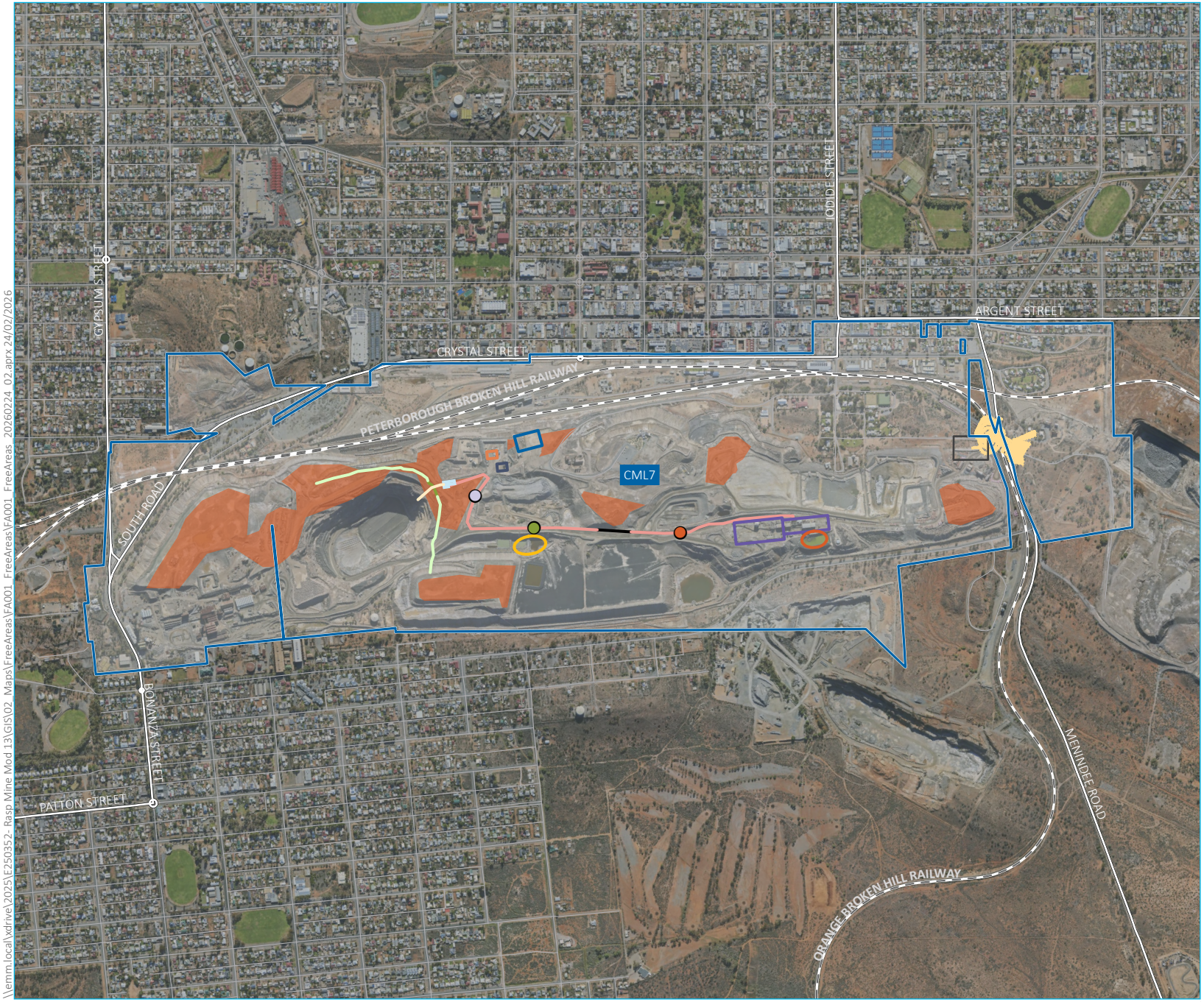
Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

Free areas as shown in Project Approval 07_0018

RASP Mine Mod 13
Modification Report
Figure 3.5

EMM
creating opportunities



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Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

Proposed modification and free areas

RASP Mine Mod 13
Modification Report
Figure 3.6

EMM
creating opportunities

3.4.4 Tailings dewatering system construction

A suitable 40 x 20 x 20 m platform for the filtration plant will be established using an excavator to level the area and prepare for concrete footings and foundation. Concrete pours will take approximately 10 days with 8 deliveries per day. Tools and equipment required for footings and foundation includes compactor, bobcat and small power tools such as welders, grinders, saws, nail guns and hand tools. The structural steel erection would take approximately 18 weeks and would involve the use of cranes, pneumatic power tools, small power tools and hand tools. Construction of the tailings slurry line pipe would take approximately 14 days.

3.5 Receiving and processing ore from Pinnacles Mine

BHO intends to receive 100,000 tpa of ore from the Pinnacles Mine and process this ore at Rasp Mine. Pinnacles Mine, owned by Pinnacles Mines Pty Ltd and operated by BHM, is located approximately 14 kilometres west of Rasp Mine. Pinnacles Mine is approved under Development consent (DA 13/13732), which was granted under the then section 80(1)(a) of Division 2 of Part 4 of the EP&A Act on 25 June 2014. Parallel to this modification, Pinnacles Mines Pty Ltd is proposing to modify DA 13/13732 to allow for haulage of up to 100,000 tpa of crushed ore from the Pinnacles Mine into Rasp Mine (via the Eyre Street entrance).

Ore receipt would occur in B-double trucks on a campaign basis at fortnightly or monthly intervals to support processing requirements at Rasp Mine. Rasp Mine would receive up to 1,512 deliveries of ore from Pinnacles Mine per year.

Pinnacles Mine ore would be unloaded at the existing Rasp Mine ROM pad, and processed using the existing processing facility. Final concentrate products would be transported via rail to Port Adelaide. Tailings would be managed in accordance with approved Rasp Mine tailings management procedures.

The receipt and processing of Pinnacles Mine ore would diversify the ore sources, enabling the Rasp Mine to optimise production, reduce costs and create greater operational stability. Pinnacles Mine ore is a key factor in extending the life of the Rasp Mine and supports the long-term future of the operation.

3.6 Increase in ore extraction

The project approval limits the amount of ore that can be extracted over the life of the project to 8,450,000 tonnes. In the five additional years that the mine would operate, BHO anticipates that it could yield approximately 3,750,000 tonnes of ore.

This would require the total amount of ore permitted to be extracted to be increased to 12,200,000 tonnes of ore over the life of the project.

3.7 Free areas as described in PA 07_0018

The proposed modification also seeks to correct a misdescription of the free areas as shown in Appendix 4 of 07_0018. Free areas have been previously modified on two occasions at the Rasp Mine, to allow additional infrastructure to be developed. The relevant modifications were Mod 1 which allowed the development of the main ventilation shaft north of the Kintore Pit and Mod 4 which allowed the development of a concrete batching plant to the east of the main ventilation shaft.

However, following the approvals of both Mod 1 and Mod 4, the figure showing the free areas in Appendix 4 of the project approval was not updated. Therefore, the proposed modification seeks to update the figure to correctly show the remaining free areas at the site.

3.8 Extension of mine life

BHO is seeking to extend mining operations by five years, from 31 December 2026 to 31 December 2031. The extension of time is supported by the proposed mine plan, importation of ore from Pinnacles Mine and long-term planning for the site. In parallel with this modification application, BHO has applied to renew and extend the mining lease for CML7 to align with the extended mine life.

3.9 Hours of operation

Most of the proposed construction activities will be restricted to the standard construction hours between 7:00 am and 6:00 pm Monday to Friday, 8:00 am to 1:00 pm on Saturdays, and no work on Sundays or public holidays.

The exceptions are the raise boring activity during the proposed ladderway construction and filter plant construction. The proposed ladderway construction is proposed to occur 24 hours seven days a week. The filter plant construction is proposed to occur from 7:00 am to 6:00 pm Monday to Saturday and from 8:00 am to 6:00 pm Sundays.

3.10 Alternatives considered

Exploration activities have determined a high-quality resource in the British deposit; therefore the extension of mining is proposed for the British deposit.

A review of possible emergency egress ladderway locations was undertaken by BHO (see Appendix G), which determined the proposed location is the most suitable as it is located in a stable area in the northern area of the mine, within CML7, is not within any surface exclusion or heritage area.

While other areas were broadly considered for the emergency egress ladder, no other locations were considered suitable.

Without the proposed modification, particularly the extension of mine life, the economic benefits into the Broken Hill LGA would not be realised. The inclusion of the Pinnacles Mine ore would diversifying the ore source feed and would optimise production and create greater operational stability. The tailings dewatering system is critical for reducing tailings handling and movement, recycling of water and reducing risk of in-rush. No other alternatives were considered.

4 Statutory context

4.1 Environmental Planning and Assessment Act 1979

4.1.1 Approval pathway

The Rasp Mine Project was approved on 31 January 2011 under the now repealed Part 3A of the EP&A Act. Under clause 6 of Schedule 2 of the Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017, the project was transitioned to an SSD by order, which took effect by publication in the NSW Government Gazette on 4 July 2018.

BHO is now seeking to modify 07_0018 to authorise the above activities pursuant to section 4.55(2) of the EP&A Act. In accordance with section 4.55(2) of the EP&A Act, a consent authority may modify a development consent if it is satisfied that the development to which the consent as modified relates is the same or substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all).

With consideration to section 4.55(2) of the EP&A Act, section 3BA(6) of the Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017 provides:

> **3BA Winding-up of transitional Part 3A modification provisions on cut-off date of 1 March 2018 and other provisions relating to modifications**
>
> (6) In the application of section 4.55 (1A) or (2) or 4.56 (1) of the Act to the following development, the consent authority need only be satisfied that the development to which the consent as modified relates is substantially the same development as the development authorised by the consent (as last modified under section 75W):
>
> (a) development that was previously a transitional Part 3A project and whose approval was modified under section 75W,

MOD 4 to 07_0018 was the last modification granted under the since repealed section 75W of the EP&A Act. As such, the consent authority needs only be satisfied that the proposed modification is substantially the same development as last modified on 6 September 2017. The proposed modification is considered to allow the Project to remain substantially the same development as last modified under section 75W of the EP&A Act being for mining within CML7, as:

- there would be no change to key aspects of the project, including annual ore extraction, ore processing and transportation systems
- the tailings dewatering system would result in fewer environmental impacts
- the proposed changes to operations are unlikely to change the approved impacts of the mine overall.

The suitability to modify to 07_0018 under section 4.55(2) of the EP&A Act was confirmed by the NSW Department of Planning, Housing and Infrastructure (DPHI) in correspondence dated 15 January 2026.

4.1.2 Approval authority

The Minister for Planning and Public Spaces (or delegate) is the approval authority for the proposed modification.

4.1.3 Applicability of section 4.15 of the EP&A Act

In 2025 the NSW Government implemented legislative reforms, which included reforms to the EP&A Act. The objective of the EP&A reforms was to reflect the evolving priorities of planning in NSW.

In accordance with the amendments of Section 4.15(b) of the EP&A Act, an assessment of environmental impacts on both the natural and environments, and social and economic impacts were assessed. The results of these assessments are discussed in Section 6 of this report.

The impact assessment concluded that the project is not likely to result in any significant impacts. BHO will continue to manage the site in accordance with the current and approved management and mitigation measures under 07_0018.

4.2 NSW Environmental Planning and Assessment Regulation 2021

Section 100 of the EP&A Regulation lists the information required in a modification application under section 4.55(2) of the EP&A Act. Table 4.1 described where this information is provided.

EL5818 will need to be converted into a new mining lease to cover the extension of mining into British deposit.

Table 4.1 EP&A Regulation section 100 information requirements

Section 100 information requirements		Where addressed
(1)(a)	the name and address of the applicant	Section 1.5
(1)(b)	a description of the development that will be carried out under the development consent	Section 1.1
(1)(c)	the address and folio identifier of the land on which the development will be carried out	Section 1.5
(1)(d)	a description of the modification to the development consent, including the name, number and date of plans that have changed, to enable the consent authority to compare the development with the development originally approved	Section 3
(1)(e)	whether the modification is intended to— (i) merely correct a minor error, misdescription or miscalculation, or (ii) have another effect specified in the modification application	Section 4.1.1
(1)(f)	a description of the expected impacts of the modification	Section 6
(1)(g)	an undertaking that the modified development will remain substantially the same as the development originally approved	Section 4.1.1
(1)(h)	for a modification application that is accompanied by a biodiversity development assessment report—the biodiversity credits information	Not applicable
(1)(i)	if the applicant is not the owner of the land—a statement that the owner consents to the making of the modification application	Not applicable
(1)(j)	whether the modification application is being made to— (i) the Court under the Act, section 4.55, or (ii) the consent authority under the Act, section 4.56.	Not applicable
(2)	Subsection (1)(i) does not apply if the consent of the owner is not required under section 98.	Landowner consent is not required pursuant to section 98(3) of the EP&A Regulation.

Section 100 information requirements		Where addressed
(3)	If a modification application under the Act, section 4.55(1A) or (2) relates to BASIX development, or BASIX optional development if the development application was accompanied by a BASIX certificate, the application must be accompanied by— (i) the BASIX certificate, or (ii) a new BASIX certificate if the current BASIX certificate is no longer consistent with the development.	Not applicable

4.3 Planning instruments and policies

4.3.1 State Environment Planning Policies

The State Environment Protection Policy (Resources and Energy) 2021 (Resources and Energy SEPP) aims to provide for the proper management and development of mineral, petroleum, and extractive material resources for the purpose of promoting the social and economic welfare of NSW.

Part 2.3, Clauses 16 to 23 of the Resources and Energy SEPP require consideration to be given to the significance of the resource, the compatibility of projects with other surrounding land uses, including the existing and potential extraction of minerals, natural resource management and environmental management, resource recovery, transportation and rehabilitation. The information presented in this modification report addresses each of the matters for consideration prescribed in the abovementioned clauses, as applicable.

Clauses 16 and 20 of the Resources and Energy SEPP requires the consent authority to consider the compatibility of the Project with other nearby land uses and impacts on significant water resources, threatened species and greenhouse emissions. Existing and approved land uses in the vicinity of the proposed modification consist of:

- Delprats Shaft historic workings
- current mining infrastructure and operations of BHO

The proposed modification would not change these existing uses and would operate without impacting these users beyond the impacts currently approved. The Café and Line of Lode lookout and Miners Memorial are also located on CML7 beyond Delprats Shaft and would not be impacted by the proposed modification.

There would be no additional water usage requirements in addition to that already assessed and approved for the site.

4.3.2 Broken Hill Local Environmental Plan 2013

The majority of the mine, including the proposed Mod 13 activities, is within land zoned Special Purpose Zone 1 (SP1) Special Activities – Mining under the *Broken Hill Local Environment Plan 2013*. Mining purposes and mining is permissible with consent within this SP1 zone.

4.3.3 Broken Hill Development Control Plan No 11 Management of Lead Contamination

While development control plans are not required to be considered for State significant development projects, the Broken Hill Development Control Plan (DCP) 11 has nonetheless been considered. DCP 11 provides guidelines for the management of issues relating to lead contamination. Lead contamination is closely controlled under the approved management plans for the site. The modified activities would be undertaken above and beneath the surface on an existing disturbed mine site. Any activity above the surface will be closely controlled and monitored so that the currently approved levels of lead contamination would not change.

4.4 Changes to conditions

There are no changes to the currently approved conditions required to facilitate the proposed extension of mining into the British deposit and the additional onsite infrastructure. The following changes are required to facilitate the extension of mine life, the increase in total ore production, the receipt of ore from Pinnacles Mine and the update to the free areas figure (Table 4.2).

Table 4.2 Changes to conditions

Aspect	Current condition of approval	New/changed condition of approval
Mine life	Schedule 2, condition 5 *The Proponent may carry out mining operations on site until 31 December 2026.*	Changed condition 5: *The Proponent may carry out mining operations on site until 31 December 2031.*
Production	Schedule 2, condition 6 *The Proponent shall not extract more than 500,000 tonnes of ore per annum on-site, or more than 8,450,000 tonnes of ore over the life of the project.* Schedule 2, condition 6A *The annual extraction limit set in Schedule 2 condition 6 can be increased up to no more than 750,000 tonnes of ore per annum subject to further air quality impact assessment undertaken to the satisfaction of the EPA and a revised limit approved in writing by the Secretary.*	Changed condition 6: *The proponent shall not extract more than 500,000 tonnes of ore per annum on site, or more than 12,200,000 tonnes of ore over the life of the project.* Schedule 2, condition 6A *The annual extraction limit set in Schedule 2 condition 6 can be increased up to no more than 750,000 tonnes of ore per annum subject to further air quality impact assessment undertaken to the satisfaction of the EPA and a revised limit approved in writing by the Secretary.*
Receiving 100,000 tpa of ore from Pinnacles Mine	N/A	New condition: *The proponent may receive and process up to 100,000 tonnes per annum of ore from Pinnacles Mine.*
Free areas	Appendix 4 Plan of Free areas	Replace Appendix 4 Figure with updated figure showing remaining free areas

4.5 Other relevant NSW State legislation and environmental planning instruments

Table 4.2 Other relevant NSW State Legislation

NSW legislation or EPIs	Comment
Protection of the Environment Operations Act 1997	Rasp Mine is a 'premised-based scheduled activity' under Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act). Rasp Mine operates under EPL 12559. EPL 12559 licenses Rasp Mine for: • crushing, grinding, or separating (>100,000-500,000 t annual processing capacity) • mining for minerals (>100,000-500,000 t annual production capacity). No changes to the EPL are required as a result of this modification.

NSW legislation or EPIs	Comment
Mining Act 1992	The *Mining Act 1992* (Mining Act) encourages and facilitates the discovery and development of mineral resources in NSW, while encouraging ecologically sustainable development. The Rasp Mine operates under Consolidated Mining Lease CML7 and is also permitted to mine a small section within Mining Lease ML1249 under a sublease arrangement with the adjoining mine operator (Perilya Limited). EL5818 will need to be converted to a mining lease to cover the extension of mining into British deposit. A Rehabilitation Strategy and Rehabilitation Management Plan for the Rasp Mine has been prepared in accordance with the Mining Regulation 2016 requirements and Schedule 3 Condition 34 and 34A of the 07_0018 development consent.
Heritage Act 1977	The *Heritage Act 1977* is designed to protect historic heritage items. No items of historic heritage are located within the areas that would be required for Mod 13. The Café and Line of Lode lookout and Miners Memorial are located on CML7 beyond Delprats Shaft and would not be impacted by the proposed modification.

5 Stakeholder engagement

5.1 Overview of consultation

Broken Hill Operations Pty Ltd (BHO) has undertaken early consultation with relevant government agencies and stakeholders in relation to the proposed Mod 13. Consultation was undertaken prior to lodgement of the modification application to inform the proposed scope of works, confirm the approval pathway, and identify any issues requiring consideration in the environmental assessments.

Consultation has been commensurate with the scale and nature of the proposed modification and consistent with the approach adopted for previous approved modifications to the Rasp Mine.

Consultation activities are summarised below and evidence provided in Appendix D.

5.2 Consultation undertaken

NSW Department of Planning, Housing and Infrastructure (DPHI)

BHO undertook multiple engagements with DPHI – Resource Assessments in relation to Mod 13:

- 5 September 2025 – BHO provided a presentation to DPHI outlining current mine operations and future proposed modifications, including the elements of Mod 13.
- 5 September 2025 – A draft scoping letter for Mod 13 was provided to DPHI for review and comment. DPHI provided feedback on the draft scoping letter, which was subsequently addressed in revised versions.
- 25 November 2025 – BHO submitted a scoping report for Mod 13 to DPHI.
- 26 November 2025 – DPHI provided feedback on the scoping letter, which was incorporated into a revised scoping letter.
- 15 January 2026 – DPHI confirmed that the modification can be assessed under Section 4.55(2) of the EP&A Act and confirmed it would not be issuing formal environmental assessment requirements for the proposed modification. DPHI advised that consultation must continue through preparation of the modification report.

These engagements informed the final scope of the proposed modification and the suite of environmental assessments undertaken.

NSW Environment Protection Authority (EPA)

- 1 December 2025 – BHO provided a detailed notification letter to the NSW EPA requesting comment on the proposed modification.
- The EPA responded that it had no initial comments and advised that it would review the Modification Report and supporting environmental assessments when formally submitted.

NSW Resources Regulator – Safety

- 1 December 2025 – BHO provided a detailed notification letter to the NSW Resources Regulator (Safety).
- In a follow-up phone conversation on 5 December 2025, the Regulator indicated that it had no initial comments or issues in relation to the proposed modification at that time.

NSW Resources Regulator – Environment

- 1 December 2025 – BHO provided a detailed notification letter to the NSW Resources Regulator (Environment).
- Feedback received noted that the proposal lacked detail regarding land use changes and rehabilitation requirements associated with tailings dewatering system dams once decommissioned.
- BHO advised that the proposed modification would not change the approved final land use or closure plans for tailings facilities, and that relevant matters would be addressed in the Modification Report.

NSW Health

- 3 December 2025 – BHO provided a detailed notification letter to NSW Health requesting comment on the proposed modification.
- NSW Health advised that it had no comments on the proposal.

Broken Hill City Council

- 5 December 2025 – BHO provided a detailed notification letter to the Broken Hill City Council requesting comment on the proposed modification.

Crown Lands

- 5 December 2025 – BHO provided a detailed notification letter to Crown Lands requesting comment on the proposed modification.
- Feedback noted that:
    - Menindee Road in the proposed location of the new ML is identified as dedicated Public road, per the NSW Government Gazette 23/10/2009.
    - Crown land being part of Willyama Common under the management of Willyama Common Trust
- Crown Lands noted it had no further comments.

Perilya Broken Hill Operations

- 5 December 2025 – BHO provided a detailed notification letter to Perilya Broken Hill Operations requesting comment on the proposed modification.
- No response was received from Perilya Broken Hill Operations.

Dam Safety NSW (DSNSW)

- 5 December 2025 – BHO provided a detailed notification letter to DSNSW requesting comment on the proposed modification.
- Feedback received noted that the Modification was ‘along the same lines’ as the submission for Modification 12. No further comments were received.

DPHI - Compliance

- 5 December 2025 – BHO provided a detailed notification letter to DPHI – Compliance requesting comment on the proposed modification.

NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW)

- 5 December 2025 – BHO provided a detailed notification letter to DCCEEW requesting comment on the proposed modification.
- Feedback received stated that DCCEEW will await submission of the Mod report to provide comments.

Department of Climate Change, Energy, the Environment and Water (Heritage)

- 5 December 2025 – BHO provided a detailed notification letter to DCCEEW Heritage requesting comment on the proposed modification.
- Feedback received stated that DCCEEW Heritage NSW has no initial concerns or comments with regards to heritage for the modification, but noted that a formal response will be provided once a request for comment on the modification report has been formally referred to Heritage NSW.

ARTC

- 14 December 2025 – BHO provided a detailed notification letter to Traffic NSW requesting comment on the proposed modification.
- ARTC stated that it is generally comfortable with the proposed modification, and offered the following feedback and requirements for attention:
- ARTC requested BHO to demonstrate via provision of appropriate documentation, the following -
    - 1. From a rail perspective, ARTC lease the land and railway infrastructure, and the proposal would need to demonstrate:
        - a. Geotechnical studies that demonstrate no impact to land subject to Title and / or Rail and other Infrastructure present on the land.
        - b. Vibration / blast assessment / modelling that demonstrates no impact to land subject to Title and / or Rail and other Infrastructure present on the land.
    - 2. From a planning approvals perspective, ARTC would need confirmation that MOD13 approvals had been received by Rasp prior to any works commencing and there were no implications for ARTC.
    - 3. Further review of the land tenure and mineral rights for the land (e.g. 4//DP1067380 contains detail on title for minerals and excludes land below 15.24m)

Transport NSW (TfNSW)

- 14 December 2025 – BHO provided a detailed notification letter to TfNSW requesting comment on the proposed modification.
- Feedback received from TfNSW requested the following:
    - A Traffic Impact Assessment
    - A review from BHO of the existing Traffic Management Plan; and
    - Design of a Water Quality and Drainage System upstream of TfNSW lands, which is unrelated to this Mod.

5.3 Ongoing and proposed consultation

BHO will continue to consult with key government agencies and community stakeholders during the assessment of the proposed modification. Any issues raised during exhibition of the proposed modification by Government and community stakeholders will be comprehensively addressed by BHO in a Submissions Report.

BHO will also continue engagement with the Broken Hill Lead Reference Group, which meets regularly, and will provide information on Mod 13 for comment.

6 Assessment of impacts

6.1 Introduction

A comprehensive proportionate and risk-based assessment of potential environmental impacts has been undertaken for the proposed modification. This section provides a detailed summary of the findings of the assessment of the impacts of the project. The level of assessment and confirmation of whether there are likely significant impacts is summarised in Table 6.1.

Table 6.1 Level of assessment

Aspect	Level of assessment (quantitative/qualitative)	Likely significant impact?
Noise	Quantitative	Section 6.2 No significant impact.
Blast and vibration	Quantitative	Section 6.3 No significant impact.
Geotechnical	Quantitative	Section 6.4 No significant impact.
Water resources	Qualitative	Section 6.5 No significant impact.
Air quality	Quantitative	Section 6.6 No significant impact.
Greenhouse gas	Quantitative	Section 6.7 No significant impact.
Human Health	Quantitative	Section 6.8 No significant impact.
Social	Quantitative	Section 6.9 No significant impact.
Geochemical	Quantitative	Section 6.10 No significant impact.
Waste	Quantitative	Section 6.11 No significant impact.
Other impacts (visual, biodiversity, traffic, heritage, waste, rehabilitation, tailings compatibility)	Qualitative	Section 6.12 No significant impact.

6.2 Noise

A Noise Impact Assessment (NIA) has been undertaken for the proposed modification (Appendix E)

6.2.1 Existing environment

The existing acoustic environment of Rasp Mine is characterised by a combination of noise sources including ongoing mining operations at Rasp, traffic on surrounding local roads, rail movements, and other urban and industrial activities typical of the Broken Hill township. Background noise levels vary across the surrounding residential areas depending on proximity to the mine, road networks and other local activity.

Rasp Mine currently operates in accordance with 07_0018 and EPL 12559, which establish operational noise limits at surrounding residential receivers. Noise limits are defined for the day, evening and night periods and are based on Project Noise Trigger Levels (PNTLs) derived from background noise monitoring and assessment undertaken for previous approved modifications to the project.

The assessment locations adopted for the NIA are consistent with those used in previous approved noise assessments for the Rasp Mine and are representative of the nearest and most affected residential receivers.

Previous attended noise monitoring undertaken at Rasp Mine has demonstrated that existing site operations comply with the relevant operational noise limits at surrounding residential receivers. The mine has an established framework for noise management, including implementation of the approved Noise and Blast Management Plan, ongoing monitoring and compliance reporting in accordance with the EPL.

The proposed Mod 13 would occur within the context of this established acoustic environment and would largely involve a continuation of existing approved mining and processing operations. No new noise-sensitive receivers are proposed as part of the modification, and the surrounding land use pattern would remain unchanged.

6.2.2 Impact assessment

The NIA assesses the potential construction and operational noise impacts associated with the proposed Mod 13 on surrounding residential receivers. The assessment considers noise generated by both temporary construction activities and ongoing operational activities associated with the proposed modification. The key noise-generating activities assessed include:

- construction of the emergency egress ladderway, including raise boring activities undertaken on a continuous basis
- construction of the tailings dewatering system, including filter plant construction and tailings pipeline installation
- operation of the tailings dewatering system and associated tailings placement activities within TSF3.

i Construction noise impacts

Construction noise impacts were assessed for activities proposed to occur during both standard construction hours and, where relevant, outside recommended standard hours. Particular consideration was given to raise boring activities associated with the emergency egress ladderway, which are proposed to occur on a 24-hour, seven-day-per-week basis. Construction noise impacts were assessed against the applicable noise management levels derived in accordance with the Interim Construction Noise Guideline and the Project Approval requirements.

Construction noise impacts associated with the proposed Mod 13 were assessed for activities related to construction of the emergency egress ladderway and the tailings dewatering system.

Construction of the emergency egress ladderway would involve short-term surface works, including establishment of a concrete pad, followed by raise boring activities undertaken on a continuous basis. Construction of the tailings dewatering system would involve bulk earthworks, concrete works, structural erection and installation of associated infrastructure over a defined construction period. These activities would be undertaken within the existing disturbed mine footprint.

The NIA evaluated construction noise impacts at surrounding residential receivers for both standard construction hours and, where relevant, works proposed to occur outside recommended standard hours. Raise boring activities, which are proposed to occur on a 24-hour, seven-day-per-week basis, were specifically assessed for the day, evening and night periods.

The assessment demonstrates that construction noise levels are predicted to comply with the applicable construction noise management levels at surrounding residential receivers, or can be appropriately managed through implementation of feasible and reasonable noise mitigation and management measures. These measures are consistent with existing site practices and the requirements of the Interim Construction Noise Guideline and Project Approval conditions.

Construction activities would be temporary in nature and confined to the duration of the relevant works. As such, construction noise impacts are not expected to result in any long-term adverse impacts on surrounding receivers

ii Operational noise impacts

The operational noise assessment demonstrates that, with implementation of existing approval conditions and standard noise management and mitigation measures, construction and operational noise associated with the proposed modification can be managed to comply with the relevant noise criteria and would not result in unacceptable noise impacts on surrounding receivers.

Operational noise impacts associated with the proposed Mod 13 were assessed for the continuation of existing approved mining and processing operations together with the proposed operational components, including operation of the tailings dewatering system and associated tailings management activities within TSF3.

The assessment confirms that underground mining of the British deposit would not result in changes to surface noise emissions and therefore would not alter the existing operational noise environment. Importation and processing of ore from the Pinnacles Mine would utilise existing site infrastructure and operating practices and would not introduce new operational noise sources beyond those already approved.

Noise emissions from operation of the proposed tailings dewatering system were assessed in combination with existing approved operations to determine cumulative noise impacts at surrounding residential receivers. Conservative assumptions were adopted in the assessment to account for uncertainties associated with early-stage equipment specifications.

The NIA demonstrates that predicted operational noise levels would comply with the applicable operational noise limits specified in 07_0018 and EPL 12559 and Environment Protection Licence at all assessed residential receivers. As a result, the proposed modification is not expected to result in any exceedance of approved operational noise criteria or any increase in the level of noise impacts currently experienced by surrounding receivers

Operational noise would continue to be managed through implementation of the approved Noise and Blast Management Plan and ongoing compliance monitoring in accordance with existing approval and licensing requirements.

6.2.3 Management, mitigation and monitoring

Noise associated with construction and operation of the proposed Mod 13 would be managed in accordance with the existing conditions of 07_0018, EPL 12559 and the approved Noise and Blast Management Plan.

Construction noise would be managed through implementation of feasible and reasonable mitigation measures consistent with the Interim Construction Noise Guideline, including management of construction hours, use of appropriate plant and equipment, and community notification where required for works undertaken outside standard construction hours. These measures are consistent with noise management practices previously implemented at the Rasp Mine and approved under earlier modifications.

Operational noise would continue to be managed through the approved Noise and Blast Management Plan, which includes operational controls, ongoing noise monitoring and compliance reporting to ensure noise emissions remain within the applicable operational noise limits specified in the Project Approval and EPL. No changes to the existing operational noise limits or monitoring framework are proposed as part of Mod 13

Existing attended noise monitoring undertaken at the Rasp Mine has demonstrated compliance with the approved operational noise limits at surrounding residential receivers. Noise monitoring would continue to be undertaken in accordance with the approved Noise and Blast Management Plan and the requirements of EPL 12559. No changes to the existing operational noise limits, monitoring locations or monitoring frequency are proposed as part of Mod 13.

6.2.4 Conclusion

The NIA demonstrates that construction and operational noise associated with the proposed Mod 13 can be appropriately managed to comply with the relevant noise criteria at surrounding residential receivers. The assessment confirms that predicted noise levels would comply with the applicable construction and operational noise limits, or can be managed through implementation of existing approval conditions and standard noise management measures.

demonstrates that with implementation of existing approval conditions and standard noise management measures, noise generated by the proposed modification can be managed to comply with the applicable noise criteria and would not result in significant noise impacts.

The site would continue to operate in accordance with the noise criteria in 07_0018 and in accordance with the approved Noise and Blast Management Plan, which would be reviewed and updated as necessary.

6.3 Blast and vibration

A blast and vibration impact assessment was completed for the proposed modification (F).

6.3.1 Existing environment

The extension of mining into British deposit will be carried out using conventional blasting methods already in use at Rasp Mine. BHO monitors each blast to ensure compliance with blast and vibration limits in the project approval.

6.3.2 Impact assessment

The blast and vibration impact assessment was conducted with the following worst-case parameters:

Table 6.2 Assessment parameters

Aspect	Parameter
Production blasthole diameter	89 mm (or 76mm for stopes near sensitive receivers)
Maximum charge length	23 m (or 10 m for some undercut down-hole stopes)
Maximum bulk explosive density	1.0 g/cc (or 0.8b/cc for some up-hole stopes)
Maximum charge per blasthole for down-holes	143 kg (62kg in 89mm or 45kg in 76mm diameter for some undercut down-hole stopes)
Maximum charge per blasthole for up-holes	114 kg (83 kg for 76mm for some up-hole stopes)
Peak ground vibration trend range	k=1,500 to 1,000, b=-1.45
Minimum distances	calculated for each sensitive location to the centroid of the top of each slope

Peak vector ground vibration levels are likely to remain compliant at all sensitive receivers. For the nearest private residences to the proposed extension of mining in ML 16 (i.e.at Chettle Street and the Perilya-owned residences at Junction Circle) a reduced scale of blasting may be used as required to ensure compliance with limits, including:

- a smaller blasthole pattern, reduced from 89 to 76mm for both down-hole and up-hole stopes
- staged undercutting of down-hole stopes, reducing maximum charge from 23m to 10m
- a reduction in maximum bulk explosive density, from 1.0g/cc to 0.8g/cc for up-hole stopes.

Monitored data will be used to validate modelling assumptions and adjust blast design. Further monitoring of the stope blasts closest to sensitive receivers would be undertaken for compliance purposes. Additional mitigation measures may be necessary to reduce peak ground vibration for some stopes and nearby sensitive receivers, including Chettle Street and Junction Circle.

6.3.3 Management, mitigation and monitoring

Blasting will be completed in compliance with applicable ground vibration limits, including residential amenity limits specified by Rasp Mine EPL conditions, non-residential infrastructure limits from Australian Standard AS2187, TSF2 Tailing facility limits set by Dam Safety NSW (DSNSW) and recommendations provided in the *Rasp Mine – Potential Impact of Blasting on Tailings Storage Facility, Technical Memorandum* (WSP Golder, 2019).

Additional blasting and vibration mitigation measures proposed for Mod 13 include:

- staged undercutting of down-hole stopes
- a reduction in maximum bulk explosive density for up-hole stopes, and a smaller diameter blasthole pattern in some down-hole and up-hole stopes
- Optimised electronic firing of stopes to limit vibration interactions via sequential firing and adequate separation times
- a reduction in overall blast size for some stopes if larger (longer duration) blast events produce elevated ground vibration levels at critical sensitive locations
- initially scheduling production from stopes further away from Chettle Street and Junction Circle. This will better inform the blast design process for closer (more sensitive) stoping operations.

6.3.4 Conclusion

Following the implementation of mitigation and management measures, impacts from blasting and vibration as a result of the proposed blasting in Mod 13 are anticipated to be negligible and manageable.

6.4 Geotechnical

6.4.1 Overview

A geotechnical assessment has been undertaken by Ground Control Engineering Pty Ltd (GCE) to assess the suitability of the proposed mine design and production strategy for the British deposit and associated underground infrastructure, including the proposed emergency egress ladderway. The assessment is provided in Appendix G and has been informed by updated core logging and laboratory rock strength testing.

6.4.2 Geological and geotechnical setting

The principal rock units within the mine sequence stratigraphy at the British deposit comprise Hores Gneiss and Potosi Gneiss**,** which form the dominant host rocks for underground infrastructure development at Rasp Mine. These units are generally competent and strong and have supported extensive historic and current underground mining at greater depths elsewhere in the mine.

The geotechnical assessment is based on geotechnical core logging from 17 diamond drillholes**,** supplemented by laboratory testing of intact rock samples, including uniaxial compressive strength (UCS), elastic properties and triaxial testing.

6.4.3 Rock mass conditions and strength

The results of intact rock testing indicate that the host rock and ore are generally classified as strong (R4)**,** which is consistent with field assessments undertaken during geotechnical logging. UCS values recorded across tested samples demonstrate competent rock strength characteristics typical of the Rasp Mine geological setting.

Rock mass classification indicates that expected rock mass conditions within the hangingwall, ore zone, footwall and host rock are predominantly fair to good, with localised zones of poorer ground associated with discrete fault or shear zones. These conditions are consistent with those encountered elsewhere within the approved underground workings at the Rasp Mine.

6.4.4 Structure and geotechnical risks

The dominant geological structure influencing the British deposit is the British Shear, a regional fault that offsets the orebody. Geotechnical logging identified a number of fault and shear zones, typically ranging from 1 to approximately 5 metres in width. While some shear zones occur within the hanging wall and above the upper mining levels, the majority are not considered continuous or extensive enough to pose a risk of large-scale instability.

As with other areas of the Rasp Mine, the geological environment is complex and the presence of previously unidentified structures cannot be entirely discounted. The risks associated with unidentified structures would continue to be managed through ongoing geotechnical mapping, data collection and refinement of mine designs as development progresses.

The geotechnical assessment also identified several potential geotechnical risks associated with mining of the British deposit. These include the potential for localised stope overbreak where unfavourably oriented structures intersect stoping surfaces, uncertainty associated with the current structural model of the British Shear and surrounding rock mass, and the possibility of smaller scale hangingwall or crown failures where weaker rock mass conditions occur. Variability in rock mass properties and the potential presence of unidentified structures may also influence stope stability. These risks are typical of underground mining in structurally complex geological environments such as Broken Hill and would continue to be managed through conservative mine design, ground support systems and ongoing geotechnical monitoring during development and stoping.

6.4.5 Impact assessment

i Stope stability

A stope stability assessment was undertaken using the Modified Stability Graph Method, which indicates that hanging wall conditions are expected to control overall stope stability. Based on weighted mean Q' values, maximum theoretical unsupported spans of approximately 22 metres were predicted.

ii Crown pillar stability

A crown pillar stability assessment was undertaken using both empirical methods and numerical modelling. The assessment indicates that the proposed crown pillar between the British deposit stopes and the ground surface would remain stable. The mine design incorporates an approximately 80 metre crown pillar between the upper production stopes and the ground surface, providing a substantial separation between underground mining activities and surface features.

Numerical modelling predicts negligible vertical displacement at the ground surface following complete extraction, with a maximum predicted displacement of approximately 2 millimetres occurring at depth and no measurable displacement expected at the ground surface. On this basis, the risk of interaction between underground mining and surface infrastructure, including nearby roads and the ARTC railway corridor, is considered negligible.

iii Emergency egress ladderway

The geotechnical assessment confirms that the ground conditions are suitable for the installation of the proposed emergency egress ladderway, subject to final siting and detailed design. Development headings and wide-span underground infrastructure would be reinforced in accordance with industry standards and existing Rasp Mine ground support practices.

6.4.6 Mitigation and management measures

Geotechnical risks associated with the proposed Mod 13 would be managed through the continued implementation of BHO's existing, approved ground control and geotechnical management framework. This framework has been developed through extensive operational experience at the Rasp Mine and has been successfully applied to previously approved underground mining extensions.

Key mitigation and management measures include:

- application of established underground mine design criteria, including stope geometry, pillar design and sequencing, informed by site-specific geotechnical data
- installation of appropriate ground support systems, including reinforcement and surface support, designed to suit prevailing ground conditions
- ongoing geotechnical mapping and data collection during development and stoping to confirm ground conditions and refine designs as required
- routine geotechnical inspections and monitoring of underground workings
- implementation of site-specific trigger action response plans (TARPs) to manage any identified changes in ground conditions
- controlled construction practices for raiseboring activities associated with the emergency egress ladderway
- management of crown pillar integrity through conservative design and monitoring to minimise the risk of surface interaction.

These measures are consistent with existing practices at the Rasp Mine and are considered sufficient to manage the geotechnical risks associated with the proposed extension of mining into the British deposit and the installation of the emergency egress ladderway. No additional or project-specific geotechnical mitigation measures are required beyond those already approved.

6.4.7 Conclusion

The geotechnical assessment concludes that the proposed extension of mining into the British deposit and associated underground infrastructure can be undertaken safely and within acceptable risk levels. The proposed mining methods and design controls are consistent with existing approved operations at the Rasp Mine and would not result in any new or increased geotechnical risks.

Numerical modelling indicates that underground extraction of the British deposit would result in negligible ground deformation, with no measurable displacement predicted at the ground surface. Accordingly, the assessment did not identify any potential impact on surface infrastructure, including the nearby railway corridor and local roads.

Any residual risks would be effectively managed through established ground control measures and ongoing geotechnical monitoring.

6.5 Water

6.5.1 Overview

A water resources assessment has been undertaken to assess the potential impacts of Mod 13 to surface water and groundwater resources (Appendix H).

The assessment considers the potential water-related impacts associated with the proposed extension of mining into the British deposit, installation of an emergency egress ladderway, introduction of a tailings dewatering system, receipt and processing of ore from the Pinnacles Mine, and the proposed extension of mine life to 31 December 2031.

The assessment builds on previous water assessments completed for the Rasp Mine, including those supporting Modification 10, Modification 11 and Modification 12, and evaluates whether Mod 13 would result in any new or materially different water-related impacts.

6.5.2 Existing environment

The site is situated on a local catchment divide and has negligible upstream surface water catchment. There are no external surface water inflows to the site.

Surface water drainage across the site has been extensively modified over time and consists of open channels and surface water storages designed to manage sediment-laden and mine-affected runoff. Rainfall runoff within the site is typically retained within on-site storages or unlined depressions and is managed in accordance with the existing water management system.

Groundwater intercepted by underground mine workings is pumped to the surface and reused on site, primarily for ore processing and underground operations. Mine-affected water is recycled on site, with sumps and surface ponds used to temporarily store water prior to reuse. There is no routine discharge of mine-affected water off site.

Surface water and groundwater impacts are managed in accordance with BHO's existing Water Management Plan.

6.5.3 Impact assessment

i Extension of mining into the British deposit

The extension of underground mining into the British deposit would represent a continuation of existing underground operations. The British deposit is located within ML block 16 and would be accessed via underground workings without any new surface disturbance.

For the purposes of the assessment, the depth of the British deposit has been assumed to be comparable to existing mine workings at approximately 270 metres below ground level. Groundwater inflows associated with mining the British deposit are therefore expected to be similar to those already experienced at the Rasp Mine, and keeping within the current extraction water licence.

Water intercepted during mining would be managed using existing underground sumps and pumping infrastructure and reused on site in accordance with existing water management practices. No new groundwater extraction, discharge or dewatering impacts are anticipated as a result of the extension of mining into the British deposit.

ii Emergency egress ladderway

Construction of the emergency egress ladderway would involve raiseboring between the surface and the underground workings. Raiseboring does not require blasting, and drill cuttings generated during construction would fall to the base of the raise and remain underground.

Water would be required during ladderway construction for drilling activities. This water would be sourced as raw water from external supply and managed in accordance with existing site procedures. The ladderway construction would not intersect groundwater resources beyond those already encountered within the underground mine, and no changes to groundwater flow regimes are anticipated.

Surface works associated with the ladderway would be limited and localised, and would be managed using standard site drainage controls to prevent off-site runoff or erosion.

iii Tailings dewatering system

Mod 13 includes the introduction of a tailings dewatering system comprising a filtration plant, tailings slurry line and water return line between the processing plant and the filtration facility.

The dewatering system would produce a filtered tailings cake which would be transferred to TSF3 for deposition. Water recovered through the filtration process would be returned via a dedicated pipeline to a lined process water pond for reuse within the processing circuit.

The introduction of the tailings dewatering system would improve water efficiency at the site by increasing water recovery and reducing reliance on tailings harvesting activities currently undertaken at TSF2. Over time, this is expected to result in a reduction in overall water losses and dust-related water demand.

Construction activities associated with the dewatering system would be managed using standard erosion and sediment controls. No new surface water discharges or changes to downstream surface water quality are anticipated.

iv Receiving and processing ore from Pinnacles Mine

Mod 13 proposes to import and process up to 100,000 tpa of ore from the Pinnacles Mine. The importation of ore would not increase the approved processing rate at the Rasp Mine.

Processing of Pinnacles Mine ore would utilise the existing processing plant and water management systems. As such, the proposal would not materially change site water demand, water balance, or water management practices.

Ore deliveries would be unloaded at the existing run-of-mine pad, and no additional water infrastructure or surface disturbance would be required to support ore importation.

6.5.4 Mitigation and management measures

Water-related impacts associated with Mod 13 would continue to be managed through BHO's existing water management framework, including:

- capture and reuse of mine-affected water
- management of surface runoff within on-site storages
- recycling of process water within the processing circuit
- erosion and sediment controls during construction activities
- recycling of water during the raiseboring process
- ongoing implementation of the site Water Management Plan.

No additional water mitigation measures are required as a result of Mod 13.

6.5.5 Conclusion

The water resources assessment demonstrates that Mod 13 would not result in any significant or material impacts on surface water or groundwater resources. All proposed activities can be managed within the capacity of existing water management systems, and no new off-site water impacts are anticipated.

6.6 Air quality

6.6.1 Overview

An air quality assessment has been undertaken to assess the potential impacts of Mod 13 on local and regional air quality. The assessment was completed by Zephyr Environmental Pty Ltd and is provided in Appendix I. The assessment has been prepared in accordance with the NSW EPA Approved Methods for the Modelling and Assessment of Air Pollutants in NSW and relevant national criteria.

The assessment focuses on the potential air quality impacts associated with the proposed receipt and processing of ore from the Pinnacles Mine, in combination with the other components of Mod 13, including the extension of mining into the British deposit, installation of an emergency egress ladderway, introduction of a tailings dewatering system, and extension of mine life.

6.6.2 Assessment methodology

Air dispersion modelling was undertaken using the AERMOD modelling system to predict concentrations and deposition rates of particulate matter and lead at surrounding sensitive receptors. The modelling considered emissions of:

- total suspended particulates (TSP)
- particulate matter less than 10 microns (PM_{10})
- particulate matter less than 2.5 microns ($PM_{2.5}$)
- lead (Pb) in air and deposited dust.

A total of 70 sensitive receptors, consistent with those assessed in previous approved modifications and human health risk assessments, were included in the modelling domain.

Two operational scenarios were modelled:

- Scenario 1 – Current approved operations: extraction and processing of up to 500,000 tpa of ore sourced from the Rasp Mine.
- Scenario 2 – Mod 13 (worst-case): processing of up to 500,000 tpa, including up to 100,000 tpa of ore sourced from the Pinnacles Mine and transported to the Rasp Mine by road.

Scenario 2 represents a conservative worst-case as it involves a longer haulage distance than internal haulage from the Rasp Mine portal to the run-of-mine pad, while maintaining the same total processing throughput.

The modelling incorporated existing approved control measures and background air quality conditions, consistent with the approach adopted for previous approved modifications.

6.6.3 Impact assessment

The key difference between the current approved operations and the proposed Mod 13 scenario is the change in ore source, with up to 100,000 tpa of ore proposed to be transported from the nearby Pinnacles Mine to the Rasp Mine for processing. The overall ore processing rate at the Rasp Mine would remain unchanged at 500,000 tpa. As a result, the overall scale of processing activities and associated emission sources would remain consistent with the existing approved operations. While the transport distance for ore delivery would increase relative to internal haulage from the underground portal, haulage would occur on sealed roads and represents a conservative worst-case scenario in the modelling. Consequently, the emissions inventory for the Mod 13 scenario is similar to that for existing operations, resulting in only negligible differences in predicted air quality outcomes.

Contour plots of predicted particulate concentrations, including annual average TSP and 24-hour and annual average PM10 concentrations, are provided in the Air Quality Assessment (Appendix I) and illustrate the spatial distribution of predicted impacts across the modelling domain. Consistent with the NSW EPA Approved Methods, assessment criteria are presented on cumulative concentration graphs, while incremental concentration plots are presented without criteria as they are used for comparative purposes only.

Table 6.3 Summary of results

Aspect	Assessment
Particulate matter (PM_{10}, $PM_{2.5}$ and TSP)	Predicted incremental and cumulative concentrations for all particulate matter metrics remain below the applicable NSW EPA assessment criteria at all sensitive receptors under both scenarios.
Lead concentrations and deposition	Predicted annual average lead concentrations and lead deposition rates under the Mod 13 scenario are effectively unchanged compared to current approved operations and remain below relevant assessment criteria at all sensitive receptors.
Comparative impacts	The difference between Scenario 1 and Scenario 2 results is minimal, indicating that receiving ore from the Pinnacles Mine for processing at Rasp Mine does not result in a perceptible increase in air quality impacts.

The assessment also notes that the future introduction of a tailings dewatering system would likely reduce dust emissions associated with tailings harvesting activities, resulting in a potential net reduction in site-wide air emissions relative to existing operations.

6.6.4 Human health considerations

The air quality modelling undertaken for Mod 13 was reviewed by SLR Consulting Australia Pty Ltd (SLR) to determine whether the proposed modification would alter the conclusions of the previously approved Human Health Risk Assessment for Rasp Mine, which was undertaken for Modification 6**.**

SLR concluded that the predicted air quality outcomes for Mod 13 do not materially change the exposure assumptions or risk outcomes underpinning the approved human health risk assessment. Accordingly, the conclusions of the existing HHRA remain valid, and Mod 13 is not expected to result in any additional human health risk beyond that already assessed and approved for the mine.

Further detail is provided in the human health risk assessment review included in Appendix L**.**

6.6.5 Mitigation, management and monitoring

Air quality impacts associated with Mod 13 would continue to be managed through the implementation of existing, approved air quality management and monitoring measures, including:

- use of sealed roads and controlled haulage practices
- dust suppression measures, including water carts and sprays where required
- Application of chemical dust suppressant on unsealed roadways and trafficable areas
- Application of chemical dust suppressant to ‘free areas’ (exposed, non-trafficked areas)
- covered or enclosed processing infrastructure

- ongoing ambient air quality monitoring in accordance with the EPL.

The mine operates a comprehensive air quality monitoring network, with three high volume air samplers measuring Total Suspended Particulate (TSP) matter, two Tapered Element Oscillating Microbalances (TEOMs) measuring PM10, and seven Dust Deposition Gauges (DDGs) measuring dust deposition and percentage of deposited lead.

No new or additional air quality mitigation measures are required as a result of Mod 13.

6.6.6 Conclusion

The air quality assessment demonstrates that Mod 13 would not result in any significant or material increase in air quality impacts compared to the current approved operations. All predicted air quality impacts comply with relevant assessment criteria, and the proposal would not increase impacts at sensitive receivers.

6.7 Greenhouse gas

A greenhouse gas assessment (GHGA) has been undertaken for Mod 13 (Appendix J).

6.7.1 Existing environment

Greenhouse gas (GHG) emissions contribute to climate change at a global scale rather than resulting in localised environmental impacts. The existing environment in relation to GHG emissions is therefore defined by the current contribution of Rasp Mine operations to regional, state, national and global emissions inventories.

Rasp Mine is an existing underground mining and processing operation that generates GHG emissions primarily through the combustion of diesel fuels for mobile and stationary equipment (scope 1 emissions) and the consumption of grid-supplied electricity (scope 2 emissions). Additional indirect emissions occur through upstream and downstream activities, including fuel production, electricity generation, transport of concentrate products and processing of those products by end users (scope 3 emissions).

Existing operations at Rasp Mine are not classified as a large emitter under the NSW Guide for Large Emitters, and the mine is not subject to reporting requirements under the Commonwealth National Greenhouse and Energy Reporting Scheme or the Safeguard Mechanism. The broader policy context for climate change and GHG emissions is defined by Australia's commitment to net zero emissions by 2050 and NSW Government targets for emissions reduction and climate resilience.

6.7.2 Impact assessment

The GHGA assessed the potential GHG emissions associated with the proposed Mod 13 and evaluates those emissions in the context of relevant NSW and Commonwealth climate change policies and guidance.

The assessment was undertaken in accordance with the NSW Guide for Large Emitters and considers scope 1, scope 2 and scope 3 emissions associated with the proposed modification.

i Greenhouse gas emissions

The assessment considered the incremental increase in GHG emissions attributable to Mod 13 relative to the existing approved operations. Emissions were assessed for the operational phase only, as the proposed modification represents a continuation of existing mining and processing activities rather than a new development.

Scope 1 and scope 2 emissions associated with Mod 13 are primarily generated from diesel consumption and electricity use. The assessment demonstrates that the combined scope 1 and scope 2 emissions would peak at approximately 23.3 kt CO_2-e per year and would not exceed the NSW Guide for Large Emitters threshold of 25,000 t CO_2-e in any assessment year. On this basis, Mod 13 is not considered to be a large emitter

Scope 3 emissions were also quantified and are dominated by downstream emissions associated with processing of concentrate products by end-user smelters. These emissions occur outside the control of the project and beyond the immediate project boundary, but were included for completeness in accordance with NSW guidance

ii Climate change considerations

In accordance with Departmental requirements, the assessment also considered the proposed modification in the context of climate change mitigation and policy objectives.

The assessment demonstrates that the proposed modification would not result in a material change to the emissions profile of the existing operation and would remain consistent with NSW and Commonwealth climate change policy settings. The projected reduction in emissions intensity over time reflects anticipated decarbonisation of the NSW electricity grid, consistent with state and national climate targets.

The proposed modification does not introduce new emission-intensive activities, nor does it represent a departure from the existing approved operational framework. As such, the proposal would not materially hinder the achievement of Australia's or NSW's legislated emissions reduction targets or climate change objectives.

6.7.3 Management, mitigation and monitoring

GHG emissions associated with the proposed Mod 13 would be managed through continuation of existing operational practices and implementation of mitigation measures identified in the Greenhouse Gas Assessment.

Management of scope 1 emissions would continue to focus on efficient mine planning, optimisation of haul routes, equipment maintenance, minimisation of engine idling and fuel-efficient operating practices. Scope 2 emissions would continue to be managed through optimisation of electricity use and adoption of energy-efficient equipment, with emissions intensity expected to decrease over time as the NSW electricity grid decarbonises

Additional mitigation measures proposed include the use of solar-powered lighting and monitoring equipment and investigation of further opportunities to reduce emissions where feasible and reasonable over the life of the project. Scope 3 emissions would continue to be managed indirectly through engagement with downstream markets operating within international climate policy frameworks.

No new GHG-specific monitoring or reporting requirements are proposed as part of Mod 13. GHG emissions would continue to be managed in accordance with existing regulatory requirements and corporate environmental management practices.

6.7.4 Conclusion

The GHGA demonstrates that the proposed Mod 13 would not result in significant GHG emissions and would not exceed the NSW Guide for Large Emitters threshold in any assessment year. The proposed modification represents a continuation of existing approved operations and does not introduce new emission-intensive activities.

The assessment confirms that the proposal is consistent with relevant NSW and Commonwealth climate change policies and would not materially impact the achievement of legislated emissions reduction targets. With implementation of existing management and mitigation measures, the proposed modification would result in an acceptable level of GHG emissions and would not give rise to unacceptable climate change impacts.

6.8 Human health risk

A review of potential human health risks associated with Mod 13 has been undertaken by SLR Consulting Australia Pty Ltd (Appendix L).

6.8.1 Overview

The review considered whether the proposed modification would alter the conclusions of the previously approved Human Health Risk Assessment (HHRA) completed for the Rasp Mine for Mod 6.

The SLR review focuses on the potential implications of Mod 13 for air quality–related exposure pathways, particularly those associated with lead. The review considered the updated air quality modelling undertaken for Mod 13 and assessed whether predicted changes in particulate matter and lead deposition would alter the exposure assumptions or conclusions of the previously approved HHRA.

6.8.2 Existing human health risk assessment framework

A comprehensive HHRA for the Rasp Mine was completed by SLR Consulting in December 2020 in support of Modification 6. That assessment was undertaken in accordance with the enHealth (2012) Guidelines for Assessing Human Health Risks from Environmental Hazards and adopted the NHMRC blood lead management goal of 5 µg/dL, which remains current.

The HHRA assessed a range of exposure pathways for surrounding sensitive receptors, including inhalation of airborne particulates, ingestion of deposited dust and soil and dermal contact.

An addendum to the HHRA was subsequently completed to address minor changes to site activities, and further correspondence was provided to assess the implications of Modification 10. The conclusions of the HHRA have therefore been progressively reviewed and confirmed through multiple approved modifications.

6.8.3 Impact assessment

SLR reviewed the air quality modelling undertaken by Zephyr Environmental for Mod 13 to determine whether the proposed activities would materially change human health risk outcomes.

The review considered two air quality scenarios:

- current approved operations at the Rasp Mine
- a conservative worst-case Mod 13 scenario involving the processing of up to 500,000 tpa of ore at the Rasp Mine, including up to 100,000 tpa sourced from the Pinnacles Mine

The Mod 13 scenario was considered conservative due to the longer haulage distance associated with receiving ore from Pinnacles Mine, while maintaining the same overall processing rate at Rasp Mine.

The air quality modelling indicates that Mod 13 would result in only very small changes in predicted particulate matter concentrations and deposition rates relative to the existing approved operations. Predicted cumulative annual lead concentrations and lead deposition rates were either unchanged or slightly reduced compared to the existing situation, and no exceedances of relevant air quality criteria were predicted at sensitive receptors.

As part of the review, SLR also considered the potential implications of the proposed five-year extension of the mine life to 2031 on predicted soil lead concentrations used in the HHRA exposure modelling. Using the same methodology applied in the 2020 HHRA, soil lead concentrations were recalculated assuming a 10-year operational period rather than the five-year period previously assessed.

The updated calculations indicate that the additional soil lead contributed by mine operations over the extended period may increase by approximately two to three times relative to the values used in the 2020 HHRA. However, this increase relates only to the incremental contribution of mine-derived lead to soils. The assessment shows that mine-derived soil lead represents only a very small proportion of total soil lead concentrations, typically less than approximately 1% of total soil lead, with the majority of soil lead arising from existing background concentrations associated with the natural mineralisation of the Broken Hill region and historical mining activities.

When total soil lead concentrations were recalculated for the extended mine life, incorporating both deposition and natural loss processes such as surface runoff, the resulting predicted total soil lead concentrations were slightly lower than those predicted in the 2020 HHRA. As indoor dust lead concentrations are directly related to soil lead concentrations, the same trend was observed for predicted indoor dust lead concentrations.

Given that exposure to lead in the Broken Hill environment is dominated by existing soil and dust lead rather than incremental mine-derived contributions, the increase in the incremental soil lead component does not materially change overall exposure estimates or predicted blood lead concentrations. Accordingly, the review concluded that the proposed extension of mine life and associated incremental soil lead deposition would not alter the conclusions of the previously approved HHRA.

SLR also noted that the future introduction of a tailings dewatering system would likely reduce dust-related emissions associated with tailings harvesting activities, which would further reduce potential exposure pathways.

6.8.4 Mitigation and management

Human health risks associated with Rasp Mine operations will continue to be managed through the implementation of existing, approved environmental management measures, including:

- air quality mitigation and monitoring measures
- compliance with EPL requirements
- ongoing review of operational practices to minimise dust and lead exposure
- continued implementation of the site's environmental management plans.

No additional human health risk mitigation measures are required as a result of Mod 13

6.8.5 Conclusion

The human health risk review confirms that Mod 13 does not alter the conclusions of the previously approved Human Health Risk Assessment for the Rasp Mine.

Although the proposed extension of the mine life results in an increase in the incremental soil lead contribution associated with mine operations, this component represents only a very small fraction of total soil lead concentrations in the Broken Hill environment and does not materially influence overall exposure pathways or predicted blood lead levels.

Mod 13 is therefore not expected to result in any additional or unacceptable human health risks beyond those already assessed and approved for the Rasp Mine.

6.9 Social impact

A Social Impact Assessment (SIA) has been undertaken for Mod 13 (Appendix K).

6.9.1 Existing environment

Mining has been a defining influence on the social, economic and cultural character of Broken Hill for more than a century and remains a key contributor to local employment, economic activity and community identity.

The local community is characterised by an ageing population, relatively high levels of socio-economic disadvantage compared to the NSW average, and a higher proportion of Aboriginal and Torres Strait Islander residents. Broken Hill also functions as a regional service hub for Far West NSW, providing health, education and community services to surrounding unincorporated areas.

Key social issues in the local area include employment stability, access to housing and childcare, workforce retention, health and wellbeing, and ongoing community concern regarding historical lead contamination. These issues form part of the existing social context within which the Rasp Mine operates and have been considered in previous approvals and management plans.

The existing Rasp Mine workforce is predominantly residential, with no significant reliance on fly-in fly-out labour. The mine has established relationships with local stakeholders, community groups and government agencies and contributes to the community through direct employment, procurement and community investment initiatives.

6.9.2 Impact assessment

The SIA assessed the potential social impacts and benefits associated with the proposed Mod 13, having regard to the existing social environment and the incremental change resulting from the proposed modification.

The assessment was undertaken in accordance with the *Social Impact Assessment Guideline for State Significant Projects* (DPHI, 2025) and considers impacts across key social themes, including way of life, community, health and wellbeing, livelihoods, surroundings and decision-making systems.

i Nature of social change

As Mod 13 primarily involves the continuation of existing approved mining operations, with an extension of mine life by five years and a limited number of additional works, the proposed modification would not introduce a new workforce, change the workforce profile, or alter the residential nature of the existing workforce.

As a result, the proposed modification is not expected to result in substantial social change when compared to the project as currently approved. The scale, location and nature of operations would remain largely unchanged, and existing community relationships and management frameworks would continue to apply.

ii Social impacts and benefits

The SIA identifies that the most significant social benefits associated with the proposed modification relate to the extension of employment, income stability and economic confidence in Broken Hill through to 2031. The extension of mine life is expected to support workforce retention, local business continuity and ongoing investment in the local economy.

Potential adverse social impacts identified in the SIA largely relate to existing and ongoing issues rather than new impacts, including community concerns regarding lead exposure, amenity impacts such as noise and vibration, pressure on housing and childcare availability, and perceptions regarding cumulative impacts from mining activities.

The assessment also acknowledges that climate change may exacerbate existing community concerns through increased frequency of extreme weather events, such as intense rainfall and dust-generating conditions; however, these risks are addressed through existing environmental and social management frameworks and are not expected to be materially altered by Mod 13.

The assessment concludes that these impacts are generally of low to moderate significance following implementation of existing mitigation and management measures, and that no new high-risk social impacts would arise as a result of Mod 13.

6.9.3 Management, mitigation and monitoring

Social impacts associated with the proposed Mod 13 would be managed through continuation of existing approved management plans, engagement processes and community investment initiatives.

Key management measures include implementation of the Community Lead Management Plan, Noise and Blast Management Plan, Air Quality Management Plan and Pollution Incident Response Management Plan, which collectively address potential health, amenity and safety-related social impacts. Ongoing engagement with the Broken Hill Lead Reference Group, health authorities and community stakeholders would continue in accordance with existing commitments.

Community engagement and communication would continue through established mechanisms, including newsletters, public notifications, stakeholder meetings and maintenance of grievance and complaints handling procedures. These mechanisms provide opportunities for community feedback and ongoing monitoring of social impacts.

No new or additional social impact mitigation or monitoring measures are proposed specifically for Mod 13, as the existing management framework is considered adequate to address the identified impacts and benefits.

6.9.4 Conclusion

The Social Impact Assessment demonstrates that the proposed Mod 13 would not result in significant adverse social impacts. The proposed modification represents a continuation of existing approved operations and would not materially change the social environment in which the Rasp Mine operates.

The extension of mine life would provide ongoing social and economic benefits to the Broken Hill community through continued employment, local procurement and community investment. With implementation of existing management measures and engagement processes, the proposed modification is expected to result in an overall neutral to positive social outcome and is considered socially acceptable.

6.10 Geochemistry

A geochemistry assessment has been undertaken for Mod 13 by Okane (Appendix M).

6.10.1 Overview

As part of Mod 13, Broken Hill Operations Pty Ltd (BHO) proposes to receive and process up to 100,000 tonnes per annum of ore from the Pinnacles Mine at the Rasp Mine processing facility. Tailings generated from the processing of Pinnacles Mine ore would be managed within the existing Rasp Mine tailings management system and ultimately disposed of within the Rasp Mine tailings storage facilities (TSFs).

Given that tailings generated from the processing of Pinnacles Mine ore would be co-disposed with Rasp tailings, a geochemical characterisation assessment was undertaken by Okane Consultants to confirm that the inclusion of Pinnacles Mine tailings would not materially change the geochemical behaviour of the tailings stored at the Rasp Mine TSFs. The assessment is provided in the memorandum *Rasp and Pinnacles Mine Tailings Geochemical Characterisation* (Okane 2026).

6.10.2 Existing environment

The Rasp Mine and the nearby Pinnacles Mine are both silver–lead–zinc deposits of the Broken Hill Type and occur within the same regional mineral system. The two deposits are located approximately 10–15 kilometres apart and share similar ore mineralogy, particularly with respect to sulphide minerals including galena (PbS) and sphalerite (ZnS). Tailings generated at the Rasp Mine are managed within the approved tailings storage facilities at the site.

6.10.3 Impact assessment

i Tailings geochemical characterisation

To confirm that the processing of Pinnacles Mine ore would not alter the geochemical characteristics of tailings stored at the Rasp Mine, five tailings samples from each of the Rasp and Pinnacles Mine tailings streams were analysed. Laboratory testing undertaken by ALS included:

- Acid Base Accounting (ABA) testing, including total sulphur, acid neutralisation capacity (ANC), maximum potential acidity (MPA) and net acid producing potential (NAPP)
- Total metals and metalloids analysis
- Australian Standard Leaching Procedure (ASLP) testing for selected parameters.

ii Acid generation potential

Acid-base accounting results indicate that both the Rasp and Pinnacles Mine tailings samples are classified as potentially acid forming (PAF) based on the relationship between maximum potential acidity (MPA) and acid neutralisation capacity (ANC). However, measured pH values for both tailings streams were generally near-neutral to moderately alkaline, indicating that there is limited readily oxidisable acidity present within the tailings material.

The analysis also indicates that a substantial proportion of sulphur within the tailings occurs within galena and sphalerite minerals. These sulphide minerals have limited capacity to generate acidity compared with pyrite. Estimates suggest that these minerals may account for up to approximately 40% of the sulphur-hosted species in the tailings, which substantially reduces the potential for acid generation.

iii Metals and metalloids

Total metal and metalloid concentrations were broadly similar between the Rasp and Pinnacles Mine tailings samples. While concentrations of arsenic, cadmium, lead and zinc were higher in the Pinnacles Mine samples, the overall dissolved load and electrical conductivity values of both tailings streams were comparable. This indicates that the mobility of dissolved ions is expected to be similar for both tailings materials.

iv Leaching

Leach testing using the Australian Standard Leaching Procedure demonstrated similar leaching characteristics between the two tailings streams. In some cases, Rasp tailings exhibited higher concentrations of dissolved constituents than Pinnacles Mine tailings, including fluoride concentrations that were at least an order of magnitude greater than those measured in Pinnacles Mine samples. These results indicate that the inclusion of Pinnacles Mine tailings would not increase the potential for contaminant leaching within the TSF.

6.10.4 Management, mitigation and monitoring

Tailings generated from the processing of Pinnacles Mine ore would be managed within the existing Rasp Mine tailings management framework and in accordance with the current development consent and approved management plans.

Existing management measures include:

- deposition of tailings within approved tailings storage facilities
- monitoring of tailings deposition and geotechnical stability
- ongoing environmental monitoring in accordance with the site's Environment Protection Licence and approved environmental management plans.

Given the similarity in geochemical characteristics between Rasp and Pinnacles Mine tailings, no additional management or monitoring measures are required beyond those currently implemented for the operation.

6.10.5 Conclusion

Geochemical testing undertaken on representative tailings samples from the Rasp and Pinnacles Mine deposits demonstrates that the tailings materials exhibit broadly similar geochemical characteristics. Both tailings streams display comparable acid generation potential, metal concentrations and leaching behaviour.

The assessment concludes that the co-disposal of Pinnacles Mine tailings with Rasp tailings within the existing tailings storage facilities is unlikely to result in additional geochemical risks or impacts to the receiving environment.

Accordingly, the proposed processing of Pinnacles Mine ore at the Rasp Mine and disposal of associated tailings within the existing TSF system is considered acceptable from a geochemical perspective.

6.11 Waste management

To support the proposed extension of mine life and continued processing activities under Mod 13, an assessment has been undertaken of existing extraction rates, processing throughput and waste storage capacity at Rasp Mine.

The purpose of this assessment is to demonstrate that the modified project would continue to operate within the limits of the existing development consent, and that the approved tailings and waste rock storage facilities have sufficient remaining capacity to accommodate the additional five years of operation and associated material movements. The assessment confirms that Mod 13 represents a continuation of the currently approved operational regime.

Rasp Mine currently has an estimated 988,280 tonnes of suitable waste rock available for site capping requirements. The mine will generate approximately 352,405 tonnes of additional suitable capping material during the period 2026-2031, totalling a suitable waste rock capping material inventory of approximately 1,340,685 tonnes at the end of December 2031 (BHO, 2025b). The total remaining capacity in the Kintore Pit is 4679063 cubic meters, which at the current rate of filling equates to approximately 21 years' worth of capacity.

All waste rock generated that has equal to or greater than 0.5% lead would continue to be retained underground in voids or stockpiled in Kintore Pit on the surface for use for backfilling in the future, in accordance with the approved *Waste Management Plan* (BHO 2024). Existing strict protocols to manage emplacement of waste rock in underground workings will continue to apply for the proposed modification.

Waste rock with less than 0.5% lead may be used on the surface for approved purposes in accordance with the conditions in 07_0018. A waste rock inventory review was completed by BHO. Inert waste rock (low lead (<0.5%) and low sulphur (≤0.2%)) is proposed to be used for rehabilitation capping purposes to mitigate any dust and lead bearing dust from being dispersed from the mine site post closure.

A surface cover of inert waste rock (250 mm thick) will provide the necessary protection from water and wind erosion. In addition, TSF 2 and 3 will require a capillary break of crushed rock 200 mm thick. Waste rock produced as a result of the modification will be suitably tested to ensure it meets the surface capping material criteria, and if appropriate it will be stockpiled at Kintore Pit or BHP Pit, and then subsequently used in accordance with the Rehabilitation Strategy and Rehabilitation Management Plan during closure preparations.

Approved operational limits and proposed modifications are shown below in Table 6.4. Waste generation and management, and storage capacities are shown in Table 6.5 and Table 6.6.

Table 6.4 Operational rates

Parameter	Existing approved limit	2025 operating rate	Mod 13 proposal	Change to approved limit	Compliance with 07_0018
Annual ore extraction rate	500,000tpa	454,500 tpa	500,000tpa	No change to extraction limit	Within approved limit
Total life-of-mine extraction	8,450,000t	7,662,115t at the end of 2025	12,200,000t	Increase of 3,750,000t	To be authorised by modification
Ore processing rate	500,000tpa	500,000tpa	Includes up to 100,000tpa of ore from Pinnacles Mine	No change to processing rate	Remains within existing processing limit
Source of ore	Rasp underground	N/A	Rasp underground and Pinnacles Mine	Additional feed source only	No changes to processing amount
Processing infrastructure	Existing plant	Existing plant	No expansion required	None	Approved infrastructure retained

Table 6.5 Waste generation

Waste stream	Existing management method	Expected change under Mod 13	Net increase in waste rate
Tailings	Disposal to TSF2, TSF3 and underground backfill.	Direct deposit into TSF3.	No increase in generation rate
Waste rock	Underground placement and surface storage, and use in rehabilitation	No change to emplacement strategy. Additional surplus waste rock can be placed in TSF3	Additional 352,405 tonnes of waste rock estimated to be produced over the additional five years.

Waste stream	Existing management method	Expected change under Mod 13	Net increase in waste rate
Filter cake (dewatered tailings)	Not applicable	Filter cake produced by dewatering plant	No increase, same throughput.

Table 6.6 Storage capacity

Facility	Approved Function	Existing remaining capacity with modification
TSF1	Tailings storage	Not in use and not planned for use following modification.
TSF2	Tailings drying/interim storage	TSF2 is used for drying and interim storage of tailings prior to transfer. Dried tailings are progressively removed from TSF2 and transferred to TSF3 for long-term storage.
TSF3	Primary long-term storage	As at 5 November 2025, the remaining capacity to the top of the Kintore pit is approximately 4,679,063 m^3. Based on the current tailings deposition rate of approximately 18,000 m^3 per month, this equates to approximately 255 months of remaining capacity. The projected tailings level by 2031 is RL 10297 (mine grid), leaving approximately 2,597,271 m^3 of additional capacity to the top of the pit (RL 10323). At the current deposition rate this represents approximately 14 years of remaining capacity, indicating that the facility will not be full by the end of the proposed extended operating period.
Underground backfill	Course tailings/rock	Coarse tailings and rock are utilised as underground backfill within mined voids as part of the standard mining method at Rasp Mine. Backfilling capacity is dependent on the availability of underground void space rather than a fixed storage limit. The proposed modification does not change the backfilling strategy and sufficient underground capacity is expected to remain available throughout the extended operational period.
Surface waste rock areas	Temporary/permanent storage	Approximately 375,000 tonnes of surplus waste rock may be generated over the additional five years of operation associated with the modification. At the projected tailings level in 2031, TSF3 is expected to retain approximately 2,597,271 m^3 of remaining capacity, equivalent to approximately 5,142,597 tonnes of material. Surplus waste rock could therefore be accommodated either through increased thickness of existing waste rock placement areas or through placement within TSF3 if required. Accordingly, sufficient storage capacity exists to accommodate the additional waste rock generated under the modified project.

6.12 Other impacts

Table 6.7 summarises the assessments other potential impacts and mitigation measures associated with the proposed modification.

Table 6.7 Summary of assessment of other impacts

Issue	Assessment
Traffic	The transport of ore from the Pinnacles Mine is not considered part of Mod 13 and has been considered under a separate modification application. There would not be additional traffic impacts on classified or local roads associated with Mod 13. A full traffic assessment is being completed to support the Pinnacles Transport Modification. Mod 13 would result in a limited number of additional heavy vehicle movements onsite associated with the receipt of ore from the Pinnacles Mine. Ore would be transported by B-double trucks at fortnightly or monthly intervals, with deliveries occurring via existing approved onsite haulage routes and unloaded at the existing run-of-mine pad. The receipt of ore would not change the approved processing rate at the Rasp Mine. Traffic volumes associated with Mod 13 are considered minor in the context of existing heavy vehicle movements in and around Broken Hill. The project would continue to operate in accordance with existing operational mitigation provided in the Traffic Management Plan (BHO 2024), which would be reviewed and updated as necessary.
Heritage	The proposed Mod 13 activities would not impact any of the known heritage buildings or items at the site. BHO respects known heritage values and it is anticipated that the proposed modifications will have minimal to no impacts on these values. Field surveys for the original EIS indicated that no Indigenous archaeology exists in the project area. If any unexpected heritage items are identified during the proposed works, the works in the immediate vicinity of the find would cease and the project heritage specialist and environmental manager notified. Should an unexpected heritage item be identified, the Heritage Council of NSW will be notified in accordance with Section 146 of the *Heritage Act 1977*.
Visual	The emergency egress ladderway will be constructed using raised boring methods and following construction completion the only remaining surface component would be the shipping container. The shipping container would have a height of 2 m and will be silver or grey coloured. The tailings dewatering system will be in an enclosed building adjacent to the Kintore Pit. This is in the centre of the site and would not dissimilar to other structures on site. The modifications will be undertaken in an existing mine site that has been operating for over 140 years, within a precinct that is dominated by mining development and highly disturbed. Therefore, it is anticipated that the visual impacts of Mod 13 would be negligible.
Biodiversity	The proposed modifications are within the existing open cut mine site, in a precinct that is dominated by mining development and is therefore heavily disturbed and cleared of vegetation. No additional clearing would be undertaken for the proposed modifications. The proposed modification would not increase the impact on biodiversity values and does not trigger the requirements for a Biodiversity Development Assessment Report (BDAR) under the *NSW Biodiversity Conservation Act 2016.*
Rehabilitation	The proposed modifications are within the existing mine site, in a precinct that is dominated by mining development and is therefore heavily disturbed and cleared of vegetation. The tailings dewatering plant, including a small section of pipeline located on a free area, would be subject to decommissioning and capping under existing conditions of approval. Final land uses for the Rasp Mine are described in a Rehabilitation Management Plan (EMM,2022), which provides conceptual final land uses and proposed rehabilitation objectives. The management plan would be updated to include any changes to approved rehabilitation activities, in consultation with the Resources Regulator. The proposed modification will not alter the rehabilitation plans for TSFs; the site rehabilitation objectives; or the post mining land use. Rehabilitation will continue to be guided by the existing Rehabilitation Management Plan (EMM 2022).

Issue	Assessment
Cumulative impacts	The cumulative impacts of the proposed Mod 13 have been assessed alongside existing approved Rasp Mine operations and other foreseeable developments in Broken Hill. Technical studies covering noise, air quality, water, greenhouse gas emissions, climate change and social factors show that Mod 13, which largely continues existing activities without increasing scale, workforce or disturbance, would not generate significant additional impacts. Amenity and health-related factors are expected to remain within acceptable limits with ongoing implementation of current management and monitoring programs. Greenhouse gas emissions would not materially increase and would stay below the NSW Guide for Large Emitters threshold, meaning the modification would not contribute significantly to climate change or hinder emissions reduction targets. Socially, extending the mine's life is expected to provide stable employment and economic benefits, and broader community pressures such as housing, childcare and health services are not expected to worsen. Overall, Mod 13 is not anticipated to result in unacceptable cumulative environmental, climate or social impacts.

7 Justification of the modified project

7.1 Mod 13 impacts

Potential impacts that may result from the proposed modification have been examined in this report. The assessment of environmental issues has been multi-disciplinary and involved consultation with DPHI and other agency stakeholders (including DSNSW, BHCC, Resources Regulator, and the EPA).

The assessments demonstrate that Mod 13 would not result in any significant adverse environmental, social or economic impacts. The proposed modification comprises incremental changes to an established underground mining operation and would not introduce new or unacceptable impact pathways.

Specifically:

- water impacts would remain localised and managed within existing, approved water management systems
- air quality impacts would remain within applicable criteria and would not result in any new exceedances at sensitive receptors
- geotechnical conditions are suitable for the proposed extension of mining and installation of the emergency egress ladderway
- blast vibration impacts will be managed via the implementation of current mitigation and management measures.
- human health risk outcomes would remain unchanged from those previously assessed and approved
- other impacts, including traffic, waste, visual, biodiversity and heritage impacts, would be minor or negligible.

The proposed modification will not result in significant biophysical, social or economic impacts and this report has identified that any residual impacts can be appropriately managed in accordance with the existing conditions of approval. All activities will continue to be undertaken in accordance with the approved management plans for the mine.

7.2 Mod 13 benefits

Mod 13 would deliver a range of benefits that support the continued operation of the Rasp Mine and the Broken Hill community, including

- realising a logical extension to the existing mining operations which will effectively extract a known resource
- the extension of mine life will allow the mine to continue its operations, providing significant socio-economic benefits
- improving mine safety and emergency response capability through the installation of an additional emergency egress ladderway
- improving operational efficiency and water recovery through the introduction of a tailings dewatering system
- providing operational flexibility through the ability to process ore from the Pinnacles Mine

- extending the life of the mine to 31 December 2031, supporting continued employment and economic activity in Broken Hill.

The proposed modification will allow BHO to meet its legislative requirements as outlined in the *Work, Health and Safety (Mines and Petroleum sites) Regulations 2022* and will allow benefits to be realized from extractable resources. Therefore, the proposed modification is critical to the continued operation of the Rasp Mine in both legislative and operational contexts.

The ongoing development of the resource at Rasp Mine will provide indirect social and economic benefits through increased job security for its employees, contractors and subsequent benefits to the local and regional economy through income and expenditure, and more widely in NSW through royalty payments. The proposed modification is an alteration with minimal environmental impact to an approved facility, which allows orderly and economic access to and use of a resource. All aspects relating to environmental management will continue in accordance with the project approval and the approved management plans for the mine.

7.3 Ecological sustainable development

Under section 516A of the EPBC Act, Commonwealth organisations have a statutory requirement to report on their environmental performance and how they accord with, and advance, the principles of Ecological Sustainable Development (ESD).

Australia's National Strategy for Ecologically Sustainable Development (AGESDSC 1992), defines ESD as "using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased". The four principles of ESD (Clause 7(4) of Schedule 2 of the EP&A Regulation) are:

- Precautionary principle – the precautionary principle states that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

- Inter-generational equity – the principle of inter-generational equity is that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

- Conservation of biological diversity and maintenance of ecological integrity – the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.

- Improved valuation and pricing of environmental resources – improved valuation, pricing and incentive mechanisms should be promoted.

The overall objectives of ESD are to use, conserve and enhance natural resources. This ensures that ecological processes are maintained facilitating improved quality of life, now and into the future. BHO is committed to the principles of ESD and understands that biophysical, social and economic objectives are interdependent. BHO acknowledges that a well-designed and effectively managed operation will avoid significant and costly environmental impacts or degradation.

The proposed modification has been designed to minimise impacts to a level which is as low as is reasonably practicable. The proposed modification does not change the approved functions of the mine and would not result in any major surface disturbance. No additional management measures are therefore required to mitigate residual impacts.

Consideration has also been given to appropriately identifying, avoiding, mitigating and managing environmental risks to demonstrate environmental due diligence and will provide for ongoing and adaptive monitoring and management of the operation in line with the principles of ESD.

7.4 Greenhouse gas emissions and climate change

Greenhouse gas emissions and climate change have been specifically considered in response to Departmental requirements. The Greenhouse Gas Assessment (Appendix J) was prepared having regard to the NSW EPA *NSW Guide for Large Emitters* and provides an estimate of scope 1, scope 2 and scope 3 emissions associated with the proposed modification.

7.4.1 Greenhouse gas emissions

The assessment confirms that the proposed Mod 13 would not be classified as a large emitter, with combined scope 1 and scope 2 emissions remaining below the relevant threshold in all assessed years. Accordingly, the proposal does not trigger the large-emitter assessment pathway and would not result in a material change to the existing emissions profile of the Rasp Mine.

7.4.2 Climate change

GHG emissions contribute to climate change at a global scale. The Greenhouse Gas Assessment demonstrates that Mod 13 would not result in any material increase in GHG emissions and, consistent with the modified project as a whole, would not result in any additional climate change impacts beyond those previously assessed for the approved operation.

The proposal has been considered in the context of NSW's legislated emissions reduction targets (50% below 2005 levels by 2030, 70% by 2035, and net zero by 2050). On this basis, the proposed modification would not materially hinder the achievement of NSW emissions reduction objectives.

8 Conclusion

BHO is seeking to extend operations at the Rasp Mine until 31 December 2031, supported by the following proposed activities:

- extending mining operations into the British deposit
- establishment of an emergency egress ladderway to surface in ML 16
- changes to on-site operations to include a tailings dewatering system
- receiving and processing of 100,000 tpa of ore from Pinnacles Mine
- increase the total volume of ore allowed to be extracted to 12,200,000 tonnes

The proposed modification also asks to update the free areas figure in the project approval.

Proposed Mod 13 represents a logical and justified extension of the existing approved Rasp Mine operations. The modification would allow continued mining to be undertaken for a further five years following the current expiry date of the project approval and allow BHM to extract a greater amount of ore from the site.

The proposed implementation of the dewatering system will improve operational water efficiency on site. The establishment of an emergency egress ladderway will ensure the safe operation of the mine as it progresses into the British deposit area.

Receiving ore from Pinnacles Mine will ensure that efficiencies can be realised across the BHO operations in the local area.

The proposed modification would not result in significant impacts. The assessments undertaken for the proposed modification support this conclusion. BHM would review and if necessary update its management plans in accordance with the conditions of approval to ensure that the activities proposed for the modification continue to comply with approved limits. Overall, the proposed modification has merit and is approvable.

Abbreviations

BHM	Broken Hill Mines Pty Ltd
BHO	Broken Hill Operations Pty Ltd
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	Environmental Planning and Assessment Regulation 2021
EPL	Environmental Protection Licence
LGA	local government area
Mt	Million tonnes
NSW	New South Wales
POEO Act	*Protection of the Environment Operations Act 1997*
SA	South Australia
SSD	State significant development
t	tonnes
tpa	Tonnes per annum
TSF	Tailings Storage Facility

References

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Zephyr Environmental 2025, *Rasp Mine Modification 13 Air Quality Assessment*.

Appendix A
Statutory Compliance Table

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Table A.1 Statutory Compliance

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Environmental Planning and Assessment Act 1979		
Section 1.3	**Objects of Act** The objects of this Act are as follows— (a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources, (b) to promote the supply, delivery and maintenance of housing, including affordable housing, (c) to promote productivity through the development and management of the State and its resources, (d) to protect the environment, including the conservation of threatened species of native animals and plants and ecological communities and their habitats, (e) to promote resilience to climate change and natural disasters through adaptation, mitigation, preparedness and prevention, (f) to promote the sustainable management of built and cultural heritage, including Aboriginal cultural heritage, (g) to promote good design, amenity and the proper construction and maintenance of built environments, including the protection of the health and safety of the occupants of buildings, (h) to provide opportunities for participation in environmental planning and assessment, (i) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment, (j) to promote a proportionate and risk-based approach to environmental planning and assessment, (k) to promote the orderly and economic use and development of land.	Chapter 4 Chapter 6 Chapter 7

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 4.15	**Evaluation** (1) **Matters for consideration—general** In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application— (a) the provisions of— (i) any environmental planning instrument, and (ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and (iii) any development control plan, and (iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and (iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), (v) (Repealed) that apply to the land to which the development application relates, (b) the significant likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality, (c) the suitability of the site for the development, (d) any submissions made in accordance with this Act or the regulations, (e) the public interest. (1A) The regulations may, for the purpose of the consideration of a matter referred to in subsection (1)(b), (c) or (e), declare— (a) factors that are of relevance to development the subject of the development application, and (b) factors that are not of relevance to development the subject of the development application. (1B) Despite subsection (1), a consent authority, in determining a development application, must not take into consideration a factor the subject of a declaration under subsection (1A)(b)	Chapter 3 Chapter 4 Chapter 6 Chapter 7

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Environmental Planning and Assessment Regulation 2021		
Section 98	**Modification applications for development** (1) A modification application may be made by— (a) the owner of the land to which the modification application relates, or (b) another person, with the consent of the owner of the land. (2) The consent of the owner is not required if the original development application was made, or could have been made, without the consent of the owner. (3) The consent of the owner of the land is not required for a modification application made by a public authority, or a modification application for public notification development, if the applicant complies with subsections (4) and (5). (4) The applicant must give notice of the modification application— (a) to the owner of the land before the modification application is made, or (b) by publishing, no later than 14 days after the modification application is made. a notice in a newspaper circulating in the area in which the development would be carried out.	This modification will be notified publicly.
Section 99	**Making a modification application** (1) A modification application must— (a) be in the approved form, and (b) contain all the information and documents required by— (i) the approved form, and (ii) the Act or this Regulation, and (c) be submitted on the NSW planning portal. (2) If the modification application is for State significant development— (a) the application must also include particulars of the nature of the modification, and (b) the applicant must have regard to *the State Significant Development Guidelines in preparing the application*.	This report

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 100	**Content of modification application** (1) A modification application must contain the following information— (a) the name and address of the applicant, (b) a description of the development that would be carried out under the development consent, (c) the address and folio identifier of the land on which the development would be carried out, (d) a description of the modification to the development consent, including the name, number and date of plans that have changed, to enable the consent authority to compare the development with the development originally approved, (e) whether the modification is intended to— (i) merely correct a minor error, misdescription or miscalculation, or (ii) have another effect specified in the modification application, (f) a description of the expected impacts of the modification, (g) an undertaking that the modified development would remain substantially the same as the development originally approved, (h) for a modification application that is accompanied by a biodiversity development assessment report—the biodiversity credits information, (i) if the applicant is not the owner of the land—a statement that the owner consents to the making of the modification application, (j) whether the modification application is being made to— (i) the Court under the Act, section 4.55, or (ii) the consent authority under the Act, section 4.56.	This report

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 103	**Modification applications for mining and petroleum development consents** (1) This section applies to an application under the Act, section 4.55(2), to modify a development consent that relates to mining or petroleum development on land— (a) shown on the Strategic Agricultural Land Map, or (b) subject to a site verification certificate. (2) The application must be accompanied by— (a) for development on land shown on the Strategic Agricultural Land Map as critical industry cluster land—a current gateway certificate that applies to the development to be carried out under the modified consent, or (b) for development on other land— (i) a current gateway certificate that applies to the development to be carried out under the modified consent, or (ii) a site verification certificate certifying that the land on which the development would be carried out is not biophysical strategic agricultural land. (3) To avoid doubt, *State Environmental Planning Policy (Resources and Energy) 2021*, Part 2.4, other than Divisions 2 and 5, applies, with necessary modifications, to an application to modify a development consent as if it were a development application.	The proposed modification is not subject to the Strategic Agricultural Land Map
Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017		
Schedule 2, Section 3BA	**Winding-up of transitional Part 3A modification provisions on cut-off date of 1 March 2018 and other provisions relating to modifications** (6) In the application of section 4.55(1A) or (2) or 4.56(1) of the Act to the following development, the consent authority need only be satisfied that the development to which the consent as modified relates is substantially the same development as the development authorised by the consent (as last modified under section 75W)— (a) development that was previously a transitional Part 3A project and whose approval was modified under section 75W.	Chapter 2

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Mining Act 1992		
Section 380AA	(1) An application for development consent, or for the modification of a development consent, to mine for coal cannot be made or determined unless (at the time it is made or determined) the applicant is the holder of an authority that is in force in respect of coal and the land where mining for coal is proposed to be carried out, or the applicant has the written consent of the holder of such an authority to make the application. Note— In this Act, development consent means a development consent under *the Environmental Planning and Assessment Act 1979*, Part 4 or an approval under that Act, Part 3A or Division 5.2. (2) For that purpose, an authority in respect of coal need not be in force in respect of the whole of the land to which the application for development consent relates but must be in force for the land where mining for coal is proposed. (3) For the purposes of this section, an authority that is a mining lease is considered to be in force in respect of the land on which it authorises prospecting or mining for coal, and not in respect of land on which it only authorises the carrying out of ancillary mining activities (and not prospecting or mining for coal). A mining lease is not an authority for the purposes of this section if it is for ancillary mining activities only.	Chapter 4
Protection of the Environment Operations Act 1997		
Section 43	**Types of licences** Environment protection licences may be issued for the following purposes— (a) to authorise the carrying out of scheduled development work at any premises, as required under section 47, (b) to authorise the carrying out of scheduled activities at any premises, as required under section 48, (c) to authorise the carrying out of scheduled activities not related to premises, as required under section 49, (d) to control the carrying out of non-scheduled activities for the purpose of regulating water pollution resulting from any such activity, as referred to in section 122.	Chapter 4
Water Management Act 2000		
Section 89	**Water use approvals** (1) A water use approval confers a right on its holder to use water for a particular purpose at a particular location. (2) A water use approval may authorise the use within New South Wales of water taken from a water source outside New South Wales.	Chapter 4

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 90	**Water management work approvals** (1) There are three kinds of water management work approvals, namely, water supply work approvals, drainage work approvals and flood work approvals. (2) A water supply work approval authorises its holder to construct and use a specified water supply work at a specified location. (3) A drainage work approval confers a right on its holder to construct and use a specified drainage work at a specified location. (4) A flood work approval confers a right on its holder to construct and use a specified flood work at a specified location.	Chapter 4
Section 91	**Activity approvals** (1) There are two kinds of activity approvals, namely, controlled activity approvals and aquifer interference approvals. (2) A controlled activity approval confers a right on its holder to carry out a specified controlled activity at a specified location in, on or under waterfront land. (3) An aquifer interference approval confers a right on its holder to carry out one or more specified aquifer interference activities at a specified location, or in a specified area, in the course of carrying out specified activities.	Chapter 4
State Environment Planning Policy (Planning Systems) 2021		
Section 2.1	**Aims of Chapter** The aims of this Chapter are as follows (a) to identify development that is State significant development, (b) to identify development that is State significant infrastructure and critical State significant infrastructure, (c) to identify development that is regionally significant	Chapter 4

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
State Environment Planning Policy (Resources and Energy) 2021f		
Section 2.1	**Aims of Chapter** The aims of this Chapter are, in recognition of the importance to New South Wales of mining, petroleum production and extractive industries□ (a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and (b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and (c) to promote the development of significant mineral resources, and (d) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources, and (e) to establish a gateway assessment process for certain mining and petroleum (oil and gas) development□ (i) to recognise the importance of agricultural resources, and (ii) to ensure protection of strategic agricultural land and water resources, and (iii) to ensure a balanced use of land by potentially competing industries, and (iv) to provide for the sustainable growth of mining, petroleum and	Chapter 3 Chapter 4 Chapter 6 Chapter 7
Section 2.9	**Development permissible with consent** (1) Mining Development for any of the following purposes may be carried out only with development consent□ (a) underground mining carried out on any land, (b) mining carried out□ (i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or (ii) on land that is, immediately before the commencement of this section, the subject of a mining lease under the *Mining Act 1992* or a mining licence under *the Offshore Minerals Act 1999*, (c) mining in any part of a waterway, an estuary in the coastal zone or coastal waters of the State that is not in an environmental conservation zone, (d) facilities for the processing or transportation of minerals or mineral bearing ores on land on which mining may be carried out (with or without development consent), but only if they were mined from that land or adjoining land, (e) mining on land that is reserved as a state conservation area under the *National Parks and Wildlife Act 1974*, (f) extracting a bulk sample as part of resource appraisal of more than 20,000 tonnes of coal or	Chapter 4

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 2.16	**Non-discretionary development standards for mining** (1) The object of this section is to identify development standards on particular matters relating to mining that, if complied with, prevents the consent authority from requiring more onerous standards for those matters (but that does not prevent the consent authority granting consent even though any such standard is not complied with). (2) The matters set out in this section are identified as non-discretionary development standards for the purposes of section 4.15(2) and (3) of the Act in relation to the carrying out of development for the purposes of mining. Note The development standards do not prevent a consent authority from imposing conditions to regulate project-related noise, air quality, blasting or ground vibration impacts that are not the subject of the development	Chapter 4
Section 2.17	**Compatibility of proposed mine, petroleum production or extractive industry with other land uses** Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must (a) consider (i) the existing uses and approved uses of land in the vicinity of the development, and (ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and (iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and (b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a)(i) and (ii), and (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph	Chapter 1 Chapter 3 Chapter 6 Chapter 7

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 2.19	**Compatibility of proposed development with mining, petroleum production or extractive industry** (1) This section applies to an application for consent for development on land that is, immediately before the application is determined— (a) in the vicinity of an existing mine, petroleum production facility or extractive industry, or (c) identified by an environmental planning instrument as being the location of significant resources of minerals, petroleum or extractive materials. (2) Before determining an application to which this section applies, the consent authority must— (a) consider— (i) the existing uses and approved uses of land in the vicinity of the development, and (ii) whether or not the development is likely to have a significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and (iii) any ways in which the development may be incompatible with any of those existing or approved uses or that current or future extraction or recovery, and (b) evaluate and compare the respective public benefits of the development and the uses, extraction and recovery referred to in paragraph (a)(i) and (ii), and (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a)(iii).	Chapter 1 Chapter 3 Chapter 4
Section 2.20	**Natural resource management and environmental management** (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following— (a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable, (b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable, (c) that greenhouse gas emissions are minimised to the greatest extent practicable. (2) Without limiting subsection (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.	Chapter 6

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 2.21	**Resource recovery** (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery. (2) Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material. (3) The consent authority may refuse to grant consent to development if it is not satisfied that the development would be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.	Chapter 6 Chapter 7
Section 2.22	**Transport** (1) Before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following— (a) require that some or all of the transport of materials in connection with the development is not to be by public road, (b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools, (c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads. (2) If the consent authority considers that the development involves the transport of materials on a public road, the consent authority must, within 7 days after receiving the development application, provide a copy of the application to— (a) each roads authority for the road, and (b) the Roads and Traffic Authority (if it is not a roads authority for the road). Note— Section 7 of the *Roads Act 1993* specifies who the roads authority is for different types of roads. Some roads have more than one roads authority. (3) The consent authority— (a) must not determine the application until it has taken into consideration any submissions that it receives in response from any roads authority or the Roads and Traffic Authority within 21 days after they were provided with a copy of the application, and (b) must provide them with a copy of the determination. (4) In circumstances where the consent authority is a roads authority for a public road to which subsection (2) applies, the references in subsections (2) and (3) to a roads authority for that road do not include the consent authority.	Chapter 7

Relevant legislation or instrument	Mandatory consideration	Relevant section in report
Section 2.23	**Rehabilitation** (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that would be affected by the development. (2) In particular, the consent authority must consider whether conditions of the consent should— (a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or (b) require waste generated by the development or the rehabilitation to be dealt with appropriately, or (c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under section 3 of Schedule 6 to the Act and the *Contaminated Land Management Act 1997*), or (d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.	Chapter 7
Broken Hill Local Environmental Plan		
Section 2.3	**Zone objectives and Land Use Table** (2) The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.	Chapter 4
Section 6.2	**6.2 Essential services** Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the development are available or that adequate arrangements have been made to make them available when required— (a) the supply of water, (b) the supply of electricity, (c) the disposal and management of sewage, (d) stormwater drainage or on-site conservation, (e) suitable vehicular access.	Chapter 7

Appendix B
Consolidated project description

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Table B.1 Consolidated project description

Project Element	Approved Project Description
Approval	State Significant Development Project Approval **07_0018** under the Environmental Planning and Assessment Act 1979, as modified.
Proponent	Broken Hill Operations Pty Ltd
Project location	Rasp Mine, Broken Hill, NSW
Mining operations	
Mine life	Mining operations permitted until 31 December 2031.
Mining method	Underground mining using methods including long hole stoping, benching, modified Avoca, room and pillar and uphole retreat methods.
Mining areas	Underground mining within CML7, including ML Blocks 13–16 and the British deposit.
Ore extraction rate	Up to 500,000 tonnes per annum, which may increase to 750,000 tonnes per annum subject to further assessment and approval.
Total ore extraction	12.2 million tonnes of ore over the life of the project.
Mine access	Underground access via declines from surface including the Kintore Pit boxcut.
Emergency egress	Emergency egress ladderways installed to provide escape routes from underground workings, including a ladderway associated with mining of the British deposit.
Ore processing and transport	
Ore processing	Ore processed at the on-site processing plant using crushing, grinding, flotation, thickening and filtration.
Additional ore sources	Processing of up to 100,000 tonnes per annum of ore from the Pinnacles Mine.
Products	Zinc and lead concentrates containing associated silver.
Transport of concentrate	Concentrate transported from the site by rail to Port Pirie and Port Adelaide in South Australia.
Tailings and waste emplacement	
Tailings management	Tailings stored in TSF1, TSF2 (Blackwood Pit), TSF3 (Kintore Pit) and underground voids as backfill.
Tailings infrastructure	Tailings management supported by a tailings dewatering and filtration plant, producing filtered tailings for emplacement in TSF3.
Waste rock management	Waste rock used for underground backfill, stored in surface facilities including Little Kintore Pit and BHP Pit, or used for construction, tailings embankments and rehabilitation where material meets contamination criteria.
Site infrastructure	
Ancillary infrastructure	Crushing and processing plant, tailings backfill plant, tailings dewatering plant, rail siding facilities, ventilation systems, water management infrastructure, internal roads, workshops, administration offices, storage warehouse and core shed.

Appendix C
Project mitigation measures

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C.1 Project mitigation measures

Environmental Aspect	Mitigation Measure	Project Phase
Air Quality & Lead	Apply water carts, sprays and chemical suppressants to control dust on haul roads, stockpiles and disturbed areas.	Construction & Operation
	Maintain sealed or treated haul roads to reduce particulate generation.	Operation
	Suspend or modify activities during adverse wind conditions.	Operation
	Enclose crushing, conveying and concentrate handling systems where practicable.	Operation
	Operate real-time air quality and lead monitoring with Trigger Action Response Plans.	Operation
	Progressive rehabilitation and capping of exposed areas to reduce wind erosion.	Operation
	Classify waste materials and restrict surface use to low-lead material (<0.5% Pb).	Operation
Noise	Restrict surface construction works to standard daytime hours where feasible.	Construction
	Use bunding, landform shielding and site layout to attenuate operational noise.	Design & Operation
	Maintain attended and real-time noise monitoring and periodic independent review.	Operation
	Implement additional controls (barriers, enclosures or quieter plant) if monitoring identifies exceedance risk.	Construction
Blasting & Vibration	Design blasting to comply with EPL criteria, AS2187 and dam safety requirements.	Operation
	Stage mining and sequence blasts to reduce vibration near sensitive receptors.	Operation
	Adjust charge size, explosive density and firing sequence to manage vibration.	Operation
	Validate blast modelling using monitoring data and adapt blast design accordingly.	Operation
Surface Water	Capture and divert runoff using bunding, drainage and containment structures.	Construction & Operation
	Maintain TSF freeboard and stormwater storage capacity.	Operation
Groundwater	Manage intercepted groundwater through existing sumps and pumping infrastructure.	Operation
Water Use and Management	Reuse captured water for processing, dust suppression and site demands.	Operation
	Operate within licensed extraction limits and implement the Site Water Management Plan.	Operation
Tailings Stability	Place and compact tailings in controlled layers to maintain geotechnical stability.	Operation
	Maintain appropriate tailings moisture conditions prior to placement.	Operation
	Install seepage collection, drainage and buttressing systems to manage inrush risk.	Construction & Operation
Geotechnical	Maintain stand-off distances and barrier pillars near historical workings and TSFs.	Design & Operation
	Undertake probe drilling, mapping and monitoring to confirm ground conditions.	Operation
Land Use	Locate new works within previously disturbed mining areas wherever practicable.	Design

Environmental Aspect	Mitigation Measure	Project Phase
Rehabilitation	Progressively rehabilitate completed areas to reduce erosion and dust generation.	Operation
Materials Management	Reuse inert waste rock underground or in approved facilities to avoid new landforms.	Operation
Traffic	Use existing approved haulage routes and internal road networks.	Operation
	Minimise haulage distances and material double-handling where practicable.	Operation
Community	Continue Community Lead Management Program and associated monitoring.	Operation
	Maintain stakeholder engagement, notification and complaints management processes.	Operation
Heritage	Avoid known heritage items and implement unexpected finds procedures if required.	Construction

Appendix D
Evidence of Consultation

EMM
creating opportunities

Joel Sulicich

From: Stuart Ross <SRoss@ARTC.com.au>
Sent: Tuesday, 23 December 2025 10:01 AM
To: Joel Sulicich
Cc: Mark Curran
Subject: MOD 13 Consultation

Hi Joel

Thanks for your recent email to ARTC inviting feedback on the proposed MOD 13.

ARTC are generally comfortable with the proposed modification and offer the following feedback and requirements for attention.

ARTC request that BHM Pty Ltd demonstrate via provision of appropriate documentation, the following -

1. From a rail perspective, ARTC lease the land and railway infrastructure, and the proposal would need to demonstrate:
    a. Geotechnical studies that demonstrate no impact to land subject to Title and / or Rail and other Infrastructure present on the land.
    b. Vibration / blast assessment / modelling that demonstrates no impact to land subject to Title and / or Rail and other Infrastructure present on the land.
2. From a planning approvals perspective, ARTC would need confirmation that MOD13 approvals had been received by Rasp prior to any works commencing and there were no implications for ARTC.
3. Further review of the land tenure and mineral rights for the land (e.g. 4//DP1067380 contains detail on title for minerals and excludes land below 15.24m)

Management of surface water drainage, and its retention within the mine site remains an important issue for both ARTC and our lessor Transport for NSW. With respect to the drainage design and recommendations for retention of stormwater on the mine site recently supplied to BHM Pty Ltd, ARTC would like to request that BHM Pty Ltd commit to working collaboratively and engage with ARTC and TfNSW to agree on a final drainage design, and contribute to and undertake drainage works on BHM Pty Ltd land as per an agreed design to ensure that majority of run-off from the mine site is retained to within the BHM Pty Ltd boundaries.

Thanks for the opportunity to provide feedback and for working collaboratively with ARTC through the year. All the best for your Christmas.

Regards

Stuart Ross
Senior Manager Environment Systems
Safety and Systems

ARTC

M. 0438 272 840
E. SRoss@ARTC.com.au

Australian Rail Track Corporation
33 Newton Street
Broadmeadow NSW 2292

artc.com.au

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Broken Hill Operations Pty Ltd
(ABN 58 054 920 893) A wholly owned subsidiary of Broken Hill Mines Ltd

Rasp Mine
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PO Box 5073, Broken Hill, NSW 2880, Australia
Tel: +61 8 8088 9111

Registered Office
Suite 1501, 470 Collins Street, Melbourne VIC 3000
www.brokenhillmines.com
Tel: +61 3 9005 6030

1 December 2025

Briohny Seaman

Unit Head

Operations

NSW Environment Protection Authority

info@epa.nsw.gov.au

From: Joel Sulicich

Subject: **Rasp Mine (PA07_0018) - Modification 13 (MOD13)**

Dear Briohny

1 Introduction

Broken Hill Operations Pty Ltd (BHO) owns and operates the Rasp Mine (the mine), which is located within the City of Broken Hill (see Figure 1.1).

BHO Rasp Mine operations are undertaken in accordance with Project Approval PA 07_0018 (as modified) granted from the then Minister for Planning on 31 January 2011, under Part3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

BHO is seeking to modify PA07_0018 (MOD13) pursuant to section 4.55(2) of the EP&A Act, for the following:

- extending mining operations into the British deposit
- installation of an escape ladder way from the underground workings to the surface
- changes to onsite operations to include a tailings dewatering system
- receipt and processing of ore from the Pinnacles Mine
- extending the life of PA07_0018 for five years, until 31 December 2031.

2 Approved project

PA07_0018 has been modified 12 times and allows mining operations at the mine until 31 December 2026, including extraction of up to 500,000 tpa, increased to 750,000 subject to further air quality impact assessment to the satisfaction of the EPA and revised limit approved by the Secretary, processing of ore on-site and deposition of tailings into the Blackwood Pit tailings storage facility (TSF2) and the Kintore Pit (TSF3).

3 Proposed modification

The proposed modifications to PA07_0018 are discussed further in the sections below.

3.1 Extension of mining into the British deposit

BHO is seeking to extend underground mining operations into the British deposit. British sits within ML Block 16 (see Figure 3.1). This particular area at Rasp Mine has been subject to historical mining, first in the 1880s and again in the 1970s.

Underground mining would be conducting using approved methods and occur 24 hours per day, seven days a week, consistent with current practices on site.

Parallel to this modification application, BHO would apply for a new mining lease from EL5818 for the small portion of land outside of Consolidated Mining Lease (CML) 7 in which the British deposit also sits.

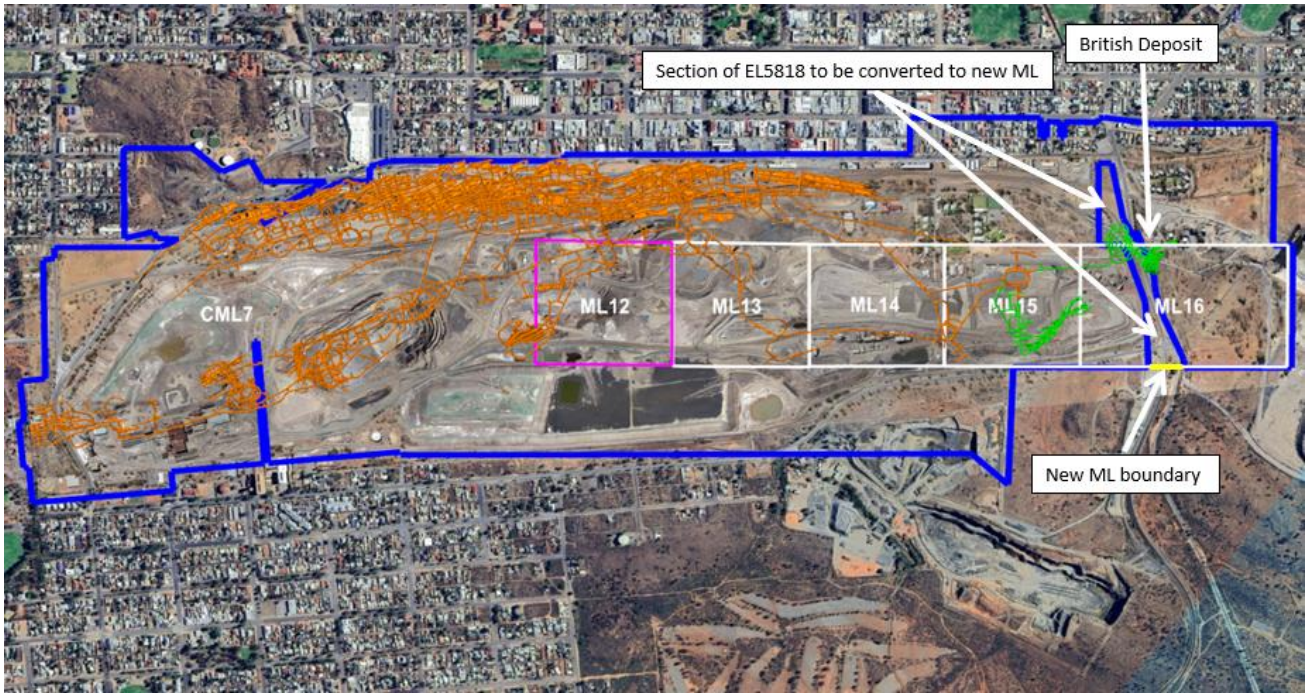


Figure 3.1 CML7, existing workings (orange) and extension of mining into British deposit

3.2 Installation of an escape ladder way

BHO is seeking to install an emergency egress ladder way from the underground workings to the surface. BHO currently maintains 2 means of access/egress from the mine; the main portal and emergency escape ladder way from Stockpile 1 underground to the surface (approved in MOD9, refer to Figure 4.3), however this additional escape ladder way is to ensure that there exists a further suitable means of emergency egress from the northern areas of the mine as mining progresses further north including the British deposit.

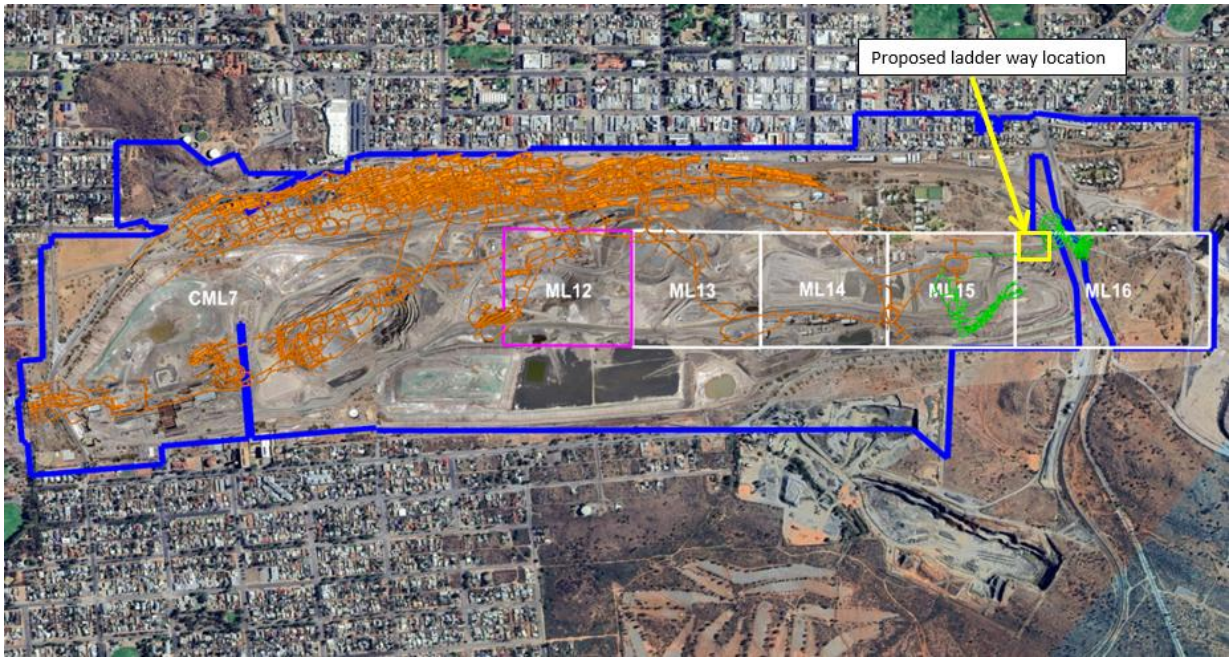


Figure 3.2 Proposed surface ladderway location

Figure 3.3 The Rasp Mine surface escape ladder way exit housing that was approved in MOD9.

3.3 Tailings dewatering system

BHO is seeking approval for tailings dewatering system to increase water recycling from tailings back into the operation and to continue to decrease geotechnical concerns related to inrush into underground workings at the site's approved processing rate. The current approved tailings management procedures are limited to solar and wind desiccation of tailings (to less than 15% moisture) at TFS2 before transport via truck to Kintore Pit (TSF3). Dried tailings are then placed in near horizontal layers at TFS3 and compacted with a roller.

The tailings dewatering system would consist of construction of a filtration plant and a tailings slurry line pipe and water return line between the filtration plant and Rasp Mine processing facility. The proposed filtration plant would be located adjacent to the Kintore Pit, in an enclosed building which would also contain a compressor, air dryer and instrument air. Power for the filter plant would be supplied from the existing system, with a new substation established adjacent to the filtration plant.

The filtration plant would produce a filter cake consistent with the current solar desiccation procedure, which would be deposited in TFS3 via conveyor belt. Dried tailings are then placed in near horizontal layers at TFS3 and compacted with a roller. The tailings dewatering system layout is shown in Figure 4.4.

Figure 3.4 Tailings dewatering system layout

The tailings dewatering system would significantly increase the amount of water recycled back into the operation. Consistent with the current solar and wind desiccation process, the tailings dewatering plant will reduce the water content of the tailings to below the threshold for liquefication. The dewatering plants, together with ongoing compaction of deposited tailings, the portal plug and placement of rock (as approved in MOD6) will continue to mitigate the risk of inrush into the mine. Dewatering will also achieve a moisture content so the tailings material will not slump or liquefy from seismic events or mining blasting activity.

3.4 Importing and processing ore from Pinnacles Mine

BHO intends to receive ore from the Pinnacles Mine at Rasp Mine and process this ore at Rasp using the existing Rasp Processing Plant. Pinnacles Mine, owned by Pinnacles Mines Pty Ltd and operated by BHM, is located approximately 14 kilometres west of Rasp Mine. Pinnacles Mine is approved under Development consent (DA 13/13732), which was granted under the then section 80(1)(a) of Division 2 of Part 4 of the EP&A Act on 25 June 2014. Parallel to this modification, Pinnacles Mines Pty Ltd is proposing to modify DA 13/13732 to allow for haulage of crushed ore from the Pinnacles Mine into Rasp Mine (via the Eyre Street entrance).

Ore receipt would occur in B-double trucks on a campaign basis and in accordance with current materials handling and processing limits to support ongoing processing requirements at Rasp Mine.

Pinnacles ore would be unloaded at the existing Rasp Mine ROM Pad and processed using the existing processing facility. Final concentrate products would be transported via rail to Port Adelaide. Tailings would be managed in accordance with approved Rasp Mine tailings management procedures. Existing tailings storage facilities and waste rock areas have sufficient capacity to handle the proposed import of ore from Pinnacles. Detailed information about the volumes/capacities would be included in the modification report.

The receipt and processing of Pinnacles ore would diversify the ore sources, enabling the Rasp Mine to optimise production, reduce costs and create greater operational stability. Pinnacles Mine ore is a key factor in extending the life of the Rasp Mine and supports the long-term future of the operation.

The import and processing of Pinnacles ore would be undertaken within existing processing limits in place at Rasp.

3.5 Extension of mine life

BHO is seeking to extend mining operations by five years, from 31 December 2026 to 31 December 2031. The extension of time is supported by the proposed mine plan, importation of ore from Pinnacles Mine and long-term planning for the site.

The Modification Report will detail the additional resource available, capacity of existing waste (tailings and rock) storage facilities, and the estimates of volume of material to be

received from Pinnacles Mine to accommodate the additional five years of mine life. The Modification Report will also include a summary of the existing extraction, processing and waste generating rates at the site and how the modified project would comply with the existing approval limits.

4 Proposed environmental assessments

BHO proposes to conduct the following environmental assessments, which will be included in the Modification Report. The Modification Report will be prepared in accordance with *State significant development guidelines – preparing a modification report.*

- Noise assessment – a noise assessment will be undertaken for the modification of surface activities such as Pinnacles ore deliveries, emergency escape ladderway installation and tailings dewatering system
- Blasting assessment - a study will be conducted to assess development and production blasting within the British deposit.
- Water resources assessment – a groundwater and surface water assessment will be conducted for the proposed activities of the modification. A study will be conducted to determine if groundwater is a possibility of being encountered and/or impacted by underground mining, in accordance with the *Aquifer Interference Policy* (DPI 2012).
- Air quality assessment – an assessment of dust and air quality will be undertaken for the proposed activities of the modification, including the proposed tonnes per annum of extraction and processing (incorporating the additional tonnage from Pinnacles).
- A greenhouse gas assessment will also be undertaken, given the proposed extension of mine life.
- Geotechnical assessment – an assessment of stability and geotechnical of ground conditions for the extension of mining into the British deposit, taking into consideration surface features including the road and rail line.
- Inrush risk assessment – an inrush due diligence assessment will be undertaken for the extension of mining into British deposit.
- Waste rock assessment – a waste rock inventory assessment will be conducted to review and confirm availability of suitable waste rock for surface capping requirements as part of site rehabilitation requirements.
- Tails storage capacity – a tails storage capacity assessment will be undertaken to confirm that suitable tails storage exists for the proposed mining extension.
- Human health risk review – will consider the previous assessments undertaken at the site in context of the proposed Mod 13 activities.

- Social Impacts Assessment – to consider the impacts of the 5 year extension to the poroject

In addition to the detailed assessments listed above, BHO will also conduct due diligence assessments for other potential impacts including visual impacts, biodiversity impacts, traffic impacts, heritage impacts, and waste management. For traffic, the trucking or ore from Pinnacles will be undertaken in the Modification Report for Pinnacles and therefore a detailed assessment of traffic impacts will not be required.

5 Consultation

BHO will consult with key stakeholders in the coming weeks to brief them on the proposed modification, including:

- Resources Regulator (Environment)
- Resources Regulator (Safety)
- Environment Protection Authority
- Mineral Exploration and Geosciences
- Dams Safety NSW
- Crown Lands
- Broken Hill City Council
- ARTC
- Transport for NSW
- Perilya Broken Hill

Community engagement for the modification would be commensurate with the engagement undertaken for previous modifications. BHO continues to meet with the Broken Hill Lead Reference Group regularly and will provide the group with details on MOD13 for comment.

All comments received from stakeholders would be considered in the proposed assessments and Modification Report.

6 Conclusion

The proposed modification includes an extension of mining, importing and processing of Pinnacles Mine ore, installation of a tailings dewatering plant and surface escape ladderway for mining into the British deposit. The proposal is also requesting an extension to the life of PA07_0018 for five years.

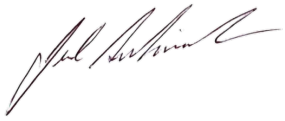
The proposed modifications are substantially the same as already approved activities with no changes to production rates, extraction rates or surface disturbance areas. Following approval, it is envisaged the works would commence as soon as possible.

BHO intends to lodge the modification application and supporting documentation in January 2025.

BHO appreciates your consideration on this matter. If you wish to provide comments about the proposal prior to the scoping document being submitted, please provide comments to me by 4/12/25.

If you wish to provide comments about the proposal prior to the Modification Report being submitted, please provide comments to me by 15/12/25. If any of the above information requires further clarification, please do not hesitate to contact me on 0427 610 774 or at jsulicich@brokenhillmines.com

Yours sincerely



Joel Sulicich

Health, Safety, Environment and Training Manager

Broken Hill Operations Pty Ltd - Rasp Mine

M: 0427 610 774

E: jsulicich@brokenhillmines.com

Joel Sulicich

From: Amy Smith <amy.smith@crownland.nsw.gov.au>
Sent: Thursday, 18 December 2025 9:11 AM
To: Joel Sulicich
Cc: Travis Cooper; Gaylene Barker
Subject: Crown Lands Response - Rasp Mine MOD13 consultation letter

Good Morning Joel,

Thank you for contacting the Department of Planning, Housing and Infrastructure – Crown Lands regarding the proposed Rasp Mine Project Approval Modification – MOD13.

The Department has reviewed the consultation letter, and we provide the following:

- A review of the Modification 13 proposal shows the extension of mining operations into the British Deposit (3.1)
    - Menindee Road in the proposed location of the new ML is identified as dedicated Public road vide NSW Government Gazette 23/10/2009.
    - Crown land being part of Willyama Common under the management of Willyama Common Trust

At this stage, the Department does not have any further comments to provide.

Kind regards,

Amy Smith
Senior Natural Resource Management Officer – Far West Land and Asset Management
Crown Lands | Department of Planning, Housing and Infrastructure
P 1300 886 235 | **T** 02 6883 5434 | **E** amy.smith@crownland.nsw.gov.au
45 Wingewarra Street, DUBBO NSW 2830 | PO Box 2185, DANGAR NSW 2309
www.crownland.nsw.gov.au

NSW GOVERNMENT

The Department of Planning, Housing and Infrastructure acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.
Please Note: our office opening hours are 9.00am to 12.00pm Monday to Friday and outside of these hours by appointment only.

From: Joel Sulicich <jsulicich@brokenhillmines.com>
Sent: Friday, 5 December 2025 5:21 PM
To: Travis Cooper <travis.cooper@crownland.nsw.gov.au>
Cc: Shaun Barker <shaun.barker@crownland.nsw.gov.au>
Subject: Rasp Mine MOD13 consultation letter

Hi Travis

Please find attached a letter from the Rasp Mine regarding its proposed Project Approval modification – MOD13.

If you wish to provide comments about the proposal prior to the Modification Report being submitted, please provide comments to me by 19/12/25.

Regards
Joel

Joel Sulicich | Health, Safety, Environment and Training Manager
Broken Hill Operations Pty Ltd | Rasp Mine
jsulicich@brokenhillmines.com
M: 0427 610 774
A: 130 Eyre Street | PO Box 5073 | Broken Hill NSW 2880 Australia

BROKEN HILL MINES

brokenhillmines.com

Joel Sulicich

From: Alison Lamond <alison.lamond@dcceew.nsw.gov.au>
Sent: Tuesday, 9 December 2025 3:30 PM
To: Joel Sulicich
Subject: RE: Rasp Mine MOD13 consultation letter

Hello Joel

Thank you for your reaching out to Heritage NSW regarding your proposed modification for the Rasp Mine Mod 13.
It is understood that you are preparing to submit the modification report and associated technical assessments. We further understand that the current letter has been prepared as an offer for further inputs into the modification report, or discussion on certain matters if required prior to lodgement. Heritage NSW has no initial concerns/comments with regards to heritage and your modification.
Please note that a formal response from Heritage NSW will be provided once a request for comment the modification report has been formally referred to Heritage NSW along with the finalised Heritage Assessment reports.

If your heritage consultant has particular issues with the heritage assessment of your proposal they can reach out to heritagemailbox@environment.nsw.gov.au for specific advice.
Regards

Alison Lamond *BSci, BA (Hons), (she/her)*
A/ Strategic Manager - Major Projects
Heritage NSW
Department of Climate Change,
Energy, the Environment and Water

M 0419 762 918 **E** alison.lamond@dcceew.nsw.gov.au

Season's greetings from Heritage NSW.
Please note that Heritage NSW will be closed from Thursday 25 December 2025 to Friday 9 January 2026.

dcceew.nsw.gov.au

Level 3, 6 Stewart Ave
Newcastle West NSW 2303

Locked Bag 1002, Dangar NSW 2309

Working days Monday to Friday, 9:00am - 5:00pm

NSW GOVERNMENT

I acknowledge the traditional custodians of the land and pay respects to Elders past and present. I also acknowledge all the Aboriginal and Torres Strait Islander staff working with NSW Government at this time.

Please consider the environment before printing this email.

From: Joel Sulicich <jsulicich@brokenhillmines.com>
Sent: Friday, 5 December 2025 5:39 PM
To: Tempe Beaven <Tempe.Beaven@dcceew.nsw.gov.au>
Subject: Rasp Mine MOD13 consultation letter

Hi Tempe

Please find attached a letter from the Rasp Mine regarding its proposed Project Approval modification – MOD13.

If you wish to provide comments about the proposal prior to the Modification Report being submitted, please provide comments to me by 19/12/25.

Regards
Joel

Joel Sulicich | Health, Safety, Environment and Training Manager
Broken Hill Operations Pty Ltd | Rasp Mine
jsulicich@brokenhillmines.com
M: 0427 610 774
A: 130 Eyre Street | PO Box 5073 | Broken Hill NSW 2880 Australia

BROKEN HILL MINES
brokenhillmines.com

Joel Sulicich

From: Tim Baker <tim.baker@dcceew.nsw.gov.au>
Sent: Monday, 8 December 2025 6:45 AM
To: Joel Sulicich
Cc: DCCEEW Water Assessments Mailbox
Subject: RE: Rasp Mine MOD13 consultation letter

Hi Joel,

Thanks for the scoping letter regarding Mod 13. DCCEEW Water will await submission of the Mod report to provide comments.

Regards
Tim

Tim Baker
Senior Project Officer
Water Assessments
Department of Climate Change, Energy, the Environment and Water

---

From: Joel Sulicich <jsulicich@brokenhillmines.com>
Sent: Friday, 5 December 2025 6:00 PM
To: Tim Baker <tim.baker@dcceew.nsw.gov.au>
Cc: DCCEEW Water Assessments Mailbox <water.assessments@dcceew.nsw.gov.au>
Subject: Rasp Mine MOD13 consultation letter

Hi Tim

Please find attached a letter from the Rasp Mine regarding its proposed Project Approval modification – MOD13.

If you wish to provide comments about the proposal prior to the Modification Report being submitted, please provide comments to me by 19/12/25.

Regards
Joel

Joel Sulicich | Health, Safety, Environment and Training Manager
Broken Hill Operations Pty Ltd | Rasp Mine
jsulicich@brokenhillmines.com
M: 0427 610 774
A: 130 Eyre Street | PO Box 5073 | Broken Hill NSW 2880 Australia

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brokenhillmines.com

Joel Sulicich

From: Development West <development.west@transport.nsw.gov.au>
Sent: Thursday, 15 January 2026 3:03 PM
To: Joel Sulicich
Subject: TfNSW Feedback - Rasp Mine MOD13 consultation letter

Hi Joel,

Thank you for providing TfNSW the opportunity to be involved in consultation for a proposed modification to PA07_0018, referred to TfNSW on 15 December 2025.

It is understood that the modification seeks to:

- Allow haulage of ore from the Pinnacles Mine to the Rasp Mine
- Extend mining operations into the British deposit.
- Install an escape ladder way from the underground workings to the surface
- Modify operations to include a tailings dewatering system
- Extend the life of PA07_0018 for five (5) years (until 31 December 2031)

TfNSW is aware that the volume of ore expected to be hauled between the mine operations is to be 60,000tpa using B-double vehicle combinations and that the heavy vehicles generated by the proposed modification, as outlined in the Briefing Letter from Pinnacles Mine in a previous submission to TfNSW on 30 April 2025, is to be:

- A maximum of 2 laden and unladen vehicles per hour (4 vehicle trips)
- A maximum of 16 laden and unladen vehicles per day (16 vehicle trips).

TfNSW key interests are the safety and efficiency of the transport network, the needs of our customers and the integration of land use and transport in accordance with the *Future Transport Strategy 2056.* The Silver City Highway (HW22) is a classified (State) road in which Broken Hill City Council is the roads authority for all public roads within the LGA.

TfNSW recommend the following information below to be included/demonstrated in your modification application:

- A Traffic Impact Assessment (TIA) should be provided to accompany the modification application. The TIA should be prepared by a suitably qualify person/s and assess the development's traffic assumptions in accordance with TfNSW's *Guide to Transport Impact Assessments, 2024*.
- A revision of the current Traffic Management Plan (TMP), identifying any affected conditions of the Development Consent and how they will be addressed to reflect changes in development operating conditions.
- Broken Hill Mine are to design, construct, operate and maintain a Water Quality and Drainage System upstream of TfNSW lands. All contaminants must be retained within the mine cadastral boundaries. All off-site discharge must achieve the requirements of the National Water Quality Management Strategy and the NSW Water Quality and River Flow Objectives. Management of the water quality system must include progressive operational maintenance, undertaken in a competent manner to maintain the Water Quality and Drainage system design effectiveness and efficiencies.

Should you have any further enquiries regarding the above comments, please do not hesitate to contact myself by emailing development.west@transport.nsw.gov.au.

Kind regards

Alex Pozzer
Development Services Case Officer
Development Services West
Transport Planning – Planning, Integration and Passenger
Transport for NSW
transport.nsw.gov.au

E alex.pozzer@transport.nsw.gov.au

Transport for NSW

OFFICIAL

OFFICIAL

From: Joel Sulicich <jsulicich@brokenhillmines.com>
Sent: Sunday, 14 December 2025 5:11 PM
To: Neil Glastonbury <Neil.J.GLASTONBURY@transport.nsw.gov.au>
Subject: Rasp Mine MOD13 consultation letter

You don't often get email from jsulicich@brokenhillmines.com. Learn why this is important

CAUTION: This email is sent from an external source. Do not click any links or open attachments unless you recognise the sender and know the content is safe.

Hi Neil

Please find attached a letter from the Rasp Mine regarding its proposed Project Approval modification – MOD13.

If you wish to provide comments about the proposal prior to the Modification Report being submitted, please provide comments to me by 24/12/25.

Regards
Joel

Joel Sulicich | Health, Safety, Environment and Training Manager
Broken Hill Operations Pty Ltd | Rasp Mine
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A: 130 Eyre Street | PO Box 5073 | Broken Hill NSW 2880 Australia

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Appendix E
Noise assessment

EMM
creating opportunities

Level 3 175 Scott Street
Newcastle NSW 2300
ABN: 28 141 736 558

02 4907 4800

www.emmconsulting.com.au

9 February 2026

Joel Sulicich
Health Safety Environment and Training Manager
Broken Hill Operations Pty Ltd - Rasp Mine
130 Eyre Street
Broken Hill NSW 2880

Re: Rasp Mine Modification 13 - Noise impact assessment

Dear Joel,

1 Introduction

EMM Consulting Pty Limited (EMM) has been engaged by Broken Hill Operations Pty Ltd (BHO) to assess the potential noise impacts for the proposed Modification 13 (MOD 13) of project approval 07_0018 (PA) for Rasp Mine in Broken Hill, NSW. Rasp Mine produces zinc, lead and silver concentrates which are dispatched via rail to Port Pirie and Port Adelaide in South Australia.

BHO operates the Rasp Mine in accordance with PA 07_0018, which allows mining operations until 31 December 2026. Rasp Mine is regulated under Consolidated Mining Lease CML7 (CML7) and is permitted to mine a predefined portion of Mine Lease 1249 under a sublease arrangement with the adjoining mine operator Perilya Broken Hill Limited (the lease holder).

This noise impact assessment report (NIA) presents an assessment of noise from the proposed MOD 13 construction activities and future Rasp Mine operations at surrounding residential receivers. The report also provides recommended construction and operation noise management and mitigation measures, where relevant.

This assessment references the project approval, noise guidelines and policies as follows:

- NSW Department of Environment and Climate Change (DECC), *Interim Construction Noise Guideline* (ICNG), 2009
- NSW Department of Planning, Housing and Infrastructure (DPHI), Consolidated Project Approval *PA 07_0018 Mod 11*, November 2023
- NSW Environment Protection Authority (EPA), Environment Protection Licence 12559 (EPL) dated 1 July 2025
- NSW EPA, *Noise Policy for Industry*, 2017

- NSW Department of Environment and Climate Change (DECC), *Interim Construction Noise Guideline*, 2009
- BHO, approved *Noise and Blast Management Plan* (NBMP), dated 9 October 2023.

2 Existing operations and proposed modification

2.1 Existing mining operations

The Rasp Mine is located in the centre of the City of Broken Hill and mining has been occurring at the site since 1885. BHO, owned by CBH Resources at the time, purchased the Rasp Mine in 2001 and commenced works at the site in 2007 with the installation of an exploration decline. Underground mining re-commenced at the site in 2011 with ore processing recommencing in 2012. Broken Hill Mines Pty Ltd (BHM) purchased BHO from CBH Resources on 1 November 2024.

Existing approved mining operations at the Rasp Mine consist mainly of underground mining operations, surface ore haulage to the Run-of-Mine (ROM) pad, waste rock haulage to in-pit storage areas, crushing and screening, processing of ore, harvesting and storage of tailings, dispatch of ore concentrate products via rail and mine rehabilitation. To support on-site mining activities, BHO also operate an on-site concrete batching plant, tailings backfill plant, rail siding facility, workshop and ventilation fans.

Most recent attended noise monitoring assessments have shown that existing site noise complies with the relevant limits at nearest residential receivers.

2.2 Proposed operations

2.2.1 Overview

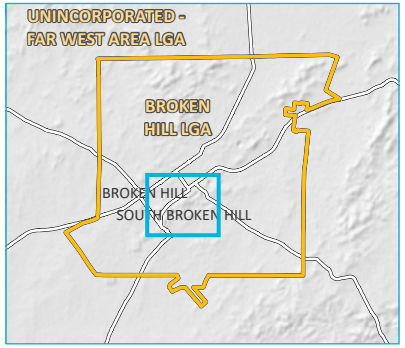
BHO is seeking to modify Rasp Mine's PA (MOD 13) pursuant to Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to allow for:

- the importation of up to 100,000 tonnes per annum (tpa) of crushed ore from Pinnacles Mine by road, on-site processing and placement of the resulting tailings
- the mining of the British ore body (upon approval of CML7 extension to include EL5818)
- the establishment of an emergency egress ladderway in Mining Lease (ML) ML16
- the implementation of a tailings dewatering system (filter plant and in-pit tailings handling)
- the discontinuation of tailings harvesting in the Blackwood Pit Tailings Storage Facility 2 (TSF2) upon commissioning of the filter plant
- increase the total volume of ore allowed to be extracted to 12,200,000 tonnes of ore over the life of the project
- a five-year extension of PA 07_0018, until 31 December 2031.

The majority of the proposed MOD 13 operation would be a continuation of existing surface operations at Rasp Mine and involve the use of existing personnel, facilities, plant and equipment.

The approval for the transportation of crushed ore from Pinnacles Mine to Rasp Mine is sought through a modification to Pinnacles Mine's development approval (DA 13/13732), and not through a modification to Rasp Mine's PA. Therefore, the assessment of noise from this activity is not included in this report.

Rasp Mine operations and proposed MOD 13 modifications are shown in Figure 2.1.



KEY

- Mining lease (CML7)
- British Mine underground workings
- Ladder way location

Tailings dewatering system layout

- Electrical
- Infrastructure
- Process water
- Tailings

Tie-in point

- Process water
- Raw water
- Tailings

Existing environment

- Train station
- Rail line
- Major road
- Minor road
- Vehicular track
- Local government area

Rasp Mine existing operations and proposed MOD13 modifications

Rasp Mine- Mod 13
Noise Impact Assessment
Figure 2.1

Source: EMM (2026); ABS (2021); DCSSS (2024); GA (2009); MetroMap (2026)

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creating opportunities

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2.2.2 Pinnacles Mine crushed ore importation

BHO intends to receive 100,000 tpa of ore from the Pinnacles Mine for processing at Rasp Mine. Pinnacles Mine, owned by Pinnacles Mines Pty Ltd and operated by BHM, is located approximately 14 kilometres (km) west of Rasp Mine.

Ore will be transported to Rasp Mine by B-double trucks on a campaign basis (fortnightly or monthly intervals), resulting in up to 2,519 deliveries of ore per year. Transport and delivery are proposed to occur between the hours of 8:00 am and 5:30 pm, Monday to Friday.

Pinnacles ore would be unloaded at the existing Rasp Mine ROM Pad and processed using the existing processing facility (refer to Figure 2.1). Final concentrate products would be transported via rail to Port Adelaide. Tailings would be managed in accordance with approved Rasp Mine tailings management procedures.

2.2.3 Emergency egress ladderway

The proposed Emergency egress ladderway (the ladderway) is additional to the two means of access/egress that currently exist at the mine. This will provide a further suitable means of emergency egress from the northern areas of the mine as underground operations progress north. The ladderway is proposed to be located in the northern corner of ML16 (refer to Figure 2.1).

The proposed ladderway installation will require the use of a raise boring machine (i.e. raise borer) to excavate a circular shaft between the underground workings and the surface. The raise borer will be set up on the surface on an evenly laid platform (i.e. approximately 9 metre (m) x 3 m x 200 millimetres (mm) concrete pad). Concrete will be delivered to the area via trucks (up to two concrete agitator truck deliveries) and will ensure a stable footing for the raise bore to operate from, stable ground at the surface breakthrough point, and lastly, a suitable pad to place the shipping container on at completion.

2.2.4 Tailings dewatering system

BHO is proposing to operate a tailings dewatering system to increase water recycling from tailings back into the operation and to continue to manage geotechnical risks related to inrush into underground workings. The current approved tailings management procedures are limited to solar and wind desiccation of tailings (to approximately 65% solid and 15% moisture) at TFS2 before transport via truck to the Kintore Pit (TSF3). Dried tailings are placed in near horizontal layers at TFS3, spread with a dozer and compacted with a roller.

The tailings dewatering system would increase the amount of water recycled back into the operation. Tailings dewatering will reduce the water content of the tailings to below the threshold for liquification. The dewatering system, together with ongoing compaction of deposited tailings, the portal plug and placement of rock (as approved in MOD 6) will continue to mitigate the risk of inrush into the mine. Dewatering will also achieve a moisture content so the tailings material will not slump or liquefy from seismic events or mining blasting activity.

The tailings dewatering system will incorporate both a filter plant (refer to Figure 2.1) and a tailings slurry line pipe and water return line between the filter plant and the processing facility. The proposed filter plant would be located adjacent to TSF3. Power for the filter plant would be supplied from the existing system, with a new substation established adjacent to the filter plant.

Tailings will be delivered from the processing facility to a surge tank at the filter plant via the tailings slurry line pipe (tailings pipeline). Slurry from the surge tank would be pumped to a chamber where a cake blow compressor will dry the filter cake. Filter cake will then be moved to a long chute and to the conveyor which will direct the tailings into TSF3. A dozer and a roller will then spread and compact the tailings within TSF3. The filtrate will be transferred back via the water pipe to a lined water pond ready for reuse in the processing facility.

The tailings dewatering system will operate 24 hours per day, including the operation of the dozer and roller within TSF3.

2.2.5 Tailings harvesting in TSF2

BHO intends to discontinue tailings harvesting currently being undertaken in TSF2 upon commissioning of the filter plant. Tailings harvesting in TSF2 was initially approved through MOD 6, with stockpiling of tailings in Cell 1 subsequently approved through MOD 10, as part of ongoing tailings management (refer to Figure 2.1).

TSF2 is currently utilised to temporarily store and naturally dry (using solar and wind) tailings. When sufficiently dried, tailings are harvested and transported to TSF3 for permanent storage. This occurs during the day period only, from 7:00 am to 7:00 pm.

Plant and equipment currently used in the TSF2 for tailings harvesting will be decommissioned.

2.2.6 Mining of the British ore body (underground) and mining operations approval extension

The mining of the British ore body will mean that underground mining will continue beyond 2026. Underground mining would be conducted using approved methods and occur 24 hours per day, seven days a week, consistent with existing operating hours. Further, this will not require any change to surface operations and hence will not affect noise from the site's operations.

2.2.7 Mining operations approval extension

BHO is seeking to extend mining operations by five years, from 31 December 2026 to 31 December 2031. The extension of time is supported by the proposed mine plan, importation of ore from Pinnacles Mine and long-term planning for the site.

2.3 Proposed construction activities

2.3.1 Overview

To allow for proposed MOD 13 operational activities, several construction activities are proposed to be undertaken at Rasp Mine including the ladderway construction and tailings dewatering system. Some of the these will occur outside the ICNG recommended standard hours, namely during out-of-hours (OOH).

Other proposed MOD 13 activities including Pinnacles ore importation and British ore body mining will only require minor construction and installation activities. These are not expected to cause any noise impacts and hence have not been considered further in this assessment.

2.3.2 Ladderway construction

A concrete pad will be constructed at the proposed ladderway location to ensure a stable footing for the raise bore to operate from and a stable ground at the surface breakthrough point. Concrete will be delivered to the area via agitator trucks (up to two deliveries in total).

Next, a small-diameter hole (pilot hole) is drilled to the underground workings; the diameter of the pilot hole is typically 230–445 mm, large enough to accommodate the drill string. Once the drill has broken into the underground opening, the drill bit is removed, a reamer head with a diameter of 1.1 m is attached to the raise borer string and raised back towards the surface.

The boring cuttings from the reamer head fall to the floor of the lower level and will remain underground. The finished raise bore hole has smooth walls and will not require any further work or ground support.

The ladderway tubes of approximately 2.1 m in length will be installed in the 1.1 m diameter raise bored hole utilising a pulley system. The exit of the ladderway at the surface is proposed to be housed in a secured 20 foot shipping container for security reasons.

Construction activities, schedule and duration associated with the proposed ladderway installation are as follows:

- Raise bore concrete pad preparation pouring; up to two concrete deliveries – on one day during the day period (ICNG standard hours only).
- Raise boring from underground to the surface (approximately 87 m in depth):
  - Pilot hole drilling – 24-hours for approximately seven days.
  - Reaming of 1.1 m diameter hole (from underground to the surface) – 24-hours for approximately 16 days.
- Installation, placement and securing of ladderway tube – 24-hours for approximately seven days.
- Placement of shipping container housing – approximately three days during the day period (ICNG standard hours only).

2.3.3 Tailings dewatering system

i Filter plant

The proposed dewatering system will require the construction of a filter plant. The filter plant will be set up on the surface on an evenly laid platform. A suitable 40 x 20 x 20 m platform for the filter plant will be established, using an excavator to prepare the area for concrete footings and foundation.

Concrete pours will take approximately 10 days with eight concrete agitator truck deliveries per day. Tools and equipment required for footings and foundation includes a compactor, bobcat and small power tools such as welders, grinders, saws, nail guns and hand tools.

The structural steel erection would take approximately 18 weeks and would involve the use of cranes, pneumatic power tools, small power tools and hand tools.

The filter plant construction is proposed to be completed during the ICNG standard hours and day OOH period; between 7:00 am and 6:00 pm Monday to Friday, 7:00 am to 6:00 pm on Saturdays and 8:00 am to 6:00 pm on Sundays. Concrete agitator truck deliveries and concrete pours will occur during the ICNG standard hours only.

ii Tailings pipeline

The construction of the tailings pipeline (slurry and water return line) will involve installing a pipeline between the filter plant and the existing site processing plant (refer to Figure 2.1).

This will comprise trenching activities between the filter plant and the processing plant, which will mainly involve the use of an excavator.

This is expected to be completed in approximately 13 weeks and is proposed to occur during the ICNG standard hours and day OOH period; from 7:00 am to 6:00 pm Monday to Saturday and from 8:00 am to 6:00 pm Sundays.

2.3.4 Construction hours and duration

Some of the proposed construction activities will be restricted to the ICNG standard hours between 7:00 am and 6:00 pm Monday to Friday, 8:00 am to 1:00 pm on Saturdays, and no work on Sundays or public holidays.

The exceptions are the raise boring activity during the proposed ladderway construction and filter plant construction. The proposed ladderway construction is proposed to occur 24 hours seven days a week and hence during the ICNG standard hours, as well as during the day, evening and night OOH periods. The filter plant construction is proposed to occur from 7:00 am to 6:00 pm Monday to Saturday and from 8:00 am to 6:00 pm Sundays, and hence during the ICNG standard hours and day OOH period.

The proposed MOD 13 construction hours and activity approximate duration are summarised in Table 2.1.

Table 2.1 Proposed MOD 13 construction hours and duration

Construction	Activities	Construction hours	Approximate duration
Ladderway	Area establishment	Standard hours	5 days
	Concrete pad (concrete pour)	Standard hours	1 day
	Raise boring	24/7	23 days
	Ladderway installation, placement and securing	24/7	7 days
	Placement of shipping container and securing	Standard hours	3 days
Tailings dewatering system	Filter plant area establishment	Standard hours/Day OOH	3 weeks
	Filter plant footings and foundations (concrete pour)	Standard hours	11 weeks
	Filter plant structural erection	Standard hours/Day OOH	18 weeks (overlap with above)
	Filter plant mechanical platework	Standard hours/Day OOH	11 weeks (overlap with above)
	Tailings pipeline installation	Standard hours/Day OOH	13 weeks (overlap with above)
	Filter plant electrical and instrumentation	Standard hours/Day OOH	14 weeks (overlap with above)

BHO has confirmed that no other construction activities are expected to occur on-site at the time of the proposed MOD 13 construction activities.

2.4 Workforce requirement

The workforce requirement is not proposed to change as a result of MOD 13 operations. Additional workforce is expected for the construction stage; however, this is expected to be minimal.

3 Existing environment and noise limits

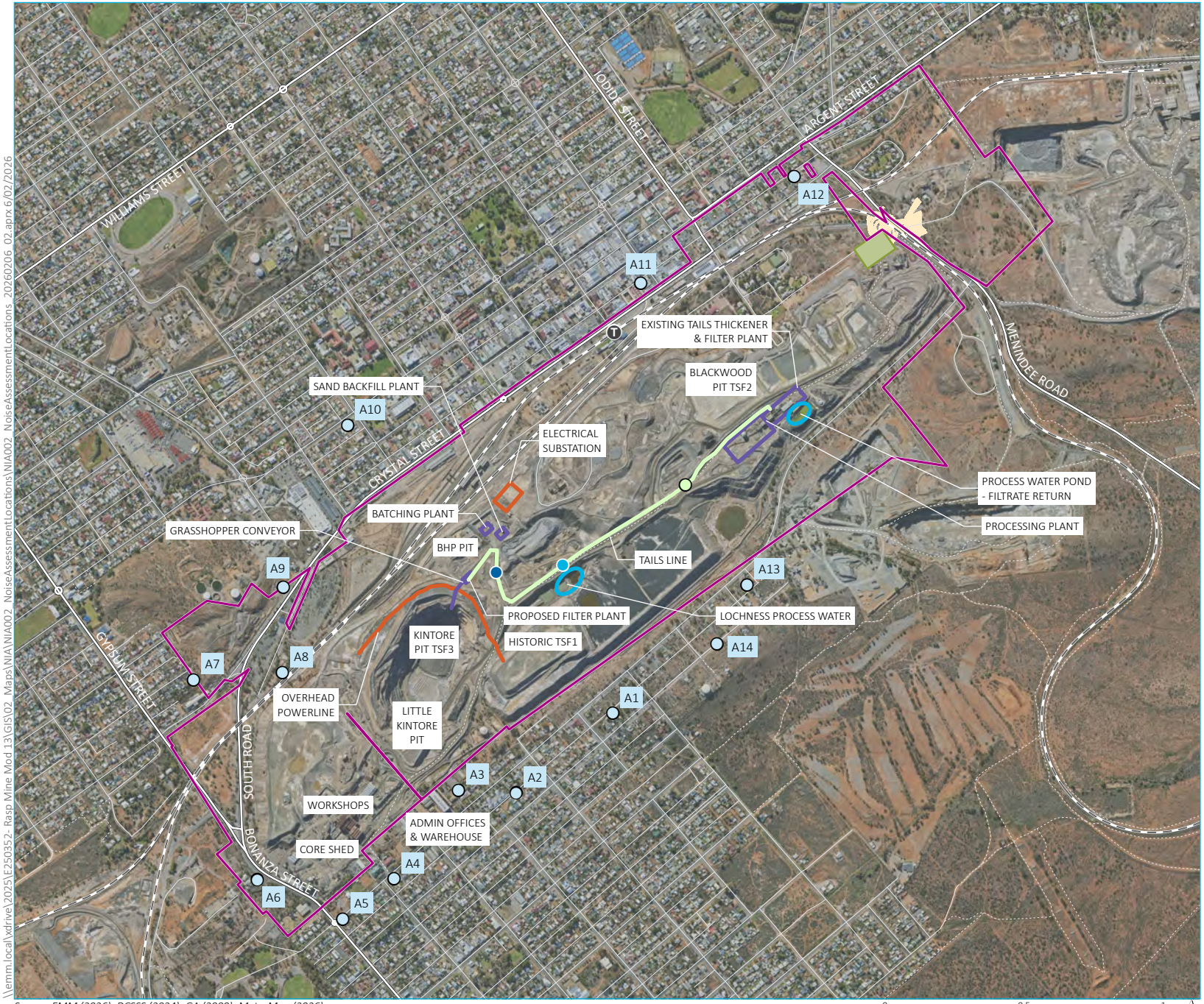
3.1 Assessment locations

The assessment locations adopted for this assessment are provided in Table 3.1 and shown in Figure 3.1. These are representative of nearest and/or most-affected residential receivers surrounding the site.

Furthermore, these locations are consistent with those adopted in previous noise assessments, listed in the PA and EPL.

Table 3.1 Assessment locations

Assessment location ID	Location	Coordinates (MGA56)	
		Easting	Northing
A1	Piper St North	544110	6462598
A2	Piper St Central	543763	6462312
A3	Eyre St North	543555	6462322
A4	Eyre St Central	543324	6462003
A5	Eyre St South	543140	6461859
A6	Bonanza St and Gypsum St	542833	6462000
A7	Carbon St	542604	6462718
A8	South Rd	542923	6462744
A9	Crystal St	542926	6463052
A10	Garnet and Blende St	543158	6463633
A11	Crystal St	544210	6464144
A12	Crystal St	544761	6464527
A13	Eyre St North	544592	6463059
A14	Piper St North	544532	6462860



KEY

- Noise assessment location
- Mining lease (CML7)
- Ladder way location
- British Mine underground workings

Tailings dewatering system layout

- Electrical
- Infrastructure
- Process water
- Tailings

Tie-in point

- Process water
- Raw water
- Tailings

Existing environment

- Train station
- Rail line
- Major road
- Minor road
- Vehicular track

Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

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Noise assessment locations

Rasp Mine- Mod 13
Noise Impact Assessment
Figure 3.1

EMM creating opportunities

3.2 Noise limits and criteria

3.2.1 Current operational noise limits

Condition 17 of Schedule 3 of the PA provides noise limits the site must meet during its operational phase. These are consistent with the noise limits provided in Condition L4 of the EPL.

Site operational noise limits are based on project noise trigger levels (PNTL) adopted in the MOD 6 noise impact assessment completed for the site in May 2021. The PNTL adopted in the 2021 noise impact assessment were derived based on measured or assumed minimum rating background levels (RBL) +5 dB for all assessment locations (residential), in accordance with the NPfI.

Current operational noise limits are provided in Table 3.2.

Table 3.2 Operational noise limits

Assessment location	Operational noise limits, $L_{Aeq,15min}$, dB		
	Day[1]	Evening[2]	Night[3]
A1	40	37	35
A2	40	37	35
A3	44	41	39
A4	44	41	39
A5	44	41	39
A6	48	41	39
A7	45	42	36
A8	48	39	39
A9	46	39	39
A10	42	41	35
A11	46	39	39
A12	46	39	39
A13	40	35	35
A14	40	35	35

Notes: 1. Day period: Monday to Saturday: 7:00 am to 6:00 pm, on Sundays and public holidays: 8:00 am to 6:00 pm.

2. Evening period: Monday to Saturday: 6:00 pm to 10:00 pm, on Sundays and public holidays: 6:00 pm to 10:00 pm.

3. Night period: Monday to Saturday: 10:00 pm to 7:00 am, on Sundays and public holidays: 10:00 pm to 8:00 am.

3.2.2 ICNG

Consistent with previous assessments and prior instructions from DPHI, the assessment of noise from construction works has been completed using the ICNG. The ICNG provides two methods for the assessment of construction noise emissions:

- quantitative: suited to major construction projects with typical durations of more than three weeks
- qualitative: suited to short term infrastructure maintenance (3 weeks or less).

The method for a quantitative assessment requires a more complex approach, involving noise emission predictions from construction activities to the nearest sensitive receivers, whilst the qualitative assessment methodology is a more simplified approach that relies more on noise management strategies. Due to the type of construction works proposed for MOD 13 and anticipated duration, this assessment has adopted a quantitative assessment approach.

The ICNG recommends standard hours for normal construction work which are as follows:

- Monday to Friday from 7:00 am to 6:00 pm
- Saturdays from 8:00 am to 1:00 pm
- no work on Sundays or public holidays.

The ladderway raise boring construction is proposed to be undertaken 24 hours, seven days per week, and hence during the ICNG standard hours and OOH periods. The filter plant construction is proposed during the ICNG standard hours and the day OOH period.

Where noise levels from construction works are predicted above the noise affected level during standard hours and/or OOH, all feasible and reasonable noise management and mitigation measures should be implemented.

Table 2 of the ICNG provides guidance on establishing noise management levels (NML) for residential receivers during standard hours and OOH and has been reproduced in Table 3.3.

Table 3.3 ICNG residential NML

Time of day	NML $L_{Aeq,15min}$	How to apply
Recommended standard hours	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise: • Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB	The highly noise affected level represents the point above which there may be strong community reaction to noise: • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: a) Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. b) If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
OOH	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements, see Section 7.2.2 of the ICNG.

Source: ICNG.

3.2.3 Adopted MOD 13 construction NML and PA criterion

i ICNG NML

Construction NML adopted for this assessment for standard hours and OOH were derived in accordance with the ICNG for all assessment locations and are presented in Table 3.4.

The MOD 13 construction NML for most residential assessment locations have been based on the RBL determined during previous noise assessments completed for the site and application of the NPfI.

The construction NML for standard hours are based on RBL + 10 dB.

The construction NML for OOH periods are based on RBL + 5 dB. For the evening and night OOH periods, the construction NML are consistent with the PA and EPL operational noise limits for those periods (refer to Table 3.2). Therefore, if construction noise levels (combined with existing approved operational noise) satisfy the NML for the evening and night OOH periods, the PA and EPL operational noise limits for the evening and night periods will also be satisfied.

Table 3.4 MOD 13 construction NML

Assessment location	RBL[1], dB(A)			NML (PA/EPL for OOH), $L_{Aeq,15min}$, dB			
	Day[2]	Evening[2]	Night[2]	Standard hours[3] (RBL+10)	Day OOH[4] (RBL+5)	Evening OOH[5] (RBL+5)	Night OOH[6] (RBL+5)
A1	35	32	30	45	40	37	35
A2	35	32	30	45	40	37	35
A3	39	36	34	49	44	41	39
A4	39	36	34	49	44	41	39
A5	39	36	34	49	44	41	39
A6	43	36	34	53	48	41	39
A7	40	37	31	50	45	42	36
A8	43	34	34	53	48	39	39
A9	41	34	34	51	46	39	39
A10	37	36	30	47	42	41	35
A11	41	34	34	51	46	39	39
A12	41	34	34	51	46	39	39
A13	35	30	30	45	40	35	35
A14	35	30	30	45	40	35	35

Notes: 1. Referenced from previous assessments prepared for the site.

2. In accordance with the NPfI; Day: 7:00 am to 6:00 pm Monday to Saturday; 8:00 am to 6:00 pm Sundays and public holidays; Evening: 6:00 pm to 10:00 pm; Night: remaining periods.

3. ICNG standard hours: Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm. No work on Sundays or public holidays.

4. ICNG day OOH: Saturday 7:00 am to 8:00 am and 1:00 pm to 6:00 pm and Sundays or public holidays 7:00 am to 6:00 pm.

5. ICNG evening OOH: Everyday 6:00 pm to 10:00 pm.

6. ICNG night OOH: Monday to Saturday 10:00 pm to 7:00 am and Sundays or public holidays 10:00 pm to 8:00 am.

ii PA construction noise limits

Condition 17A(a-e) of the PA states that operational noise limits for the day period provided in Table 3.2 do not apply to the following construction activities:

- construction of the CBP and associated noise bund – completed
- construction of TSF2 (MOD4) including:
  - embankment 2 – completed
  - the spillway – completed
  - embankment 3 – completed
  - embankment 1 – completed.
- capping and rehabilitation of TSF2
- construction of the cement silo and warehouse extension (MOD5) – completed
- crushing and screening activities associated with construction of TSF2 embankments (MOD7) – completed.

Noise limits for the aforementioned construction activities are provided in Condition 17B(c) of the PA, which states that BHO must ensure that noise generated by the development does not cause exceedances of the amenity criterion of $L_{Aeq,day}$ 65 dB specified for an urban/industrial interface area under the NSW Industrial Noise Policy (EPA 2000).

For consistency with the PA, this assessment also adopts the same amenity criterion for the proposed MOD 13 daytime construction works.

4 Noise modelling methodology

4.1 Modelling software and meteorological conditions

Quantitative modelling of construction and operational noise was completed using DGMR 'iNoise' noise prediction software. This software applies the EPA accepted ISO 9613 approach (including noise-enhancing meteorological effects) and calculates total noise levels at assessment locations from the concurrent operation of multiple noise sources.

The model incorporated factors such as the lateral and vertical location of plant and equipment, source-to-receiver distances, ground effects, atmospheric absorption, topography and meteorological conditions. Three-dimensional digitised ground contours of the site and surrounding land were incorporated to account for topographic effects.

4.2 Modelling methodology

4.2.1 Construction noise

i Overview

The construction noise modelling was based on information received from BHO including the locations of works, the list of activities, the list of plant and equipment items and approximate schedule. To determine the worst-case noise from the proposed construction activities, construction noise levels predicted for each activity were added to noise levels from existing site operations. Noise from existing site operations was modelled and validated based on site noise contributions determined during attended compliance monitoring completed between 2022 and 2025. The overarching approach is to model worst-case construction activities together with existing site operations, as relevant.

ii Modelled construction scenario

Each construction scenario was carefully reviewed to identify constructions works that would result in worst-case noise at offsite locations for all relevant ICNG assessment periods.

A review of the construction schedule identified that proposed construction works are anticipated to mostly occur at different stages of construction. The exception is during the dewatering system construction where some of the filter plant construction activities could overlap. However, the dewatering system construction modelling assumes all plant and equipment are operating concurrently and at full power and hence is considered conservative. Therefore, it is reasonable to assess each modelled scenario individually for the purpose of this assessment.

Some of the ladderway construction activities including raise boring, installation, placement and securing are proposed to be undertaken 24 hours and seven days a week and hence will occur during the day, evening and night OOH periods. Activities associated with the installation, placement and securing of the ladderway are expected to be minor and hence the raise boring was modelled as the worst-case scenario for the ladderway construction during the evening or night OOH periods.

Worst-case modelled construction works are summarised in Table 4.1.

Table 4.1 Modelled worst-case construction works

Construction	Modelled worst-case scenarios	ICNG assessment period
Ladderway	Area establishment	Standard hours[1]and day OOH[2]
	Concrete pad (concrete pour)	Standard hours[1]
	Raise boring	24/7 including Standard hours[1], day OOH[2], evening OOH[3] and night OOH[4]
Dewatering system – Filter plant	Area establishment	Standard hours[1] and day OOH[2]
	Concrete pour	Standard hours[1]
	Footings and foundations	Standard hours[1] and day OOH[2]
	Structural erection	Standard hours[1] and day OOH[2]
Dewatering system – Tailings pipeline	Pipe installation (trenching)	Standard hours[1] and day OOH[2]

Notes: 1. Monday to Friday 7:00 am to 6:00 pm, Saturday 8:00 am to 1:00 pm.

2. Saturday 7:00 am to 8:00 am and 1:00 pm to 6:00 pm, and Sunday 8:00 am to 6:00 pm.

3. Monday to Sunday 6:00 pm to 10:00 pm.

4. Monday to Saturday 10:00 pm to 7:00 am, Sunday 10:00 pm to 8:00 am.

iii Modelled construction plant and equipment

This assessment has adopted construction plant and equipment sound power levels from the United Kingdom Department of Environment, Food and Rural Affairs (DEFRA) *Update of Noise Database for Prediction of Noise on Construction and Open Sites* (2005), where available. Otherwise, data was sourced from an EMM sound power database for similar plant and equipment, which is based on measurements for similar construction activities.

During raise boring, minimal noise is expected from the raise borer machine on the surface. However, the raise borer will require a diesel generator (650 kVA or equivalent) on the surface for power supply. The literature for such equipment suggests that the sound power level for a 650 kVA diesel generator ranges between 95 and 106 dB $L_{Aeq,15min}$. To provide BHO flexibility with the selection of a suitable generator for the raise boring activity, noise modelling was undertaken adopting a worst-case sound power level of 106 dB.

Acoustically significant fixed and mobile plant and equipment items were considered in the model for each construction activity and adopted typical worst-case operating scenarios and utilisation. Modelled plant and equipment and adopted sound power level (Lw) for each construction activity are presented in Table 4.2. This assumes that all plant and equipment within each scenario occur concurrently. Refer to Figure 2.1 for the location of the proposed ladderway, filter plant and tailings pipeline.

Table 4.2 Modelled construction plant and equipment

Activity	Scenario	ICNG assessment period	Source	Sound power level (L_{Aw}) dB
Ladderway	Area establishment	SH[1], day OOH	Excavator	106
	Concrete pour	SH[1]	Agitator truck	113
	Raise boring	24/7 (SH[1], all OOH periods)	Diesel generator	106[2]
Dewatering system – Filter plant	Area establishment	SH[1], day OOH	Excavator	106
	Concrete pour	SH[1]	Agitator truck	113
	Footings and foundations	SH[1], day OOH	Compactor	106
			Bobcat	95
			Power tools[3]	114
			Hand tools	101
	Structural erection	SH[1], day OOH	Crane	98
			EWP	94
			Scissor lift	96
			Telehandler	98
			Pneumatic tools	105
			Power tools[4]	114
			Hand tools	101
Dewatering system – Tailings pipeline	Pipe installation (trenching)	SH[1], day OOH	Excavator	106

Notes: 1. SH = standard hours.
2. Worst-case sound power level for a 650 kVA diesel generator.
3. Include battery drill, angle grinder, saw and nail gun.
4. Include battery drill, angle grinder and saw.

4.2.2 Operational noise

The operational noise modelling was based on information received from BHO including additional proposed operational activities. These include activities associated with the filter plant operation, TSF3 tailings management, Pinnacles Ore on-site deliveries and proposed noise mitigation measures.

Noise data for the proposed filter plant was provided by the supplier. A preliminary review of the sound power data provided, and noise model established for the site, identified that noise emissions from the filter plant is unlikely to contribute to existing site noise at the nearest assessment locations. However, there is typically a high level of uncertainty associated with the reliability of sound power data for such a plant at this stage of the project (design stage). The sound power level adopted for the filter plant (refer to Table 4.3) assumes the maximum allowable level for which the filter plant will not cause additional exceedances of the noise limits, when combined with existing site noise. Notwithstanding, BHO is committed to implement additional noise mitigation to the filter plant, if necessary, to meet the maximum allowable sound power level; including full enclosure of the filter plant, sound attenuation of the dominant noise sources within the filter plant and installation of sound insulation in the filter plant enclosure.

Sound power levels for all other sources are based on EMM's database of plant and equipment sound power levels used on similar projects.

Sound power levels for key additional operational plant and equipment proposed for the project are presented in Table 4.3.

Table 4.3 Key additional proposed operational plant and equipment

Source	Description	Assessment period	Sound power level (L_{Aw}) dB
Filter plant	General operation	24/7	95[1]
Dozer (CAT D10T)	TSF3 tailings handling	24/7	120
Roller (CAT CP563D)	TSF3 tailings handling	24/7	116
Pinnacles ore deliveries	Heavy vehicle deliveries (internal roads)	Day	105

Notes: 1. Maximum allowable sound power level for the proposed filter plant.

As a conservative approach, the dozer and roller proposed for tailings handling were modelled at the highest elevation point within TSF3 during the project life (until end of 2031). Therefore, noise predictions from these sources presented in this assessment are considered worst-case for the project.

Pinnacles ore deliveries are proposed on a campaign basis (fortnightly or monthly intervals) and hence future operational noise predictions for this assessment have been provided with and without Pinnacles ore deliveries. It is estimated that this will result in a maximum of 2,519 deliveries of ore per year (i.e. 5,038 truck movements per year), a maximum of 16 deliveries per day (i.e. 32 truck movements per day) or a maximum of two deliveries per hour (i.e. four truck movements per hour).

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor adjustments to account for noise emissions with characteristics, such as tonality, intermittence or dominant low-frequency content, that may be considered annoying compared to other noise at the same level. A review of proposed additional sources identified that noise emissions from future site operations are unlikely to show such annoying characteristics at the nearest assessment locations. Furthermore, attended noise data from compliance monitoring undertaken by EMM confirms that noise from existing site operations does not contain such characteristics and therefore modifying factor adjustments are deemed to be not applicable to predicted site noise.

4.2.3 Sleep disturbance

Maximum noise levels ($L_{Aeq,15min}$ and L_{Amax}) from proposed night construction and operations with the potential to cause sleep disturbance at residences are required to be assessed in accordance with the NPfI.

The NPfI suggests that a detailed maximum noise level event assessment should be undertaken where night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40 dB or the prevailing RBL plus 5 dB (whichever is the greater).
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB (whichever is the greater).

An assessment of maximum noise levels ($L_{Aeq,15min}$ and L_{Amax}) from proposed night-time construction activities (raise boring) and proposed additional operations (filter plant and TSF3 tailings handling) was undertaken to assess the potential of sleep disturbance at nearest residences. The findings of the assessment are provided in Section 5.3.

5 Noise modelling results

5.1 Construction noise

5.1.1 Ladderway area establishment

Noise levels for the ladderway area establishment works during the ICNG standard hours and day OOH period were modelled at assessment locations. These were then combined with existing (approved) site noise before comparison to the relevant ICNG NML.

Noise predictions ($L_{Aeq,15min}$) during the ladderway area establishment works are presented in Table 5.1.

Table 5.1 Predicted site noise levels during the ladderway area establishment works

Assessment location	Predicted ladderway area establishment + existing operation $L_{Aeq,15min}$, dB		ICNG NML $L_{Aeq,15min}$, dB		Exceedance, dB	
	SH	Day OOH	SH	Day OOH	SH	Day OOH
A1	<45	<40	45	40	Nil	Nil
A2	<45	40	45	40	Nil	Nil
A3	<49	44	49	44	Nil	Nil
A4	<49	<44	49	44	Nil	Nil
A5	<49	<44	49	44	Nil	Nil
A6	<53	<48	53	48	Nil	Nil
A7	<50	<45	50	45	Nil	Nil
A8	<53	<48	53	48	Nil	Nil
A9	<51	<46	51	46	Nil	Nil
A10	<47	<42	47	42	Nil	Nil
A11	<51	<46	51	46	Nil	Nil
A12	<51	<46	51	46	Nil	Nil
A13	<45	40	45	40	Nil	Nil
A14	<45	<40	45	40	Nil	Nil

Notes: 1. SH = ICNG standard hours: Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm. No work on Sundays or public holidays.

2. ICNG day OOH: Saturday 1:00 pm to 6:00 pm and Sundays or public holidays 7:00 am to 6:00 pm.

Modelling results show that predicted site noise levels during the ladderway area establishment works (combined with existing approved operations) will satisfy the ICNG NML at all assessment locations.

Site noise levels during the ladderway area establishment works are predicted to satisfy the ICNG highly noise affected 75 dB $L_{Aeq,15min}$ NML at all receivers, and the amenity criterion of 65 dB $L_{Aeq,day}$ stated in the PA.

5.1.2 Ladderway concrete pad (concrete pour)

Noise levels for the ladderway concrete pad works (concrete pour) during the ICNG standard hours were modelled at assessment locations. These were then combined with existing (approved) site noise before comparison to the relevant ICNG NML.

Noise predictions ($L_{Aeq,15min}$) during the ladderway concrete pad works are presented in Table 5.2.

Table 5.2 Predicted site noise levels during concrete pad works

Assessment location	Predicted ladderway concrete pour + existing operation $L_{Aeq,15min}$, dB	ICNG NML $L_{Aeq,15min}$, dB	Exceedance, dB
	SH	SH	SH
A1	<45	45	Nil
A2	<45	45	Nil
A3	<49	49	Nil
A4	<49	49	Nil
A5	<49	49	Nil
A6	<53	53	Nil
A7	<50	50	Nil
A8	<53	53	Nil
A9	<51	51	Nil
A10	<47	47	Nil
A11	<51	51	Nil
A12	<51	51	Nil
A13	<45	45	Nil
A14	<45	45	Nil

Notes: 1. SH = ICNG standard hours: Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm. No work on Sundays or public holidays.

Modelling results show that predicted site noise levels during the ladderway concrete pad works (combined with existing approved operations) will satisfy the ICNG NML at all assessment locations.

Site noise levels during the ladderway concrete pad works are predicted to satisfy the ICNG highly noise affected 75 dB $L_{Aeq,15min}$ NML at all receivers, and the amenity criterion of 65 dB $L_{Aeq,day}$ stated in the PA.

5.1.3 Ladderway raise boring

Noise levels for the raise boring activity (24/7) during the ICNG standard hours and OOH periods were modelled at assessment locations. These were then combined with existing (approved) site noise before comparison to the relevant ICNG NML.

Noise predictions ($L_{Aeq,15min}$) during the raise boring activity are presented in Table 5.3.

Table 5.3 Predicted site noise levels during raise boring

Assessment location	Predicted raise boring + existing operation $L_{Aeq,15min}$, dB				ICNG NML $L_{Aeq,15min}$, dB				Exceedance, dB			
	SH	Day OOH	Evening OOH	Night OOH	SH	Day OOH	Evening OOH	Night OOH	SH	Day OOH	Evening OOH	Night OOH
A1	<45	<40	<37	<35	45	40	37	35	Nil	Nil	Nil	Nil
A2	<45	40	<37	<35	45	40	37	35	Nil	Nil	Nil	Nil
A3	<49	44	<41	<39	49	44	41	39	Nil	Nil	Nil	Nil
A4	<49	<44	<41	<39	49	44	41	39	Nil	Nil	Nil	Nil
A5	<49	<44	<41	<39	49	44	41	39	Nil	Nil	Nil	Nil
A6	<53	<48	<41	<39	53	48	41	39	Nil	Nil	Nil	Nil
A7	<50	<45	<42	<36	50	45	42	36	Nil	Nil	Nil	Nil
A8	<53	<48	<39	<39	53	48	39	39	Nil	Nil	Nil	Nil
A9	<51	<46	<39	<39	51	46	39	39	Nil	Nil	Nil	Nil
A10	<47	<42	<41	<35	47	42	41	35	Nil	Nil	Nil	Nil
A11	<51	<46	<39	<39	51	46	39	39	Nil	Nil	Nil	Nil
A12	<51	<46	41	41	51	46	39	39	Nil	Nil	**2**	**2**
A13	<45	40	35	35	45	40	35	35	Nil	Nil	Nil	Nil
A14	<45	<40	<35	<35	45	40	35	35	Nil	Nil	Nil	Nil

Notes: 1. SH = ICNG standard hours: Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm. No work on Sundays or public holidays.

2. ICNG day OOH: Saturday 1:00 pm to 6:00 pm and Sundays or public holidays 7:00 am to 6:00 pm.

3. ICNG evening OOH: Everyday 6:00 pm to 10:00 pm.

4. ICNG night OOH: Monday to Saturday 10:00 pm to 7:00 am and Sundays or public holidays 10:00 pm to 8:00 am.

Assuming a worst-case sound power level of 106 dB $L_{Aeq,15min}$ for the raise boring generator, modelling results show that predicted site noise levels during the raise boring activity (combined with existing approved operations) will satisfy the ICNG NML at most assessment locations. The exception is at A12 (refer to Figure 3.1), where site noise during the raise boring activity (combined with existing approved operations) is predicted to negligibly exceed (by up to 2 dB) the relevant ICNG NML (and PA/EPL limits) during the evening and night OOH periods.

Site noise levels during the proposed raise boring are predicted to satisfy the ICNG highly noise affected 75 dB $L_{Aeq,15min}$ NML at all receivers, and the amenity criterion of 65 dB $L_{Aeq,day}$ stated in the PA.

Notwithstanding, given the predicted negligible exceedances at A12 during the evening and night OOH periods, noise management and mitigation measures are discussed in Section 6.

5.1.4 Tailings dewatering system – Filter plant area establishment

Noise levels for the filter plant area establishment works during the ICNG standard hours and day OOH period were modelled at assessment locations. These were then combined with existing (approved) site noise before comparison to the relevant ICNG NML.

Noise predictions ($L_{Aeq,15min}$) during the filter plant area establishment works are presented in Table 5.4.

Table 5.4 Predicted site noise levels during the filter plant area establishment works

Assessment location	Predicted filter plant area establishment + existing operation $L_{Aeq,15min}$, dB		ICNG NML $L_{Aeq,15min}$, dB		Exceedance, dB	
	SH	Day OOH	SH	Day OOH	SH	Day OOH
A1	<45	<40	45	40	Nil	Nil
A2	<45	41	45	40	Nil	**1**
A3	<49	44	49	44	Nil	Nil
A4	<49	<44	49	44	Nil	Nil
A5	<49	<44	49	44	Nil	Nil
A6	<53	<48	53	48	Nil	Nil
A7	<50	<45	50	45	Nil	Nil
A8	<53	<48	53	48	Nil	Nil
A9	<51	<46	51	46	Nil	Nil
A10	<47	<42	47	42	Nil	Nil
A11	<51	<46	51	46	Nil	Nil
A12	<51	<46	51	46	Nil	Nil
A13	<45	40	45	40	Nil	Nil
A14	<45	<40	45	40	Nil	Nil

Notes: 1. SH = ICNG standard hours: Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm. No work on Sundays or public holidays.

2. ICNG day OOH: Saturday 1:00 pm to 6:00 pm and Sundays or public holidays 7:00 am to 6:00 pm.

Modelling results show that predicted site noise levels during the filter plant area establishment works will satisfy the ICNG NML at most assessment locations. The exception is at A2 (refer to Figure 3.1), where site noise during the filter plant area establishment works (combined with existing approved operations) is predicted to negligibly exceed (by up to 1 dB) the relevant ICNG NML (and PA/EPL limits) during the day OOH period.

Site noise levels during the filter plant area establishment works are predicted to satisfy the ICNG highly noise affected 75 dB $L_{Aeq,15min}$ NML at all receivers, and the amenity criterion of 65 dB $L_{Aeq,day}$ stated in the PA.

Notwithstanding, given the predicted negligible exceedance at A2 during the day OOH period, noise management and mitigation measures are discussed in Section 6.

5.1.5 Tailings dewatering system – Filter plant concrete pad (concrete pour)

Noise levels for the filter plant concrete pad works (concrete pour) during the ICNG standard hours were modelled at assessment locations. These were then combined with existing (approved) site noise before comparison to the relevant ICNG NML.

Noise predictions ($L_{Aeq,15min}$) during the filter plant concrete pad works are presented in Table 5.5.

Table 5.5 Predicted site noise levels during filter plant concrete pad works

Assessment location	Predicted filter plant concrete pour + existing operation $L_{Aeq,15min}$, dB	ICNG NML $L_{Aeq,15min}$, dB	Exceedance, dB
	SH	SH	SH
A1	<45	45	Nil
A2	<45	45	Nil
A3	<49	49	Nil
A4	<49	49	Nil
A5	<49	49	Nil
A6	<53	53	Nil
A7	<50	50	Nil
A8	<53	53	Nil
A9	<51	51	Nil
A10	<47	47	Nil
A11	<51	51	Nil
A12	<51	51	Nil
A13	<45	45	Nil
A14	<45	45	Nil

Notes: 1. SH = ICNG standard hours: Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm. No work on Sundays or public holidays.

Modelling results show that predicted site noise levels during the filter plant concrete pad works will satisfy the ICNG NML at all assessment locations.

Site noise levels during the filter plant concrete pad works are predicted to satisfy the ICNG highly noise affected 75 dB $L_{Aeq,15min}$ NML at all receivers, and the amenity criterion of 65 dB $L_{Aeq,day}$ stated in the PA.

5.1.6 Tailings dewatering system – Filter plant footings and foundations

Noise levels for the filter plant footings and foundations works during the ICNG standard hours and day OOH period were modelled at assessment locations. These were then combined with existing (approved) site noise before comparison to the relevant ICNG NML.

Noise predictions ($L_{Aeq,15min}$) during the filter plant footings and foundations works are presented in Table 5.6.

Table 5.6 Predicted site noise levels during the filter plant footings and foundations works

Assessment location	Predicted filter plant footings and foundations + existing operation $L_{Aeq,15min}$, dB		ICNG NML $L_{Aeq,15min}$, dB		Exceedance, dB	
	SH	Day OOH	SH	Day OOH	SH	Day OOH
A1	<45	<40	45	40	Nil	Nil
A2	<45	41	45	40	Nil	**1**
A3	<49	44	49	44	Nil	Nil
A4	<49	<44	49	44	Nil	Nil
A5	<49	<44	49	44	Nil	Nil
A6	<53	<48	53	48	Nil	Nil
A7	<50	<45	50	45	Nil	Nil
A8	<53	<48	53	48	Nil	Nil
A9	<51	<46	51	46	Nil	Nil
A10	<47	<42	47	42	Nil	Nil
A11	<51	<46	51	46	Nil	Nil
A12	<51	<46	51	46	Nil	Nil
A13	<45	40	45	40	Nil	Nil
A14	<45	40	45	40	Nil	Nil

Notes: 1. SH = ICNG standard hours: Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm. No work on Sundays or public holidays.

2. ICNG day OOH: Saturday 1:00 pm to 6:00 pm and Sundays or public holidays 7:00 am to 6:00 pm.

Modelling results show that predicted site noise levels during the filter plant footings and foundations works will satisfy the ICNG NML at most assessment locations. The exception is at A2 (refer to Figure 3.1), where site noise during the filter plant footings and foundations works (combined with existing approved operations) is predicted to negligibly exceed (by up to 1 dB) the relevant ICNG NML (and PA/EPL limits) during the day OOH period.

Site noise levels during the filter plant footings and foundations works are predicted to satisfy the ICNG highly noise affected 75 dB $L_{Aeq,15min}$ NML at all receivers, and the amenity criterion of 65 dB $L_{Aeq,day}$ stated in the PA.

Notwithstanding, given the predicted negligible exceedance at A2 during the day OOH period, noise management and mitigation measures are discussed in Section 6.

5.1.7 Tailings dewatering system – Filter plant structural erection

Noise levels for the filter plant structural erection works during the ICNG standard hours and day OOH period were modelled at assessment locations. These were then combined with existing (approved) site noise before comparison to the relevant ICNG NML.

Noise predictions ($L_{Aeq,15min}$) during the filter plant structural erection works are presented in Table 5.7.

Table 5.7 Predicted site noise levels during the filter plant structural erection works

Assessment location	Predicted filter plant structural erection + existing operation $L_{Aeq,15min}$, dB		ICNG NML $L_{Aeq,15min}$, dB		Exceedance, dB	
	SH	Day OOH	SH	Day OOH	SH	Day OOH
A1	<45	<40	45	40	Nil	Nil
A2	<45	41	45	40	Nil	**1**
A3	<49	44	49	44	Nil	Nil
A4	<49	<44	49	44	Nil	Nil
A5	<49	<44	49	44	Nil	Nil
A6	<53	<48	53	48	Nil	Nil
A7	<50	<45	50	45	Nil	Nil
A8	<53	<48	53	48	Nil	Nil
A9	<51	<46	51	46	Nil	Nil
A10	<47	<42	47	42	Nil	Nil
A11	<51	<46	51	46	Nil	Nil
A12	<51	<46	51	46	Nil	Nil
A13	<45	40	45	40	Nil	Nil
A14	<45	40	45	40	Nil	Nil

Notes: 1. SH = ICNG standard hours: Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm. No work on Sundays or public holidays.

2. ICNG day OOH: Saturday 1:00 pm to 6:00 pm and Sundays or public holidays 7:00 am to 6:00 pm.

Modelling results show that predicted site noise levels during the filter plant structural erection works will satisfy the ICNG NML at most assessment locations. The exception is at A2 (refer to Figure 3.1), where site noise during the filter plant structural erection works (combined with existing approved operations) is predicted to negligibly exceed (by up to 1 dB) the relevant ICNG NML (and PA/EPL limits) during the day OOH period.

Site noise levels during the filter plant structural erection works are predicted to satisfy the ICNG highly noise affected 75 dB $L_{Aeq,15min}$ NML at all receivers, and the amenity criterion of 65 dB $L_{Aeq,day}$ stated in the PA.

Notwithstanding, given the predicted negligible exceedance at A2 during the day OOH period, noise management and mitigation measures are discussed in Section 6.

5.1.8 Tailings dewatering system – Tailings pipeline

Noise levels for the tailings pipeline construction during the ICNG standard hours and day OOH period were modelled at assessment locations. These were then combined with existing (approved) site noise before comparison to the relevant ICNG NML.

Noise predictions ($L_{Aeq,15min}$) during the tailings pipeline construction are presented in Table 5.8.

Table 5.8 Predicted site noise levels during the tailings pipeline construction

Assessment location	Predicted tailings pipeline construction + existing operation $L_{Aeq,15min}$, dB		ICNG NML $L_{Aeq,15min}$, dB		Exceedance, dB	
	SH	Day OOH	SH	Day OOH	SH	Day OOH
A1	<45	42	45	40	Nil	**2**
A2	<45	42	45	40	Nil	**2**
A3	<49	45	49	44	Nil	**1**
A4	<49	<44	49	44	Nil	Nil
A5	<49	<44	49	44	Nil	Nil
A6	<53	<48	53	48	Nil	Nil
A7	<50	<45	50	45	Nil	Nil
A8	<53	<48	53	48	Nil	Nil
A9	<51	<46	51	46	Nil	Nil
A10	<47	43	47	42	Nil	**1**
A11	<51	<46	51	46	Nil	Nil
A12	<51	<46	51	46	Nil	Nil
A13	<45	43	45	40	Nil	**3**
A14	<45	44	45	40	Nil	**4**

Notes: 1. SH = ICNG standard hours: Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm. No work on Sundays or public holidays.

2. ICNG day OOH: Saturday 1:00 pm to 6:00 pm and Sundays or public holidays 7:00 am to 6:00 pm.

Modelling results show that predicted site noise levels during the tailings pipeline construction (combined with existing approved operations) will exceed the ICNG NML at six assessment locations during the day OOH period; exceedances are predicted to be negligible (1–2 dB) at four locations (i.e. A1, A2, A3 and A10) and moderate (3–4 dB) at two locations (i.e. A13 and A14) (refer to Figure 3.1).

Site noise levels during the filter plant structural erection works are predicted to satisfy the ICNG highly noise affected 75 dB $L_{Aeq,15min}$ NML at all receivers, and the amenity criterion of 65 dB $L_{Aeq,day}$ stated in the PA.

Notwithstanding, given the predicted exceedances during the day OOH period, noise management and mitigation measures are discussed in Section 6.

5.2 Operational noise

To assess potential noise impacts from the proposed MOD 13 operations, future operational noise levels have been compared to noise levels from existing site operations (approved pre-MOD 13) for the day, evening and night periods.

Pinnacles ore deliveries to Rasp Mine are proposed on weekdays (Monday to Friday) during the day period on a campaign basis (fortnightly or monthly intervals), and hence day period predictions have been provided with and without Pinnacles ore deliveries.

Future operational noise predictions for the day period (with and without Pinnacles ore deliveries) are assessed in Section 5.2.1 and future operational noise predictions for the evening and night periods are assessed in Section 5.2.2.

5.2.1 Future operational noise levels during the day period

Noise predictions from existing site operations (pre-MOD 13) and future operational noise levels (existing + MOD 13) for the day period, with and without Pinnacles ore deliveries (campaign basis), are shown in Table 5.9.

Table 5.9 Predicted future operational noise levels during the day period

Assessment location	Existing day $L_{Aeq,15min}$ noise levels, dB	Future MOD 13 day $L_{Aeq,15min}$ noise levels, dB		Site day noise limits, $L_{Aeq,15min}$, dB	Future MOD 13 day exceedance, dB	
		Without Pinnacles deliveries	With Pinnacles deliveries (campaign)[1]		Without Pinnacles deliveries	With Pinnacles deliveries (campaign)
A1	<40	<40	<40	40	Nil	Nil
A2	<40	40	41	40	Nil	**1**
A3	<44	44	45	44	Nil	**1**
A4	<44	<44	44	44	Nil	Nil
A5	<44	<44	<44	44	Nil	Nil
A6	<48	<48	<48	48	Nil	Nil
A7	<45	<45	<45	45	Nil	Nil
A8	<48	<48	<48	48	Nil	Nil
A9	<46	<46	<46	46	Nil	Nil
A10	<42	<42	<42	42	Nil	Nil
A11	<46	<46	<46	46	Nil	Nil
A12	<46	<46	<46	46	Nil	Nil
A13	<40	<40	<40	40	Nil	Nil
A14	<40	<40	<40	40	Nil	Nil

Notes: 1. Monday to Friday only.

During typical day site operations (outside of Pinnacles ore deliveries campaigns), modelling results showed that site noise from future day operations is predicted to satisfy the relevant noise limits at all assessment locations.

During Pinnacles ore deliveries campaigns (Monday to Friday only), modelling results show that site noise from future day operations is predicted to satisfy the relevant noise limits at most assessment locations. The exception is at assessment locations A2 and A3 where site noise is predicted to be negligibly (1 dB) above the relevant noise limits. These are negligible (1 to 2 dB) increases when comparing future to existing site noise levels. A 2 dB change in noise levels in the environment is generally not perceptible by the human ear and therefore noise impacts from future operations is unlikely at these locations. A review of proposed operational activities and associated noise predictions identified that Pinnacles ore deliveries (on-site truck movements) are the main contributors to predicted exceedances when combined to existing site noise.

It is important to note that predicted future day operational site noise levels presented in Table 5.8 and Table 5.9 represent worst-case operational scenarios. Therefore, it can be said that noise levels from proposed future operations (with or without Pinnacles ore campaign deliveries) would be lower than those predicted most of the time.

Notwithstanding, given operational noise levels are predicted to be negligibly (1 dB) above the site noise limits at up to two assessment locations during the day period, noise management measures will continue to be implemented at Rasp Mine as discussed in Section 6.

5.2.2 Future operational noise levels during the evening and night periods

Noise predictions from existing site operations (pre-MOD 13) and future operational noise levels (existing + MOD 13) for the evening and night periods are shown in Table 5.10.

Table 5.10 Predicted future operational noise levels during the evening and night periods

Assessment location	Existing $L_{Aeq,15min}$ noise levels, dB		Future MOD 13 $L_{Aeq,15min}$ noise levels, dB		Site noise limits, $L_{Aeq,15min}$, dB		Future MOD 13 exceedance, dB	
	Evening	Night	Evening	Night	Evening	Night	Evening	Night
A1	<37	<35	<37	<35	37	35	Nil	Nil
A2	<37	<35	<37	<35	37	35	Nil	Nil
A3	<41	<39	<41	39	41	39	Nil	Nil
A4	<41	<39	<41	39	41	39	Nil	Nil
A5	<41	<39	<41	<39	41	39	Nil	Nil
A6	<41	<39	<41	<39	41	39	Nil	Nil
A7	<42	<36	<42	36	42	36	Nil	Nil
A8	<39	<39	<39	<39	39	39	Nil	Nil
A9	<39	<39	<39	<39	39	39	Nil	Nil
A10	<41	<35	<41	<35	41	35	Nil	Nil
A11	<39	<39	<39	<39	39	39	Nil	Nil
A12	<39	<39	<39	<39	39	39	Nil	Nil
A13	35	35	35	35	35	35	Nil	Nil
A14	<35	<35	<35	<35	35	35	Nil	Nil

Modelling results showed that site noise levels for future operations (following MOD 13 construction) are predicted to satisfy the noise limits at all assessment locations during the evening and night periods.

5.3 Sleep disturbance

A review of maximum noise levels ($L_{Aeq,15min}$ and L_{Amax}) from proposed night-time construction activities (raise boring) and proposed additional operations (filter plant and TSF3 tailings handling) was undertaken to assess the potential of sleep disturbance at nearest residences.

Based on the construction $L_{Aeq,15min}$ noise predictions presented in Section 5.1.3 and proposed noise mitigation (refer to Section 6.2.2), it is anticipated that proposed night-time raise boring (during the ladderway construction) is unlikely to generate maximum $L_{Aeq,15min}$ noise levels above the NPfI sleep disturbance screening criterion ($L_{Aeq,15min}$ 40 dB) at nearest residences during noise-enhancing meteorological conditions.

Based on the operational $L_{Aeq,15min}$ noise predictions presented in Section 5.2.2, future night-time operation of the proposed filter plant is not predicted to cause maximum site $L_{Aeq,15min}$ noise levels above the relevant NPfI sleep disturbance screening criterion ($L_{Aeq,15min}$ 40 dB) at nearest residences during noise-enhancing meteorological conditions.

Maximum L_{Amax} noise levels from proposed night-time raise boring (during the ladderway construction), filter plant operation and TSF3 tailings handling (dozer and roller) are predicted to satisfy the relevant NPfI sleep disturbance screening criterion (L_{Amax} 52 dB) at nearest residences during noise-enhancing meteorological conditions.

6 Noise management and mitigation

6.1 Existing noise management

6.1.1 Adopted management and mitigation measures

Best management practices are currently used to minimise site noise offsite and include the following:

- independent noise audits are undertaken annually
- noise awareness information is provided in employee and contractor inductions
- plant and equipment are properly maintained and serviced in accordance with original equipment manufacturer requirements to ensure rated noise emission levels are not exceeded.

To ensure that site noise levels have achieved the limits at offsite locations, noise mitigation measures have been implemented over time at the site.

6.1.2 Noise monitoring management plan

The Noise Monitoring and Management Plan (NMMP) established for the site provides noise monitoring and management procedures that are currently used on-site. These include, but are not limited to, the following measures:

- Undertake compliance noise monitoring at all assessment locations and ensure that site noise satisfy the limits outlined in the project approval. The monitoring is completed in accordance with all relevant Australian Standards, policies and guidelines.
- Take relevant actions to investigate and determine feasible and reasonable mitigation measures if site noise has been identified to exceed the relevant limits.
- Monitoring results are reported to the Environmental Manager and kept on file for a minimum of 4 years.
- Provide adequate and timely response to community noise complaints.
- Review data and determine management actions to improve noise emissions from site over time.
- Ensure actions are taken to prevent noise exceedances as per conditions in the PA.

- Make noise monitoring reports available to EPA as required.

6.1.3 Noise complaints management and performance

Noise complaints from the community are currently managed in accordance with the site's NMMP and recorded as per the site's complaints procedure. It is noted that the DPHI and other relevant agencies are notified of complaints from the community should one be received.

A review of the community noise complaint register for Rasp Mine showed that no noise complaint has been received from a member of the community in the last five years. Prior to this, all matters were addressed and resolved immediately following noise complaints. This demonstrates a strong history of noise performance at offsite locations, in particular during typical mining operations and hence is consistent with attended noise monitoring results collected in the most recent years of monitoring (2022 to 2025).

6.2 Additional noise management measures to consider during construction

6.2.1 Australian Standard recommendations

Numerous practical recommendations to assist in mitigating construction noise emissions are provided in Australian Standard 'AS 2436:2010 – *Guide to Noise and Vibration Control on Construction, Maintenance and Demolition Sites'.* The recommendations provided in this standard include operational strategies, source noise control strategies, noise barrier controls, and community consultation. Examples of noise management strategies that will be considered during the proposed construction include the following:

- Regular reinforcement (such as at toolbox talks) of the need to minimise noise.
- Regular identification of noisy activities (using continuous unattended noise logging) and adoption of improvement techniques.
- Use of broadband audible reverse alarms (squawker type) on vehicles used on site.
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Scheduling respite periods for intensive works.
- All plant will be driven in a conservative manner (no over-revving).
- Machinery will not be permitted to 'warm-up' before the nominated working hours.
- Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers.
- Where practicable, adopt mobile barriers/screens or utilise the location of earth/rock stockpiles to shield neighbouring receivers.
- The quietest suitable machinery reasonably available will be selected for each work activity.
- Where possible, machinery will have efficient low-noise muffler design and be well-maintained.
- The offset distance between noisy items of plant/machinery and nearby sensitive receivers will be maximised.

- Queuing of vehicles is not to occur adjacent to residential receivers. Where queuing is required, for example due to safety reasons, an area entry position will be selected that is well removed from receivers. Where this is not feasible, engines are to be switched off to reduce their overall noise impacts on receivers.
- Where practicable, ensure the coincidence of noisy plant/machinery working simultaneously in close proximity to sensitive receivers is avoided.
- Scheduling activities to minimise impacts by avoiding conflicts with other scheduled events.
- Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
- Planning deliveries and access to the site to occur quietly and efficiently.
- Optimising the number of deliveries to the site by amalgamating loads where possible.

6.2.2 Project specific noise management and mitigation

Specific detailed noise management and mitigation measures will be reviewed once the construction activities for each task are clearly defined and contractors for the work have been selected or engaged.

In accordance with the ICNG, feasible and reasonable mitigation measures are required to be implemented to reduce potential noise impacts from proposed construction activities, in particular those proposed during the evening and night OOH periods (e.g. raise boring). Approximate reductions that can be achieved by various forms of noise controls that could be implemented are provided in Table 6.1.

Table 6.1 Relative effectiveness of various noise controls

Noise control[1]	Nominal noise reduction possible
Screening (e.g. noise barrier)	Typically 5 dB to 10 dB, maximum 15 dB
Enclosure (e.g. shed/building)	Typically 15 dB to 25 dB, maximum 50 dB

Notes: 1. Referenced from AS 2436:2010.

i Raise boring

A reverse-engineering modelling exercise was completed to determine the 'maximum' sound power level for the raise boring activities where no mitigation would be required to satisfy the ICNG NML at A12. The modelling showed that a generator with a sound power level of 102 dB $L_{Aeq,15min}$, which is 4 dB lower than the modelled sound power level, would satisfy the ICNG NML at A12. Therefore, mitigation measures would not strictly be required if the raise borer generator selected had a sound power level of 102 dB $L_{Aeq,15min}$ or lower.

A temporary noise barrier targeting noise in the direction of assessment location A12 (and adjacent residences on Crystal Street) should be sufficient in reducing generator noise (by 4 dB) to satisfy the ICNG NML for the evening and night OOH periods.

To achieve adequate screening, the noise barrier should be positioned relatively close to the generator, interrupt the source-to-receiver line of sight and be approximately five times wider than its height. Optimum screening could be achieved using a semi-enclosing (u-shaped) barrier positioned around the generator.

Another option for optimal noise reduction would be to use a temporary enclosure around the generator, which would provide maximum reduction at all surrounding residences.

It is recommended that attended noise monitoring is undertaken at the nearest receiver (i.e. A12) to verify that the proposed mitigation (i.e. temporary noise barrier) is adequate before continuation of raise boring activity during OOH evening and night periods, depending on the generator's sound power level.

Furthermore, standard construction management and mitigation measures currently implemented for construction works on-site (i.e. noise monitoring, operational strategies, source control strategies, noise barrier controls and community consultation) in accordance with the approved Rasp Mine Noise and Blast Management Plan (NBMP) dated 9 October 2023 will continue to be implemented for the duration of the MOD 13 construction.

With the implementation of the above mitigation measures, site noise levels during the proposed raise boring are likely to satisfy the ICNG NML at all receivers.

ii Tailings dewatering system

Modelling results (refer to Section 5.1.4) indicate potential negligible (1–2 dB) to moderate (3–4 dB) noise exceedances during the filter plant and tailings pipeline construction for the day OOH period. Therefore, noise management and mitigation measures will be implemented.

A review of noise predictions presented in Section 5.1.4 for the filter plant and tailings pipeline construction identified that noise from most modelled construction scenarios (excluding of existing site noise) will satisfy the relevant ICNG NML during the day OOH period. The exception is during the tailings pipeline construction, where noise from this scenario (excluding of existing site noise) will negligibly exceed (by 2 dB) the ICNG NML at one assessment location (i.e. A14).

A temporary noise barrier targeting noise in the direction of affected assessment locations (and adjacent residences) would provide some reduction (refer to Table 6.1) to filter plant and tailings pipeline construction noise during the day OOH period.

To achieve adequate screening, the noise barrier should be positioned relatively close to the noise generating activities, interrupt the source-to-receiver line of sight and be approximately five times wider than its height.

Furthermore, standard construction management and mitigation measures currently implemented for construction works on-site (i.e. noise monitoring, operational strategies, source control strategies, noise barrier controls and community consultation) in accordance with the approved NBMP will continue to be implemented for the duration of the MOD 13 construction.

With the implementation of the above mitigation measures, site noise levels during the proposed filter plant and tailings pipeline construction would satisfy the ICNG NML at all receivers.

6.3 Operational noise management and mitigation

In addition to mitigation measures described in the aforementioned sections, measures specific to proposed campaign deliveries of Pinnacles ore (on-site truck movements) during the day period have been considered. A feasible and reasonable mitigation analysis was undertaken with the aim to reduce noise from this activity at potentially affected receivers (assessment locations A2, A3 and adjacent residences to the south of the site).

Noise mitigation options are typically considered in the following hierarchy:

1. reducing noise at the source
2. reducing noise in transmission to the receiver
3. reducing noise at the receiver.

A *feasible* mitigation measure is one that can be engineered and is practical to build and implement. Determining what are *reasonable* mitigation measures from those that are feasible requires consideration of whether the noise benefits outweigh the overall adverse social, economic and environmental effects. To make this determination the following aspects are considered:

- the level of noise impact (i.e. how much the predicted level is above the relevant target noise level and how many receivers are impacted)
- the amount of noise reduction expected (e.g. a noise wall/bund should be able to reduce noise levels by a noticeable amount, i.e. at least 5 dB)
- cost effectiveness; including capital and maintenance costs
- community views.

Feasible and reasonable mitigation measures considered included the following:

- an alternative route on-site for deliveries
- noise barrier along the on-site delivery route
- a reduction in truck movements.

A review of the feasibleness and reasonableness of the considered mitigation measures concluded that although some of these measures are considered feasible, they are not considered reasonable given the negligible (1 dB) noise exceedance predicted for the proposed campaign deliveries of Pinnacles ore during the day period.

7 Conclusion

EMM has completed a noise impact assessment for the proposed Rasp Mine MOD 13. This included an assessment of noise from proposed construction activities and future Rasp Mine operations at surrounding residential receivers.

7.1 Construction noise

Noise associated with the proposed construction activities during the ICNG standard hours and OOH periods was assessed. Site noise levels during construction (combined with existing approved operations) are predicted to satisfy the relevant NML at most assessment locations; the exceptions are during the ladderway raise boring activity during the evening and night OOH periods and the tailings dewatering system construction during the day OOH period.

During the ladderway raise boring activity during the evening and night OOH periods, site noise levels (inclusive of existing operational noise) are predicted to negligibly exceed (by up to 2 dB) the relevant NML at one assessment location (A12).

During the tailings dewatering system construction during the day OOH period, site noise levels (inclusive of existing operational noise) are predicted to exceed the relevant NML during the filter plant and the tailings pipeline construction. During the filter plant construction, site noise levels (inclusive of existing operational noise) are predicted to negligibly exceed (by 1 dB) the relevant NML at one location (A2). During the tailings pipeline construction, site noise levels (inclusive of existing operational noise) are predicted to negligibly exceed (by 1 to 2 dB) the relevant NML at four locations (A1, A2, A3 and A10) and moderately exceed (by 3 to 4 dB) the relevant NML at two locations (A13 and A14).

Feasible and reasonable mitigation measures recommended herein will be implemented by BHO as a minimum to reduce potential noise impacts from the proposed ladderway raise boring activity during the evening and night OOH periods as well as the proposed tailings dewatering system construction during the day OOH period.

Construction noise levels are predicted to satisfy the ICNG highly noise affected level of 75 dB $L_{Aeq,15min}$ at all assessment locations, and the amenity criterion of $L_{Aeq,day}$ 65 dB stated in the PA.

7.2 Operational noise

Noise associated with the proposed MOD 13 operations during the day, evening and night periods was assessed.

During typical day site operations (outside of Pinnacles ore deliveries campaigns), noise from future day operations is predicted to satisfy the relevant noise limits at all assessment locations. Further, modelling results also showed that site noise levels for future operations (following MOD 13 construction) are predicted to satisfy the noise limits at all assessment locations during the evening and night periods.

During Pinnacles ore deliveries campaigns (Monday to Friday only), noise from future day operations is predicted to satisfy the relevant noise limits at most assessment locations. The exception is at two assessment locations (A2 and A3) where site noise is predicted to be negligibly (1 dB) above the relevant noise limits. These are negligible (1 to 2 dB) increases when comparing future to existing site noise levels. A 1 to 2 dB change in noise levels is generally not perceptible by the human ear and therefore noise impacts from future operations is unlikely at these locations.

Further, predicted future day operational noise represents worst-case operational scenarios, and therefore, future site noise (with or without Pinnacles ore campaign deliveries) would be lower than those presented in this assessment most of the time.

Notwithstanding, given future day operational noise during Pinnacles ore deliveries is predicted to be negligibly (1 dB) above the noise limits at up to two assessment locations, the implementation of feasible and reasonable mitigation with the aim to reduce noise from truck movements during Pinnacles ore deliveries was considered. A review of the feasibleness and reasonableness of the considered mitigation measures concluded that although some of the measures are considered feasible, they are not considered reasonable due to the negligible nature of the predicted exceedances.

7.3 Sleep disturbance

Maximum noise levels (L_{Aeq} and L_{Amax}) from proposed night-time ladderway construction (during raise boring) and tailings dewatering system operations (filter plant and TSF3 tailings handling) are predicted to satisfy the NPfI sleep disturbance screening criteria at nearest residences during noise-enhancing meteorological conditions.

We trust the above is satisfactory and if you have any further questions, please contact the undersigned.

Yours sincerely

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Review: Katie Teyhan 5/2/2026

Appendix F
Blast and vibration assessment

EMM
creating opportunities

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BLAST VIBRATION ASSESSMENT

PROPOSED MOD 13 PRODUCTION BLASTING

RASP MINE, BROKEN HILL OPERATIONS

30TH SEPTEMBER 2025

Prepared for: Joel Sulicich, Health Safety Environment and Training Manager, Rasp Mine.

Prepared by: Mike Humphreys, Principal D&B Engineer, Fromble Corp Pty Ltd.

Disclaimer: This document provides general guidance based on information provided by the client, using generic methodologies for calculating blast parameters and blasting impacts. Site-specific adjustments may be required to achieve desired results and minimise impacts as the project is implemented and additional data collected. For further assistance during implementation contact the author, or other suitable qualified person.

SUMMARY

1. This assessment provides estimates of peak ground vibration impact from the proposed stoping operations in the British Orebody at Rasp Mine, utilising both down-hole and up-hole stoping methods (Figures 1a, 1b, 1c). The proposed stoping operations will be referred to collectively as the Mod 13 stopes in this report.

2. Stope blasting will be conducted using the standard methods used at Rasp Mine and, wherever possible, use the standard 89mm diameter blasthole patterns currently applied. Where necessary, maximum instantaneous charge (MIC) per blasthole will be reduced as outlined in paragraph 6 (below) and as described later in this report, to mitigate ground vibration impacts at nearby sensitive locations.

3. The most recent and representative available ground vibration data has been used to estimate the likely range of peak ground vibration impacts at sensitive locations surrounding the proposed Mod 13 stopes. Noting that no monitored vibration data is currently available for the sensitive locations identified in closest proximity to the proposed area of operations.

4. Estimated vibration impacts have been compared with anticipated vibration limits including residential amenity, infrastructure and heritage limits specified in the Rasp Mine EPL conditions[1], non-residential infrastructure limits indicated by Australian Standard AS2187[2], and TSF2 Tailings Facility limits set by Dams Safety NSW[3] and suggested by WSP Golder[4,5].

5. This report confirms that, based on available site monitoring data and the minimum distances from the proposed Mod 13 stopes to identified sensitive locations, production blasting should be achievable in compliance with anticipated ground vibration limits, to be validated by monitored vibration outcomes when operations commence.

6. For <u>some stope blasts</u> to remain compliant with specified limits, necessary measures may require a reduced scale of blasting (reduced MIC) using (i) smaller diameter blasthole patterns (reduced from 89mm to 76mm) for both down-hole and up-hole stopes; (ii) staged undercutting of down-hole stopes (reducing maximum charge length from 23m to 10m); and/or (iii) a reduction in maximum bulk explosive density (from 1.0g/cc to 0.8g/cc) for up-hole stopes. These measures may be required to meet the current 5mm/s PVS 'lower-level' amenity limit for privately-owned residential property at Chettle Street, and the proposed 'upper level' 10mm/s PVS amenity limit for Perilya-owned residences at Junction Circle.

For further clarification contact:

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GROUND VIBRATION ASSESSMENT METHODOLOGY

7. A method for estimating the peak vector ground vibration (PVS mm/s), produced by a blast at a distance, is provided in AS2187.2-2006[2] as:

$$\mathbf{PVS = K \,.\, [distance/\sqrt{(charge\ mass)}]^{b}}$$

8. Distance is from the blast to the monitoring location (m) and charge mass is the maximum charge per blasthole (kg) for sequential firing or firing within a specified time 'window' for blasts where multiple blastholes fire together or reinforce relative to the direction of firing. The Australian Standard suggests site constants K=1140 and b=-1.6 for 'average' free-face blasting conditions, with a vibration range of 0.4 to 4 times that suggested by these 'average' values, depending on ground conditions, blast geometry and other factors.

9. However, the determination of site parameters must be validated for the blast site, based on monitoring results from actual blasts, and consider ground vibration transmission from stope blasts towards surrounding sensitive locations. This has proven to be quite variable at Rasp Mine, due to complex geology and the presence of both highly transmissive structures (dykes) and less transmissive structures (previously mined and back-filled stopes).

10. Current representative blast data for this exercise has been based on production stope blasts (not raises or development rounds) fired from 2023 to 2025, that were north of 1500mN and monitored at distances less than 2000m. These including recent production blasts in the 'Siberia' region, monitored at locations from V3 Air Express and further north, including the TSF2 embankments.

11. Using a 'best fit' attenuation rate of b=-1.45 for selected data, this suggests a conservative K-factor range from 1000 to 1500, which will be used for this exercise when considering likely vibration impacts from the proposed Mod 13 stopes (Figure 2a). This range also appears to be reasonable when looking at the 'Siberia' blasts with respect to the closest monitored results at Crystal Street and the TSF2 embankments (Figure 2b) and when comparing the monitored results from all production blasts (2017 to 2025) for all monitors within 350m (Figure 2c).

12. Identified sensitive locations surrounding the proposed Mod 13 stopes (Figure 3a), have been used to measure the closest distances to the closest stopes, from the Rasp schedule in the Deswik software package. Individual distances from each sensitive location to the centroid of the top of each stope have also been calculated (see Figure 3b example), accounting for some slight differences reported in paragraph 13, which are not significant.

APPLICABLE VIBRATION CONSTRAINTS

13. The following sensitive locations have been assessed, and regulated or guideline 'peak vector' ground vibration limits applied:

Sensitive location	Minimum calculated distance from stope top (m)	Closest measured distance from stope (m)	Ground vibration limit (mm/s)	Comment
Residence Chettle St	335	329	5	EPL lower limit
Silver Haven Hotel	397	394	5	EPL lower limit
Residence Crystal St	675	674	5	EPL lower limit
Residence Eyre Street	1362	1359	5	EPL lower limit
Perilya Junction Circle	209	203	10	EPL upper limit
Perilya Prop Square	642	637	10	EPL upper limit
British Flats	566	559	15	Commercial property
Perilya Social Club	493	488	15	Commercial property
North Mines Bowls Club	524	520	15	Commercial property
Cameron Pipe Band Hall	878	873	15	Commercial property
Dans Stockfeed	625	624	15	Commercial property
LOL Café	1305	1308	15	Commercial property
Filter Plant (Rasp Mine)	749	744	25	Industrial facility
Origin LPG Yard	365	356	25	Industrial facility
Mawson Office	1134	1130	25	Industrial facility
TSF1	1357	1349	25	Tailings facility
TSF2 EMB1d (north end)	747	741	30	Tailings facility (NSW DS)
TSF2 EMB2d (north end)	406	402	30	Tailings facility (NSW DS)
TSF2 EMB3c (north end)	597	588	30	Tailings facility (NSW DS)
Mawson Silo	564	568	50	Industrial structure
Thompsons Shaft	155	149	50	Heritage structure (Approval)
Browns Shaft	134	123	50	Heritage structure (Approval)
Menindee Road	91	91	100	Public road (Approval)
Railway Line	98	95	100	Rail corridor (ARTC)

14. Privately owned residential property and hotel accommodation has been assessed against the EPL lower peak vector limit of 5mm/s (for 95% of blasts), while Perilya mine-owned property has been assessed assuming that the EPL peak vector upper limit of 10mm/s (for 100% of blasts)[1] can be negotiated with the asset owner.

15. Commercial property has been assessed as 'light commercial' with a limit of 15mm/s applied to allow for low frequency vibration (down to 4Hz) as documented in Table J4.4.2.1 of AS2187.2 (2006)[2]. Note that this limit is a peak component limit but has been assessed on the basis of peak vector modelling which is more conservative.

16. Industrial facilities have been assessed as occupied 'non-sensitive sites' with a limit of 25mm/s as documented in Table J4.5(A) of AS2187.2 (2006), unless equipment sensitive

to vibration is identified as part of a risk assessment process and requires lower limits. Industrial structures (Mawson Silo) have been assessed has 'heavy commercial' with a limit of 50mm/s as documented in Table J4.4.2.1 of AS2187.2 (2006)[2]. Again, these are peak component limits but have been assessed based on peak vector modelling.

17. The TSF1 tailings facility is not regulated by Dams Safety NSW and has been assessed based on a 25mm/s peak vector limit, as previously suggested by WSP Golder[4]. The TSF2 tailings facility has been assessed based on a 30mm/s peak vector limit, anywhere on embankments 1, 2 and 3, as regulated by Dams Safety NSW[3]. These limits are assumed to be 'peak component' but that has not been specified.

18. Heritage structures within the Rasp Mine site (Thompson's Shaft and Brownes Shaft) have been assessed based on a 50mm/s peak vector limit, as specified in the Consolidated Project Approval[7]. These structures are also subject to periodic (6 monthly) visual inspection to assess ongoing condition.

19. Menindee Road, to the south of the British Orebody, has been assessed on the same basis as for South Road, subject to Block 7 blasting impacts[7]. A peak vector ground vibration limit of 100mm/s has been assumed, while a road closure may be required if vibration levels greater than 65mm/s are estimated. This should be reviewed with the applicable road authority (TfNSW or Local Council).

20. Rail line, to the south of the British Orebody, has been assessed based on a peak vector ground vibration limit of 100mm/s, as applied widely elsewhere. This should be reviewed with the rail authority (ARTC).

ASSESSMENT OF GROUND VIBRATION IMPACTS

21. The peak vector ground vibration trends identified using the most representative monitored historical data (Figures 2a, 2b, 2c), have been applied using the proposed production blast parameters and minimum distances to sensitive locations, to estimate maximum peak ground vibration impacts on an expected 'worst case' basis. These impacts can then be compared to applicable limits to assess the likelihood for future compliance (or otherwise).

22. The 'worst case' parameters used for this assessment were:

- Production blasthole diameter – 89mm (reduced to 76mm if necessary).
- Charge length – 23m (reduced to 10m for undercut down-hole stopes if necessary).
- Bulk explosive density (Orica Subtek) – 1.0g/cc (reduced to 0.8g/cc in up-hole stopes if necessary).
- Maximum charge per blasthole for down-holes – 143kg for full-length 89mm diameter blastholes (reducing to 62kg or 45kg in 89mm or 76mm diameter undercut down-holes).
- Maximum charge per blasthole for up-holes – 114kg in 89mm up-holes, or 83kg in 76mm up-holes if necessary.
- Peak ground vibration trends – K=1500 to 1000, b=-1.45.
- Minimum distances – Estimated for each sensitive location relative to the centroid of the top of each stope.

23. Maximum peak vector ground vibration outcomes are shown for various scenarios, using 'heat maps' of the potential compliance status for all stopes with respect to all the sensitive locations considered (Figures 4a to 4g). The peak vector ground vibration estimates derived from the best available site data indicate the following:

- While full depth 89mm diameter stope blasts, with 1.0g/cc bulk explosive (MIC=143kg), may remain compliant at most sensitive locations, non-compliant peak vibration levels are indicated for nearly all stopes at Perilya Junction Circle, Chettle Street and the Silver Haven Hotel, allowing for K=1000 to 1500 and b=-1.45 (see Figure 4b). Production blasting will be scheduled to begin with deeper (lower risk) down-hole stopes, providing monitored data for subsequent blasts.

- For 89mm down-hole stopes a staged undercut approach, limiting depth up to 10m per pass (MIC=62kg at 1.0g/cc), should be sufficient for preliminary stopes to meet regulated or suggested limits, allowing for K=1000 to 1500 and b=-1.45 (see Figures 4c and 4d). This will allow the determination of the extent to which additional mitigation measures are required for the remaining stopes, based on monitored results.

- As an alternative, 76mm diameter undercut down-hole stope blasts should also be allowed for, if further mitigation of peak vibration impact is required. In that scenario, compliance generally appears achievable, with a single stope (BRIT 02L 372 DH) remaining a potential compliance challenge, based on recent 'worst-case' data (see Figure 4e). If necessary, additional controls that could be applied include decking

(reduced MIC), longer timing (blasthole separation) and overall blast size reduction (blast duration), to limit impacts further.

- While full depth 89mm diameter up-hole stope blasts, with 0.8g/cc bulk explosive (MIC=114kg), may also remain compliant at most sensitive locations, non-compliant peak vibration levels may again present a challenge at Perilya Junction Circle, Chettle Street and the Silver Haven Hotel, allowing for K=1000 to 1500 and b=-1.45 (see Figure 4f). Subject to prior monitoring of down-hole stope blasts, additional mitigation measures may be necessary.
- Alternatively, full depth 76mm diameter up-hole stope blasts, with 0.8g/cc bulk explosive (MIC=83kg), may be necessary to limit the impacts from some up-hole stopes at Perilya Junction Circle, Chettle Street and the Silver Haven Hotel, allowing for K=1000 to 1500 and b=-1.45 (see Figure 4g). In this case, k-factors up to K=1100 (b=-1.45) are indicated for compliance at the most critical locations (e.g. Chettle Street), which has been largely achievable based on recent stope blasting practices and most sensitive monitoring locations (e.g. Argent Street). If necessary, additional controls that could be applied include longer timing (blasthole separation) and overall blast size reduction (blast duration) to limit impacts further.

CONCLUSIONS AND RECOMMENDATIONS

24. The following conclusions and recommendations are made, based on the assessment of currently available data, the assumption of good blast design, correct implementation, accurate record keeping, and the ongoing analysis of monitored data.

25. The peak ground vibration estimates for the proposed Mod 13 production stopes will need to be validated using monitored ground vibration data when Mod 13 production blasting commences, with design modifications made to ensure an ongoing compliance with limits as necessary.

26. Further monitoring of stope blasts at the closest sensitive locations is recommended, in addition to the regulated compliance monitors. In particular, at the closest sensitive residential locations, including Chettle Street and Perilya Junction Circle.

27. While production blasting is planned to be based on current 89mm diameter patterns where possible, mitigation measures may be necessary to reduce peak ground vibration impacts for some stopes and nearby sensitive locations. Possible measures include:

    - Staged undercutting of down-hole stopes (reducing maximum charge length from 23m to 10m).
    - A reduction in maximum bulk explosive density (from 1.0g/cc to 0.8g/cc) for up-hole stopes.
    - Smaller diameter blasthole patterns in some down-hole and up-hole stopes (reduced from 89mm to 76mm).
    - Optimised electronic firing of stopes to limit vibration interactions via sequential firing and adequate separation times.
    - A reduction in overall blast size for some stopes, if larger (longer duration) blast events produce elevated ground vibration levels at critical sensitive locations.
    - Compliance with limits at structures could be based on peak component levels. This is generally the convention used when assessing blasting impact on structures, as opposed to the peak vector limits applied for amenity impact at residential locations. Modelling would need to include the analysis of the longitudinal, transverse and vertical components separately.
    - Initially scheduling production from the least critical stopes where possible. This will better inform the blast design process for closer (more sensitive) stoping operations.

28. Given that operations will commence with the least critical down-hole stopes, that can be extracted using a staged undercut approach, it should be possible to validate the need to transition to 76mm drilling in both down-hole and up-hole stopes well in advance, based on more representative local data.

REFERENCES

The following references have been used in preparing this report.

1. Environment Protection Licence for Broken Hill Operations Pty Ltd, NSW EPA.
2. Appendix J, Australian Standard for Explosives Storage and Use, AS2187.2-2006.
3. Annexure "D" Standard Mining Conditions, NSW Dams Safety Committee, October 2019.
4. Rasp Mine – Potential Impact of Blasting on Tailings Storage Facility, Technical Memorandum, WSP Golder, 5th October 2019.
5. Clarification of Embankment Liquefaction Limits, Email WSP Golder to Rasp Mine, 24th June 2022.
6. Effect of Blasting on Infrastructure, ACARP Project No. C14057, Terrock Pty Ltd, 24th September 2008.
7. Rasp Mine Consolidated Project Approval, Broken Hill Operations Pty Ltd, up to Mod 11, 2023.

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Figure 1a – Location of the proposed Mod 13 stoping operations in the British Orebody

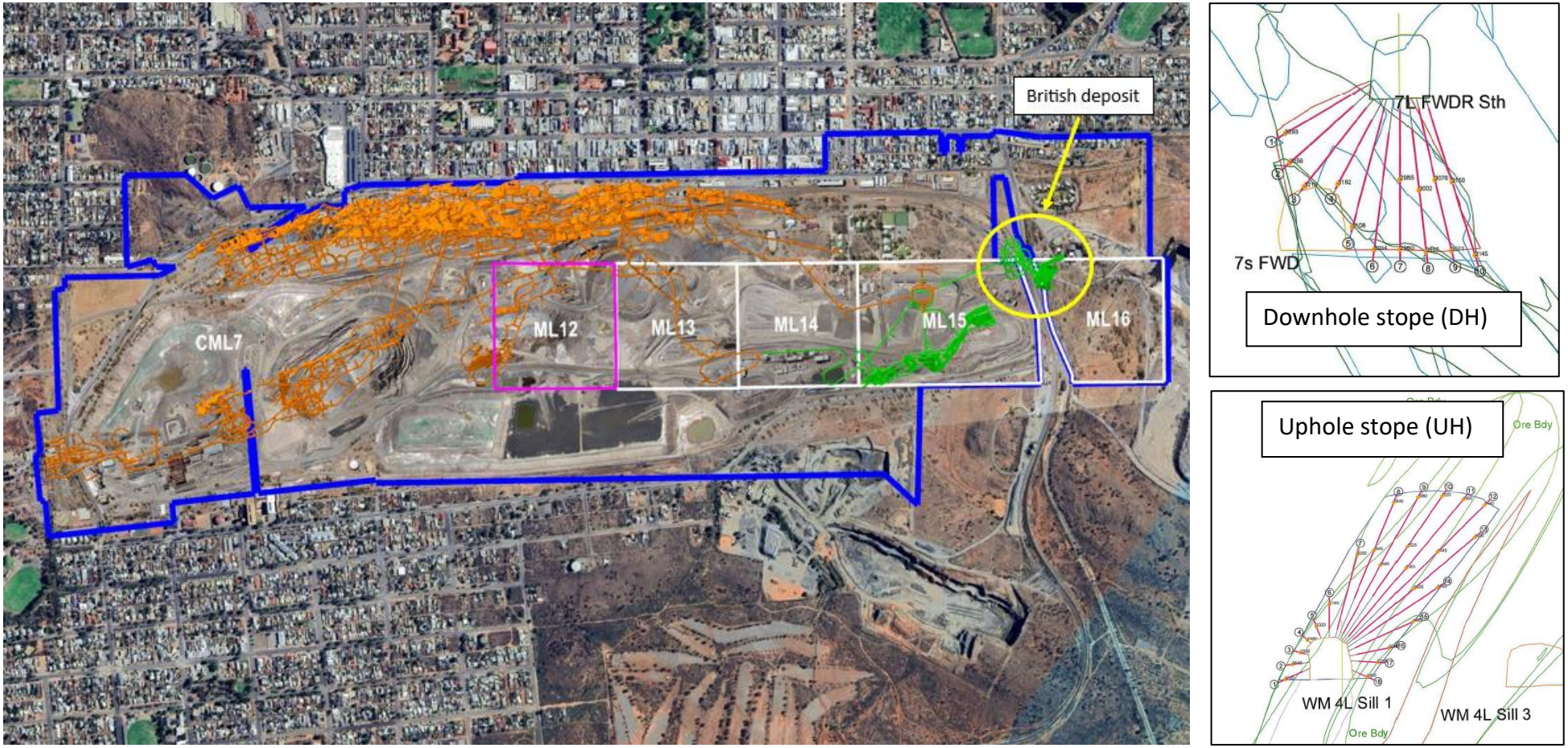


Figure 1b – Location of the proposed Mod 13 stoping operations relative to the closest identified sensitive locations

Figure 1c – Mod 13 stope layout

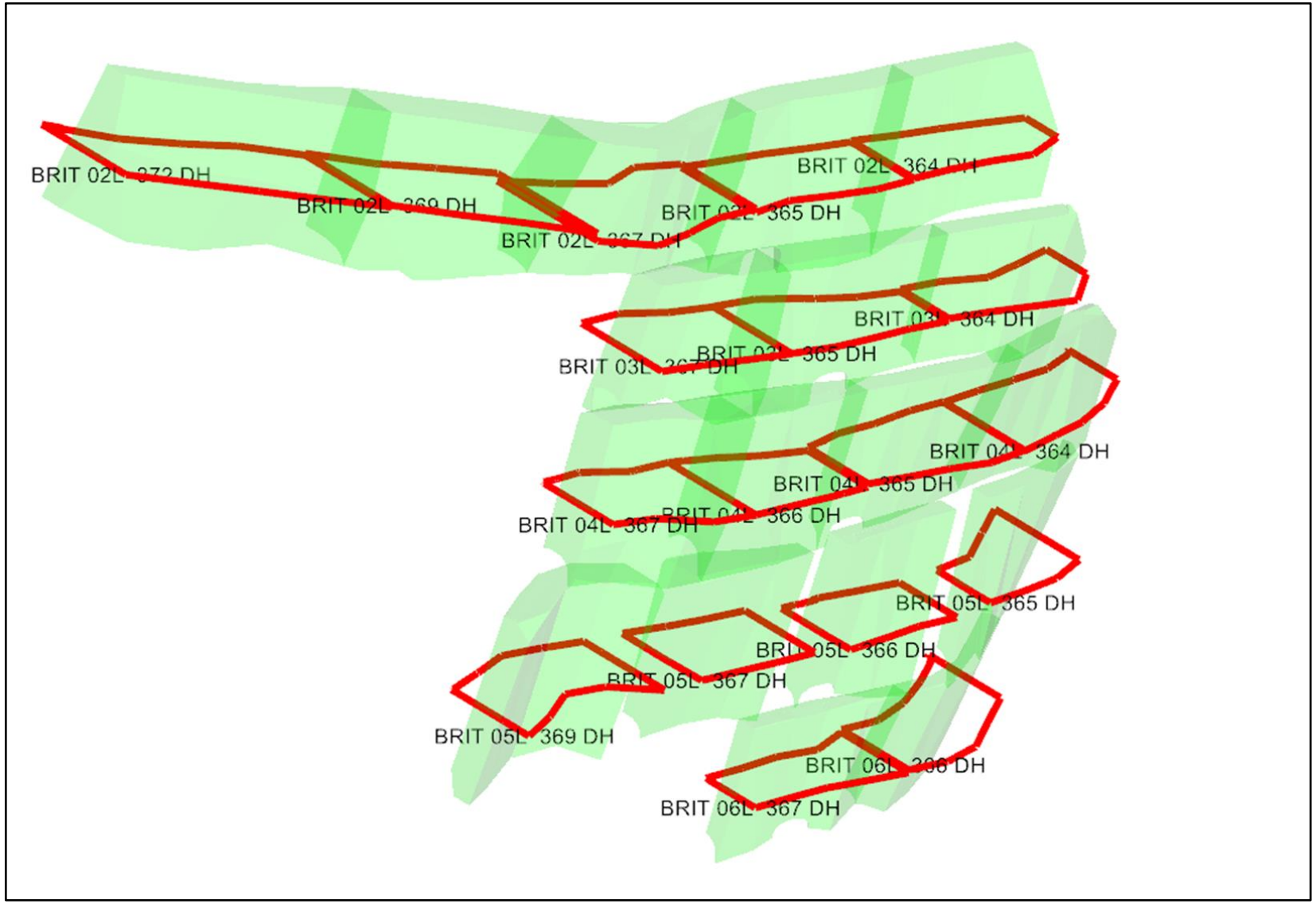
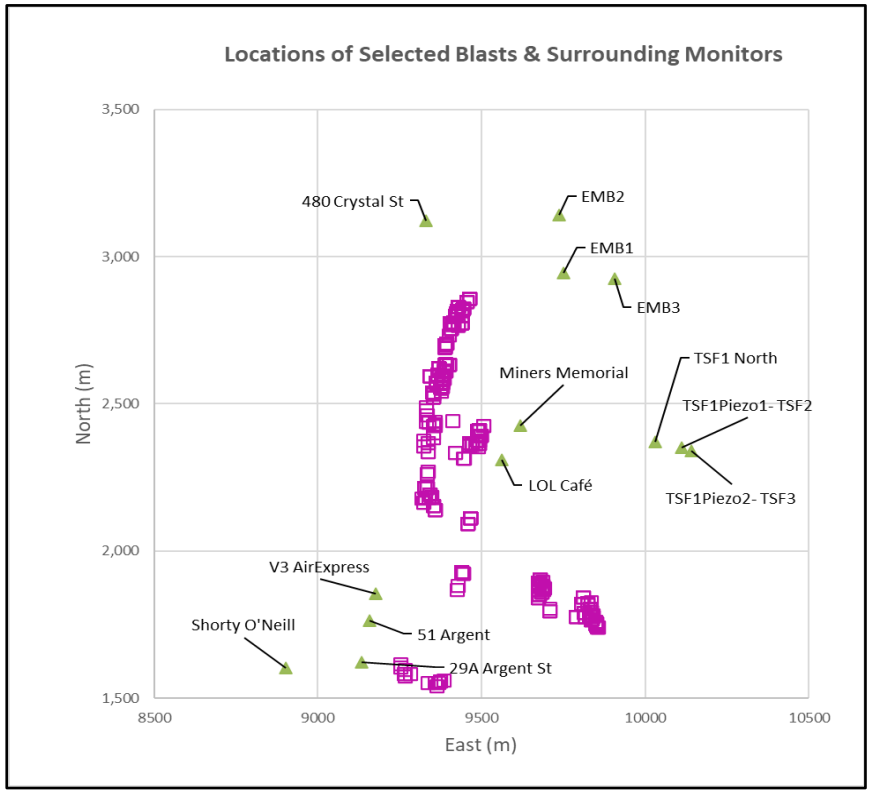


Figure 2a – Location of northernmost stope blasts and surrounding monitoring locations (left), with PVS attenuation plot of selected data (right).



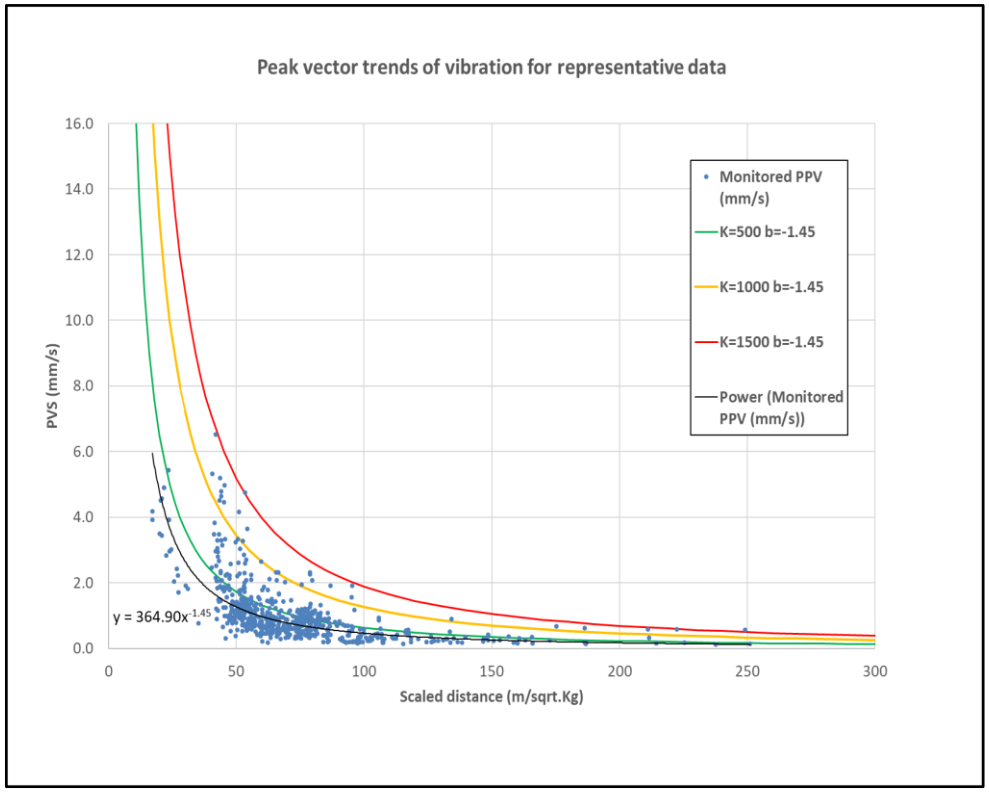
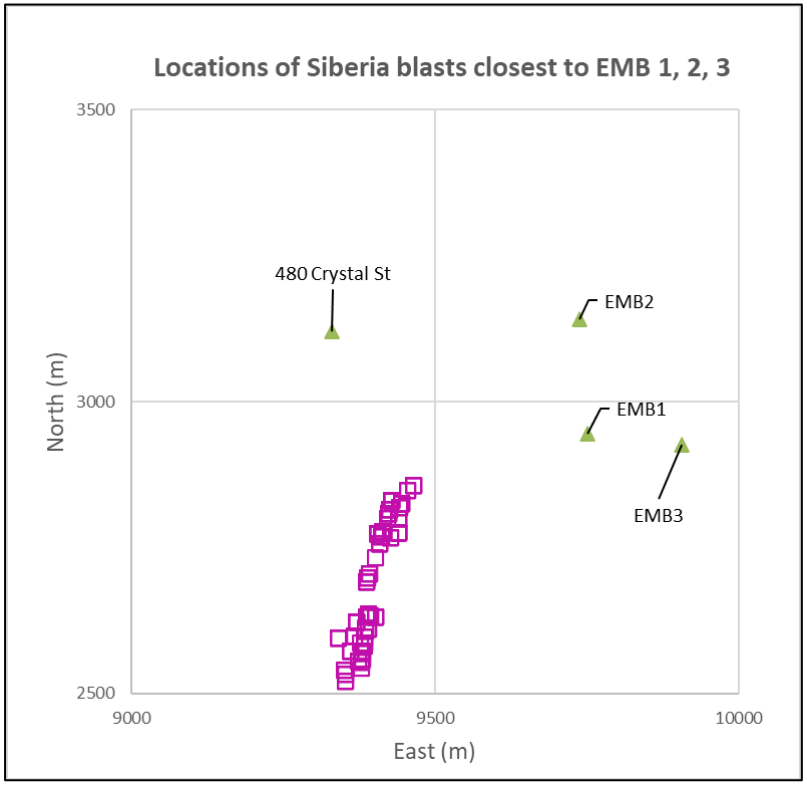


Figure 2b – Location of 'Siberia' stope blasts and closest monitoring locations (left), with PVS attenuation plot of selected data (right).



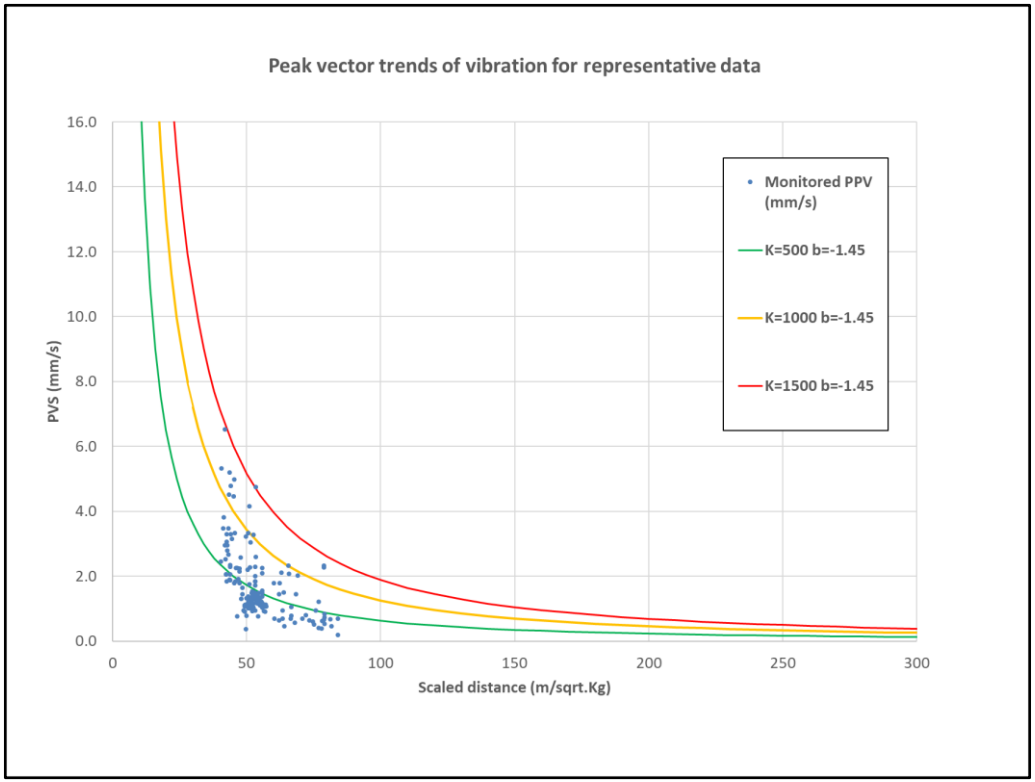


Figure 2c – Peak ground vibration (PVS) versus scaled distance for <u>all production blasts at all monitors within 350m</u> (2017 to 2025)

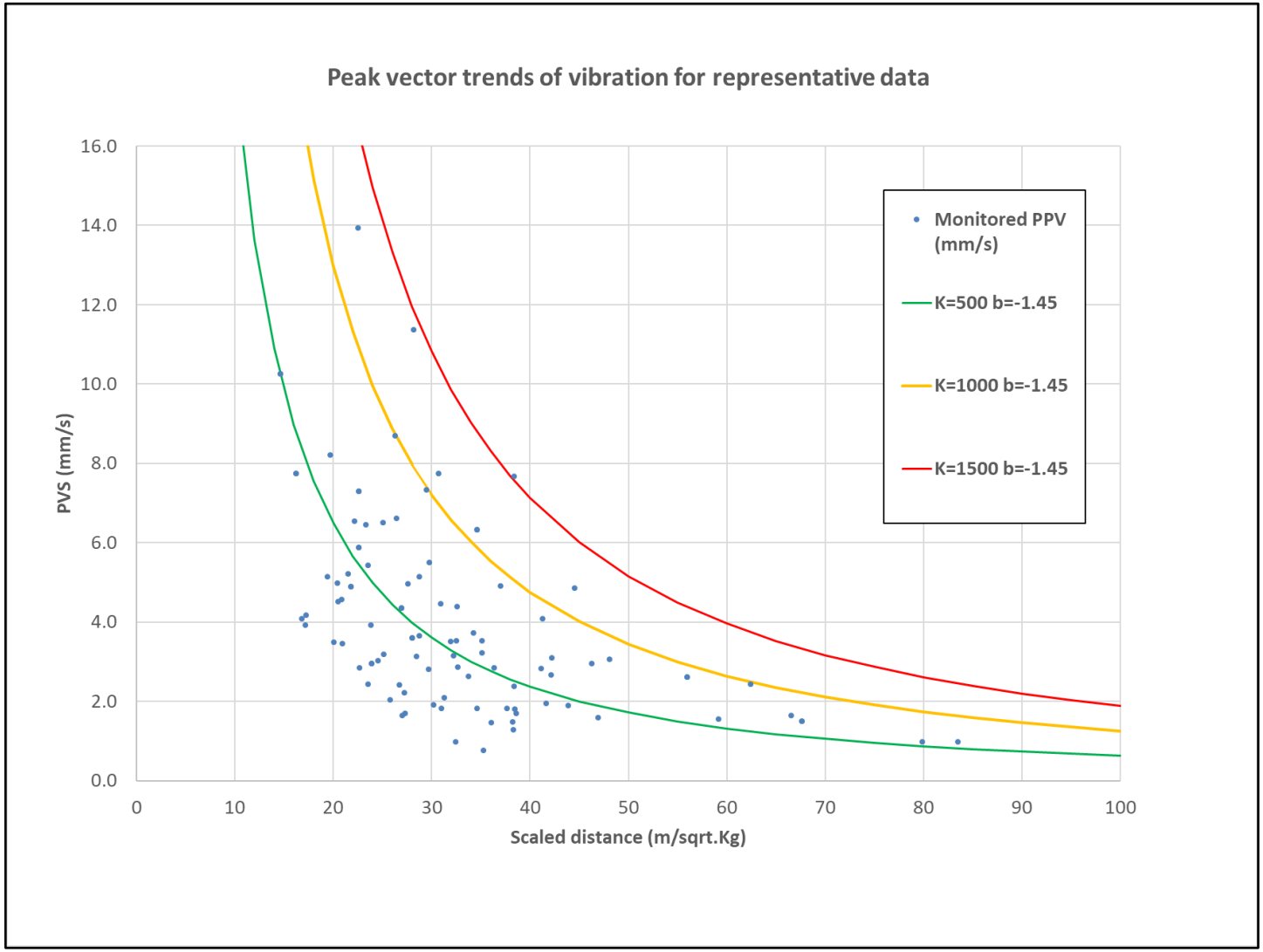


Figure 3a – Surrounding sensitive locations and minimum distances from the nearest Mod 13 stopes

Figure 3b – Example of distance data from the top of individual Mod 13 stopes to specific sensitive locations

								1	2	3	4	5
			Diameter (mm)	**89**			**Stope**	**BRIT 02L 364 DH**	**BRIT 02L 365 DH**	**BRIT 02L 367 DH**	**BRIT 02L 369 DH**	**BRIT 02L 372 DH**
			Explosive density (g/cc)	1.00			**Coords (top)**	**23**	**23**	**23**	**23**	**23**
			Charge density (kg/m)	6.2			**X1**	9756.297	9,743.78	9,727.15	9,710.46	9,702.75
			Charge column length (m)	23			**Y1**	3634.621	3,645.01	3,658.89	3,672.61	3,698.35
			Charge per hole (kg)	**143**			**Z1**	10211.67	10,211.34	10,210.93	10,211.08	10,211.60
							X2	9743.779	9,727.15	9,710.37	9,702.75	9,692.18
			k	**1500**			**Y2**	3645.014	3,658.89	3,672.31	3,698.35	3,731.76
			b	**-1.45**			**Z2**	10211.341	10,210.90	10,211.24	10,211.60	10,212.30
							X3	9745.021	9,728.51	9,712.96	9,704.96	9,693.15
			Downhle stopes				**Y3**	3649.013	3,663.28	3,680.66	3,705.46	3,734.86
			Uphole stopes				**Z3**	10211.285	10,210.85	10,211.19	10,211.72	10,212.36
							X4	9757.201	9,745.02	9,728.25	9,712.96	9,704.96
			Max PPV exceeds limit				**Y4**	3637.597	3,649.01	3,663.39	3,680.66	3,705.46
							Z4	10211.637	10,211.29	10,210.87	10,211.19	10,211.72
Sensitive Receptors												
Location	**Limit**	**Closest distance**	**Sensitive Receptor**	**X**	**Y**	**Z**	**Min Distances to Top Centroid**					
1	25	744	Filter Plant	9951	2929	10321	749	749	765	783	806	836
2	50	568	Mawson Silo	10318	3574	10297	564	578	593	612	627	642
3	15	488	Perilya Social Club	9640	3172	10310	493	493	502	513	531	558
4	15	559	British Flats	9755	3087	10320	566	566	578	593	614	643
5	10	637	Perilya Prop Square	9671	3013	10313	642	642	653	666	685	713
6	15	873	Cameron Pipe Band Hall	9535	2797	10311	878	878	886	897	915	940
7	5	674	Residence Crystal St	9330	3121	10303	675	675	676	678	688	707
8	15	624	Dans Stockfeed	9409	3127	10304	625	625	628	632	644	665
9	10	203	Perilya Junction Circle	9508	3733	10295	209	273	256	237	221	209
10	15	1308	LOL Café	9572	2357	10359	1305	1305	1316	1328	1347	1374
11	30	741	EMBK 1d	9758	2902	10317	747	747	760	775	796	825
12	30	402	EMBK 2d	9727	3249	10315	406	406	418	432	453	481
13	30	588	EMBK 3c	9937	3085	10318	597	597	613	633	655	685
14	25	1130	Mawson Office	10368	2687	10298	1134	1140	1158	1180	1203	1232
15	5	1359	Residence Eyre Street	10322	2404	10301	1362	1366	1383	1404	1427	1457
16	25	1349	TSF1	10156	2352	10325	1357	1357	1373	1392	1415	1445
17	100	91	Menindee Road	9751	3633	10302	91	91	94	103	115	134
18	100	95	Railway Line	9770	3608	10301	98	98	107	120	136	159
19	50	149	Thompsons Shaft	9824	3549	10311	155	155	170	188	208	233
20	25	356	Origin LPG Yard	9430	3466	10299	365	376	370	365	367	378
21	5	329	Residence 533 Chettle St	9374	3723	10294	335	395	378	360	346	335
22	5	394	Silver Haven Hotel	9313	3668	10296	397	446	432	415	404	397
23	50	123	Browns Shaft	9655	3801	10308	134	209	194	176	157	134
24	15	520	North Mine Bowls Club	9,540	3,171	10,307	524	524	530	538	553	577

Figure 4a – Example of maximum peak vector PPV estimates at some sensitive locations, for some individual stopes (89mm, full depth, 1.0g/cc density bulk explosives) and K=1500 / b=-1.45 'upper limit'

								1	2	3	4	5	6
			Diameter (mm)	**89**			**Stope**	**BRIT 02L 364 DH**	**BRIT 02L 365 DH**	**BRIT 02L 367 DH**	**BRIT 02L 369 DH**	**BRIT 02L 372 DH**	**BRIT 03L 364 DH**
			Explosive density (g/cc)	1.00			**Coords (top)**	**23**	**23**	**23**	**23**	**23**	**23**
			Charge density (kg/m)	6.2			**X1**	9756.297	9,743.78	9,727.15	9,710.46	9,702.75	9,766.57
			Charge column length (m)	23			**Y1**	3634.621	3,645.01	3,658.89	3,672.61	3,698.35	3,634.11
			Charge per hole (kg)	**143**			**Z1**	10211.67	10,211.34	10,210.93	10,211.08	10,211.60	10,180.17
							X2	9743.779	9,727.15	9,710.37	9,702.75	9,692.18	9,754.61
			k	**1500**			**Y2**	3645.014	3,658.89	3,672.31	3,698.35	3,731.76	3,646.13
			b	**-1.45**			**Z2**	10211.341	10,210.90	10,211.24	10,211.60	10,212.30	10,179.90
							X3	9745.021	9,728.51	9,712.96	9,704.96	9,693.15	9,755.56
			Downhle stopes				**Y3**	3649.013	3,663.28	3,680.66	3,705.46	3,734.86	3,649.23
			Uphole stopes				**Z3**	10211.285	10,210.85	10,211.19	10,211.72	10,212.36	10,179.87
							X4	9757.201	9,745.02	9,728.25	9,712.96	9,704.96	9,767.45
			Max PPV exceeds limit				**Y4**	3637.597	3,649.01	3,663.39	3,680.66	3,705.46	3,637.00
							Z4	10211.637	10,211.29	10,210.87	10,211.19	10,211.72	10,180.21
Sensitive Receptors													
Location	**Limit**	**Closest distance**	**Sensitive Receptor**	**X**	**Y**	**Z**	**Max PVPPV**						
1	25	744	Filter Plant	9951	2929	10321	4	4	4	3	3	3	4
2	50	568	Mawson Silo	10318	3574	10297	6	5	5	5	5	5	5
3	15	488	Perilya Social Club	9640	3172	10310	7	7	7	6	6	6	7
4	15	559	British Flats	9755	3087	10320	6	6	5	5	5	5	5
5	10	637	Perilya Prop Square	9671	3013	10313	5	5	5	4	4	4	5
6	15	873	Cameron Pipe Band Hall	9535	2797	10311	3	3	3	3	3	3	3
7	5	674	Residence Crystal St	9330	3121	10303	4	4	4	4	4	4	4
8	15	624	Dans Stockfeed	9409	3127	10304	5	5	5	5	5	4	5
9	10	203	Perilya Junction Circle	9508	3733	10295	24	16	18	20	22	24	15
10	15	1308	LOL Café	9572	2357	10359	2	2	2	2	2	2	2
11	30	741	EMBK 1d	9758	2902	10317	4	4	4	4	3	3	4
12	30	402	EMBK 2d	9727	3249	10315	9	9	9	8	8	7	9
13	30	588	EMBK 3c	9937	3085	10318	5	5	5	5	5	4	5

Notes:

Cells highlighted green indicate that compliance with applicable limit(s) should be achievable.

Cells highlighted red indicate potential compliance challenges.

Heat maps showing colour-coding for all stopes are shown in Figures 4b to 4g for the vibration mitigation options considered.

Figure 4b – 'Heat maps' of peak vector PPV compliance with applicable limits, for 89mm blastholes at full depth (23m), 1.0g/cc density bulk explosive, K=1500 / b=-1.45 (top) and K=1000 / b=-1.45 (bottom)

												1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			
			Diameter (mm)	89			Stope	BRIT 02L 364 DH	BRIT 02L 365 DH	BRIT 02L 367 DH	BRIT 02L 369 DH	BRIT 02L 372 DH	BRIT 03L 364 DH	BRIT 03L 365 DH	BRIT 03L 367 DH	BRIT 04L 364 DH	BRIT 04L 365 DH	BRIT 04L 366 DH	BRIT 04L 367 DH	BRIT 05L 365 BUHS	BRIT 05L 366 BUHS	BRIT 05L 367 BUHS	BRIT 05L 369 BUHS	BRIT 06L 366 DH	BRIT 06L 367 DH								
			Explosive density (g/cc)	1.00			Coords (top)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23								
			Charge density (kg/m)	6.2			X1	9756.297	9,743.78	9,727.15	9,710.46	9,702.75	9,766.57	9,754.60	9,737.86	9,784.62	9,769.64	9,752.85	9,740.06	9,792.43	9,773.34	9,755.75	9,738.93	9,796.90	9,776.05								
			Charge column length (m)	23			Y1	3634.621	3,645.01	3,658.89	3,672.61	3,698.35	3,634.11	3,646.14	3,659.68	3,641.66	3,643.98	3,657.50	3,666.76	3,649.95	3,655.91	3,666.69	3,680.03	3,664.33	3,664.65								
			Charge per hole (kg)	**143**			Z1	10211.67	10,211.34	10,210.93	10,211.08	10,211.60	10,180.17	10,179.90	10,178.57	10,152.71	10,153.13	10,152.55	10,152.63	10,123.45	10,122.02	10,121.77	10,122.19	10,090.41	10,088.37								
							X2	9743.779	9,727.15	9,710.37	9,702.75	9,692.18	9,754.61	9,737.86	9,725.96	9,769.64	9,752.75	9,740.06	9,728.70	9,777.74	9,760.07	9,743.10	9,720.62	9,776.05	9,759.16								
			k	**1500**			Y2	3645.014	3,658.89	3,672.31	3,698.35	3,731.76	3,646.13	3,659.68	3,671.91	3,643.98	3,657.04	3,666.76	3,680.73	3,653.50	3,663.76	3,676.71	3,688.46	3,664.65	3,677.68								
			b	**-1.45**			Z2	10211.341	10,210.90	10,211.24	10,211.60	10,212.30	10,179.90	10,178.57	10,179.62	10,153.15	10,152.55	10,152.63	10,152.99	10,122.12	10,121.61	10,122.09	10,120.61	10,088.37	10,088.33								
							X3	9745.021	9,728.51	9,712.96	9,704.96	9,693.15	9,755.56	9,739.86	9,727.65	9,770.52	9,753.79	9,742.39	9,730.56	9,778.75	9,761.26	9,745.03	9,722.04	9,776.94	9,760.03								
			Downhle stopes				Y3	3649.013	3,663.28	3,680.66	3,705.46	3,734.86	3,649.23	3,666.13	3,677.39	3,646.83	3,660.41	3,674.25	3,686.73	3,656.47	3,667.58	3,682.77	3,693.02	3,667.50	3,680.48								
			Uphole stopes				Z3	10211.285	10,210.85	10,211.19	10,211.72	10,212.36	10,179.87	10,179.35	10,178.44	10,152.97	10,152.52	10,151.93	10,151.76	10,122.12	10,121.70	10,121.17	10,122.51	10,088.37	10,088.35								
							X4	9757.201	9,745.02	9,728.25	9,712.96	9,704.96	9,767.45	9,755.56	9,739.86	9,785.17	9,770.52	9,753.79	9,742.39	9,792.63	9,774.24	9,756.72	9,740.83	9,796.60	9,776.94								
			Max PPV exceeds limit				Y4	3637.597	3,649.01	3,663.39	3,680.66	3,705.46	3,637.00	3,649.23	3,666.13	3,643.43	3,646.83	3,660.40	3,674.25	3,651.86	3,658.81	3,669.84	3,686.11	3,665.84	3,667.50								
							Z4	10211.637	10,211.29	10,210.87	10,211.19	10,211.72	10,180.21	10,179.87	10,179.35	10,151.85	10,152.97	10,152.52	10,151.93	10,122.41	10,122.01	10,121.79	10,122.26	10,088.84	10,088.37								
Sensitive Receptors																																
Location	**Limit**		**Closest distance**	**Sensitive Receptor**	**X**	**Y**	**Z**	**Max PVPPV**																								
1	25		744	Filter Plant	9951	2929	10321	4	4	4	3	3	3	4	4	3	4	4	3	3	4	4	3	3	3	3						
2	50		568	Mawson Silo	10318	3574	10297	6	5	5	5	5	5	5	5	5	6	5	5	5	6	5	5	5	5	5						
3	15		488	Perilya Social Club	9640	3172	10310	7	7	7	6	6	6	7	6	6	6	6	6	6	6	6	6	6	6	6						
4	15		559	British Flats	9755	3087	10320	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5						
5	10		637	Perilya Prop Square	9671	3013	10313	5	5	5	4	4	4	5	4	4	4	4	4	4	4	4	4	4	4	4						
6	15		873	Cameron Pipe Band Hall	9535	2797	10311	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3						
7	5		674	Residence Crystal St	9330	3121	10303	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4						
8	15		624	Dans Stockfeed	9409	3127	10304	5	5	5	5	5	4	5	5	5	5	5	5	5	4	4	4	4	4	4						
9	10		203	Perilya Junction Circle	9508	3733	10295	24	16	18	20	22	24	15	16	17	13	14	15	16	12	13	14	15	11	12						
10	15		1308	LOL Café	9572	2357	10359	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						
11	30		741	EMBK 1d	9758	2902	10317	4	4	4	4	3	3	4	4	4	4	4	4	3	4	3	3	3	3	3						
12	30		402	EMBK 2d	9727	3249	10315	9	9	9	8	8	7	9	8	8	8	8	8	8	8	8	8	7	7	7						
13	30		588	EMBK 3c	9937	3085	10318	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	4	5	5						
14	25		1130	Mawson Office	10368	2687	10298	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						
15	5		1359	Residence Eyre Street	10322	2404	10301	2	2	2	1	1	1	2	2	2	2	2	2	2	1	2	2	1	1	2						
16	25		1349	TSF1	10156	2352	10325	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	1	2	2						
17	100		91	Menindee Road	9751	3633	10302	79	79	75	67	56	45	51	50	48	38	38	37	36	29	29	28	27	22	22						
18	100		95	Railway Line	9770	3608	10301	71	71	63	53	44	35	49	46	42	37	37	35	33	28	28	27	25	22	22						
19	50		149	Thompsons Shaft	9824	3549	10311	37	37	32	28	24	20	31	28	25	27	25	23	22	22	21	20	18	18	17						
20	25		356	Origin LPG Yard	9430	3466	10299	11	10	10	11	10	10	9	10	10	9	9	9	9	8	8	9	9	8	8						
21	5		329	Residence 533 Chettle St	9374	3723	10294	12	9	10	11	11	12	9	9	10	8	9	9	10	8	8	9	9	7	8						
22	5		394	Silver Haven Hotel	9313	3668	10296	9	8	8	9	9	9	7	8	8	7	7	8	8	7	7	7	8	6	7						
23	50		123	Browns Shaft	9655	3801	10308	45	24	26	30	36	45	21	23	25	18	19	21	23	16	17	19	20	15	16						
24	15		520	North Mine Bowls Club	9,540	3,171	10,307	6	6	6	6	6	5	6	6	6	6	6	6	6	6	6	5	5	5	5						

												1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			
			Diameter (mm)	89			Stope	BRIT 02L 364 DH	BRIT 02L 365 DH	BRIT 02L 367 DH	BRIT 02L 369 DH	BRIT 02L 372 DH	BRIT 03L 364 DH	BRIT 03L 365 DH	BRIT 03L 367 DH	BRIT 04L 364 DH	BRIT 04L 365 DH	BRIT 04L 366 DH	BRIT 04L 367 DH	BRIT 05L 365 BUHS	BRIT 05L 366 BUHS	BRIT 05L 367 BUHS	BRIT 05L 369 BUHS	BRIT 06L 366 DH	BRIT 06L 367 DH								
			Explosive density (g/cc)	1.00			Coords (top)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23								
			Charge density (kg/m)	6.2			X1	9756.297	9,743.78	9,727.15	9,710.46	9,702.75	9,766.57	9,754.60	9,737.86	9,784.62	9,769.64	9,752.85	9,740.06	9,792.43	9,773.34	9,755.75	9,738.93	9,796.90	9,776.05								
			Charge column length (m)	23			Y1	3634.621	3,645.01	3,658.89	3,672.61	3,698.35	3,634.11	3,646.14	3,659.68	3,641.66	3,643.98	3,657.50	3,666.76	3,649.95	3,655.91	3,666.69	3,680.03	3,664.33	3,664.65								
			Charge per hole (kg)	**143**			Z1	10211.67	10,211.34	10,210.93	10,211.08	10,211.60	10,180.17	10,179.90	10,178.57	10,152.71	10,153.13	10,152.55	10,152.63	10,123.45	10,122.02	10,121.77	10,122.19	10,090.41	10,088.37								
							X2	9743.779	9,727.15	9,710.37	9,702.75	9,692.18	9,754.61	9,737.86	9,725.96	9,769.64	9,752.75	9,740.06	9,728.70	9,777.74	9,760.07	9,743.10	9,720.62	9,776.05	9,759.16								
			k	**1000**			Y2	3645.014	3,658.89	3,672.31	3,698.35	3,731.76	3,646.13	3,659.68	3,671.91	3,643.98	3,657.04	3,666.76	3,680.73	3,653.50	3,663.76	3,676.71	3,688.46	3,664.65	3,677.68								
			b	**-1.45**			Z2	10211.341	10,210.90	10,211.24	10,211.60	10,212.30	10,179.90	10,178.57	10,179.62	10,153.15	10,152.55	10,152.63	10,152.99	10,122.12	10,121.61	10,122.09	10,120.61	10,088.37	10,088.33								
							X3	9745.021	9,728.51	9,712.96	9,704.96	9,693.15	9,755.56	9,739.86	9,727.65	9,770.52	9,753.79	9,742.39	9,730.56	9,778.75	9,761.26	9,745.03	9,722.04	9,776.94	9,760.03								
			Downhle stopes				Y3	3649.013	3,663.28	3,680.66	3,705.46	3,734.86	3,649.23	3,666.13	3,677.39	3,646.83	3,660.41	3,674.25	3,686.73	3,656.47	3,667.58	3,682.77	3,693.02	3,667.50	3,680.48								
			Uphole stopes				Z3	10211.285	10,210.85	10,211.19	10,211.72	10,212.36	10,179.87	10,179.35	10,178.44	10,152.97	10,152.52	10,151.93	10,151.76	10,122.12	10,121.70	10,121.17	10,122.51	10,088.37	10,088.35								
							X4	9757.201	9,745.02	9,728.25	9,712.96	9,704.96	9,767.45	9,755.56	9,739.86	9,785.17	9,770.52	9,753.79	9,742.39	9,792.63	9,774.24	9,756.72	9,740.83	9,796.60	9,776.94								
			Max PPV exceeds limit				Y4	3637.597	3,649.01	3,663.39	3,680.66	3,705.46	3,637.00	3,649.23	3,666.13	3,643.43	3,646.83	3,660.40	3,674.25	3,651.86	3,658.81	3,669.84	3,686.11	3,665.84	3,667.50								
							Z4	10211.637	10,211.29	10,210.87	10,211.19	10,211.72	10,180.21	10,179.87	10,179.35	10,151.85	10,152.97	10,152.52	10,151.93	10,122.41	10,122.01	10,121.79	10,122.26	10,088.84	10,088.37								
Sensitive Receptors																																
Location	**Limit**		**Closest distance**	**Sensitive Receptor**	**X**	**Y**	**Z**	**Max PVPPV**																								
1	25		744	Filter Plant	9951	2929	10321	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						
2	50		568	Mawson Silo	10318	3574	10297	4	4	3	3	3	3	4	4	3	4	4	3	3	4	4	3	3	4	3						
3	15		488	Perilya Social Club	9640	3172	10310	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4						
4	15		559	British Flats	9755	3087	10320	4	4	4	3	3	3	4	4	3	4	4	3	3	3	3	3	3	3	3						
5	10		637	Perilya Prop Square	9671	3013	10313	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3						
6	15		873	Cameron Pipe Band Hall	9535	2797	10311	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						
7	5		674	Residence Crystal St	9330	3121	10303	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3						
8	15		624	Dans Stockfeed	9409	3127	10304	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3						
9	10		203	Perilya Junction Circle	9508	3733	10295	16	11	12	13	15	16	10	11	11	9	9	10	11	8	9	9	10	7	8						
10	15		1308	LOL Café	9572	2357	10359	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
11	30		741	EMBK 1d	9758	2902	10317	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						
12	30		402	EMBK 2d	9727	3249	10315	6	6	6	6	5	5	6	6	5	6	5	5	5	5	5	5	5	5	5						
13	30		588	EMBK 3c	9937	3085	10318	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3						
14	25		1130	Mawson Office	10368	2687	10298	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
15	5		1359	Residence Eyre Street	10322	2404	10301	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
16	25		1349	TSF1	10156	2352	10325	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
17	100		91	Menindee Road	9751	3633	10302	53	53	50	44	38	30	34	33	32	25	25	25	24	19	19	19	18	15	15						
18	100		95	Railway Line	9770	3608	10301	48	48	42	35	29	24	33	31	28	25	24	23	22	19	19	18	17	15	14						
19	50		149	Thompsons Shaft	9824	3549	10311	24	24	21	18	16	14	21	19	17	18	17	16	14	15	14	13	12	12	11						
20	25		356	Origin LPG Yard	9430	3466	10299	7	7	7	7	7	7	6	6	7	6	6	6	6	5	6	6	6	5	5						
21	5		329	Residence 533 Chettle St	9374	3723	10294	8	6	7	7	8	8	6	6	7	5	6	6	6	5	5	6	6	5	5						
22	5		394	Silver Haven Hotel	9313	3668	10296	6	5	6	6	6	6	5	5	5	5	5	5	5	4	5	5	5	4	4						
23	50		123	Browns Shaft	9655	3801	10308	30	16	18	20	24	30	14	15	17	12	13	14	15	11	12	13	14	10	10						
24	15		520	North Mine Bowls Club	9,540	3,171	10,307	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3						

Figure 4c – 'Heat map' of peak vector PPV compliance with applicable limits, for 89mm blastholes in undercut down-hole stopes with maximum charged depth at 10m, 1.0g/cc density bulk explosive, and K=1500 / b=-1.45. Preliminary stopes to be mined shown on rhs.

								1	2	3	4	5	6	7	8	9	10	11	12	17	18
			Diameter (mm)	89			Stope	BRIT 02L 364 DH	BRIT 02L 365 DH	BRIT 02L 367 DH	BRIT 02L 369 DH	BRIT 02L 372 DH	BRIT 03L 364 DH	BRIT 03L 365 DH	BRIT 03L 367 DH	BRIT 04L 364 DH	BRIT 04L 365 DH	BRIT 04L 366 DH	BRIT 04L 367 DH	BRIT 06L 366 DH	BRIT 06L 367 DH
			Explosive density (g/cc)	1.00			Coords (top)	23	23	23	23	23	23	23	23	23	23	23	23	23	23
			Charge density (kg/m)	6.2			X1	9756.297	9,743.78	9,727.15	9,710.46	9,702.75	9,766.57	9,754.60	9,737.86	9,784.62	9,769.64	9,752.85	9,740.06	9,796.90	9,776.05
			Charge column length (m)	10			Y1	3634.621	3,645.01	3,658.89	3,672.61	3,698.35	3,634.11	3,646.14	3,659.68	3,641.66	3,643.98	3,657.50	3,666.76	3,664.33	3,664.65
			Charge per hole (kg)	62			Z1	10211.67	10,211.34	10,210.93	10,211.08	10,211.60	10,180.17	10,179.90	10,178.57	10,152.71	10,153.13	10,152.55	10,152.63	10,090.41	10,088.37
							X2	9743.779	9,727.15	9,710.37	9,702.75	9,692.18	9,754.61	9,737.86	9,725.96	9,769.64	9,752.75	9,740.06	9,728.70	9,776.05	9,759.16
			k	1500			Y2	3645.014	3,658.89	3,672.31	3,698.35	3,731.76	3,646.13	3,659.68	3,671.91	3,643.98	3,657.04	3,666.76	3,680.73	3,664.65	3,677.68
			b	-1.45			Z2	10211.341	10,210.90	10,211.24	10,211.60	10,212.30	10,179.90	10,178.57	10,179.62	10,153.15	10,152.55	10,152.63	10,152.99	10,088.37	10,088.33
							X3	9745.021	9,728.51	9,712.96	9,704.96	9,693.15	9,755.56	9,739.86	9,727.65	9,770.52	9,753.79	9,742.39	9,730.56	9,776.94	9,760.03
			Downhle stopes				Y3	3649.013	3,663.28	3,680.66	3,705.46	3,734.86	3,649.23	3,666.13	3,677.39	3,646.83	3,660.41	3,674.25	3,686.73	3,667.50	3,680.48
			Uphole stopes				Z3	10211.285	10,210.85	10,211.19	10,211.72	10,212.36	10,179.87	10,179.35	10,178.44	10,152.97	10,152.52	10,151.93	10,151.76	10,088.37	10,088.35
							X4	9757.201	9,745.02	9,728.25	9,712.96	9,704.96	9,767.45	9,755.56	9,739.86	9,785.17	9,770.52	9,753.79	9,742.39	9,796.60	9,776.94
			Max PPV exceeds limit				Y4	3637.597	3,649.01	3,663.39	3,680.66	3,705.46	3,637.00	3,649.23	3,666.13	3,643.43	3,646.83	3,660.40	3,674.25	3,665.84	3,667.50
							Z4	10211.637	10,211.29	10,210.87	10,211.19	10,211.72	10,180.21	10,179.87	10,179.35	10,151.85	10,152.97	10,152.52	10,151.93	10,088.84	10,088.37
																Initial stopes planned for 89mm diameter, undercut down-hole production blasts					
Sensitive Receptors																					
Location	Limit	Closest distance	Sensitive Receptor	X	Y	Z	Max PVPPV														
1	25	744	Filter Plant	9951	2929	10321	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	50	568	Mawson Silo	10318	3574	10297	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	15	488	Perilya Social Club	9640	3172	10310	4	4	4	4	3	3	4	4	3	3	3	3	3	3	3
4	15	559	British Flats	9755	3087	10320	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5	10	637	Perilya Prop Square	9671	3013	10313	3	3	2	2	2	2	3	2	2	2	2	2	2	2	2
6	15	873	Cameron Pipe Band Hall	9535	2797	10311	2	2	2	2	2	1	2	2	2	2	2	2	2	1	1
7	5	674	Residence Crystal St	9330	3121	10303	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	15	624	Dans Stockfeed	9409	3127	10304	3	3	3	3	3	2	3	3	3	2	2	2	2	2	2
9	10	203	Perilya Junction Circle	9508	3733	10295	13	9	10	11	12	13	8	9	9	7	8	8	9	6	6
10	15	1308	LOL Café	9572	2357	10359	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	30	741	EMBK 1d	9758	2902	10317	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	30	402	EMBK 2d	9727	3249	10315	5	5	5	5	4	4	5	5	4	5	4	4	4	4	4
13	30	588	EMBK 3c	9937	3085	10318	3	3	3	3	2	2	3	3	3	3	3	3	3	3	2
14	25	1130	Mawson Office	10368	2687	10298	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	5	1359	Residence Eyre Street	10322	2404	10301	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16	25	1349	TSF1	10156	2352	10325	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	100	91	Menindee Road	9751	3633	10302	43	43	41	36	31	25	28	27	26	21	21	20	20	12	12
18	100	95	Railway Line	9770	3608	10301	39	39	34	29	24	19	27	25	23	20	20	19	18	12	12
19	50	149	Thompsons Shaft	9824	3549	10311	20	20	17	15	13	11	17	15	14	15	14	13	12	10	9
20	25	356	Origin LPG Yard	9430	3466	10299	6	6	6	6	6	5	5	5	5	5	5	5	5	4	4
21	5	329	Residence 533 Chettle St	9374	3723	10294	7	5	5	6	6	7	5	5	5	4	5	5	5	4	4
22	5	394	Silver Haven Hotel	9313	3668	10296	5	4	5	5	5	5	4	4	4	4	4	4	4	3	4
23	50	123	Browns Shaft	9655	3801	10308	25	13	14	17	20	25	11	12	14	10	11	12	12	8	9
24	15	520	North Mine Bowls Club	9,540	3,171	10,307	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Figure 4d – 'Heat map' of peak vector PPV compliance with applicable limits, for 89mm blastholes in undercut down-hole stopes with maximum charged depth at 10m, 1.0g/cc density bulk explosive, and K=1000 / b=-1.45. Preliminary stopes to be mined shown on rhs.

								1	2	3	4	5	6	7	8	9	10	11	12	17	18
			Diameter (mm)	89			Stope	BRIT 02L 364 DH	BRIT 02L 365 DH	BRIT 02L 367 DH	BRIT 02L 369 DH	BRIT 02L 372 DH	BRIT 03L 364 DH	BRIT 03L 365 DH	BRIT 03L 367 DH	BRIT 04L 364 DH	BRIT 04L 365 DH	BRIT 04L 366 DH	BRIT 04L 367 DH	BRIT 06L 366 DH	BRIT 06L 367 DH
			Explosive density (g/cc)	1.00			Coords (top)	23	23	23	23	23	23	23	23	23	23	23	23	23	23
			Charge density (kg/m)	6.2			X1	9756.297	9,743.78	9,727.15	9,710.46	9,702.75	9,766.57	9,754.60	9,737.86	9,784.62	9,769.64	9,752.85	9,740.06	9,796.90	9,776.05
			Charge column length (m)	10			Y1	3634.621	3,645.01	3,658.89	3,672.61	3,698.35	3,634.11	3,646.14	3,659.68	3,641.66	3,643.98	3,657.50	3,666.76	3,664.33	3,664.65
			Charge per hole (kg)	62			Z1	10211.67	10,211.34	10,210.93	10,211.08	10,211.60	10,180.17	10,179.90	10,178.57	10,152.71	10,153.13	10,152.55	10,152.63	10,090.41	10,088.37
							X2	9743.779	9,727.15	9,710.37	9,702.75	9,692.18	9,754.61	9,737.86	9,725.96	9,769.64	9,752.75	9,740.06	9,728.70	9,776.05	9,759.16
			k	1000			Y2	3645.014	3,658.89	3,672.31	3,698.35	3,731.76	3,646.13	3,659.68	3,671.91	3,643.98	3,657.04	3,666.76	3,680.73	3,664.65	3,677.68
			b	-1.45			Z2	10211.341	10,210.90	10,211.24	10,211.60	10,212.30	10,179.90	10,178.57	10,179.62	10,153.15	10,152.55	10,152.63	10,152.99	10,088.37	10,088.33
							X3	9745.021	9,728.51	9,712.96	9,704.96	9,693.15	9,755.56	9,739.86	9,727.65	9,770.52	9,753.79	9,742.39	9,730.56	9,776.94	9,760.03
			Downhle stopes				Y3	3649.013	3,663.28	3,680.66	3,705.46	3,734.86	3,649.23	3,666.13	3,677.39	3,646.83	3,660.41	3,674.25	3,686.73	3,667.50	3,680.48
			Uphole stopes				Z3	10211.285	10,210.85	10,211.19	10,211.72	10,212.36	10,179.87	10,179.35	10,178.44	10,152.97	10,152.52	10,151.93	10,151.76	10,088.37	10,088.35
							X4	9757.201	9,745.02	9,728.25	9,712.96	9,704.96	9,767.45	9,755.56	9,739.86	9,785.17	9,770.52	9,753.79	9,742.39	9,796.60	9,776.94
			Max PPV exceeds limit				Y4	3637.597	3,649.01	3,663.39	3,680.66	3,705.46	3,637.00	3,649.23	3,666.13	3,643.43	3,646.83	3,660.40	3,674.25	3,665.84	3,667.50
							Z4	10211.637	10,211.29	10,210.87	10,211.19	10,211.72	10,180.21	10,179.87	10,179.35	10,151.85	10,152.97	10,152.52	10,151.93	10,088.84	10,088.37
																Initial stopes planned for 89mm diameter, undercut down-hole production blasts					
Sensitive Receptors																					
Location	Limit	Closest distance	Sensitive Receptor	X	Y	Z	Max PVPPV														
1	25	744	Filter Plant	9951	2929	10321	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	50	568	Mawson Silo	10318	3574	10297	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	15	488	Perilya Social Club	9640	3172	10310	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	15	559	British Flats	9755	3087	10320	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	10	637	Perilya Prop Square	9671	3013	10313	2	2	2	2	2	1	2	2	2	2	2	2	2	1	1
6	15	873	Cameron Pipe Band Hall	9535	2797	10311	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	5	674	Residence Crystal St	9330	3121	10303	2	2	2	2	2	1	2	2	2	1	1	1	1	1	1
8	15	624	Dans Stockfeed	9409	3127	10304	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9	10	203	Perilya Junction Circle	9508	3733	10295	9	6	6	7	8	9	5	6	6	5	5	5	6	4	4
10	15	1308	LOL Café	9572	2357	10359	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	30	741	EMBK 1d	9758	2902	10317	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	30	402	EMBK 2d	9727	3249	10315	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
13	30	588	EMBK 3c	9937	3085	10318	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14	25	1130	Mawson Office	10368	2687	10298	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	5	1359	Residence Eyre Street	10322	2404	10301	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16	25	1349	TSF1	10156	2352	10325	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	100	91	Menindee Road	9751	3633	10302	29	29	27	24	21	16	19	18	17	14	14	14	13	8	8
18	100	95	Railway Line	9770	3608	10301	26	26	23	19	16	13	18	17	15	14	13	13	12	8	8
19	50	149	Thompsons Shaft	9824	3549	10311	13	13	12	10	9	7	11	10	9	10	9	9	8	7	6
20	25	356	Origin LPG Yard	9430	3466	10299	4	4	4	4	4	4	3	4	4	3	3	3	3	3	3
21	5	329	Residence 533 Chettle St	9374	3723	10294	4	3	4	4	4	4	3	3	4	3	3	3	3	3	3
22	5	394	Silver Haven Hotel	9313	3668	10296	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2
23	50	123	Browns Shaft	9655	3801	10308	16	9	10	11	13	16	8	8	9	7	7	8	8	5	6
24	15	520	North Mine Bowls Club	9,540	3,171	10,307	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Figure 4e – 'Heat maps' of peak vector PPV compliance with applicable limits, for 76mm blastholes in undercut down-hole stopes with maximum charged depth at 10m and 1.0g/cc density bulk explosive. K=1500 / b=-1.45 (top) and K=1000 / b=-1.45 (bottom).

								1	2	3	4	5	6	7	8	9	10	11	12	17	18
			Diameter (mm)	76			Stope	BRIT 02L 364 DH	BRIT 02L 365 DH	BRIT 02L 367 DH	BRIT 02L 369 DH	BRIT 02L 372 DH	BRIT 03L 364 DH	BRIT 03L 365 DH	BRIT 03L 367 DH	BRIT 04L 364 DH	BRIT 04L 365 DH	BRIT 04L 366 DH	BRIT 04L 367 DH	BRIT 06L 366 DH	BRIT 06L 367 DH
			Explosive density (g/cc)	1.00			Coords (top)	23	23	23	23	23	23	23	23	23	23	23	23	23	23
			Charge density (kg/m)	4.5			X1	9756.297	9,743.78	9,727.15	9,710.46	9,702.75	9,766.57	9,754.60	9,737.86	9,784.62	9,769.64	9,752.85	9,740.06	9,796.90	9,776.05
			Charge column length (m)	10			Y1	3634.621	3,645.01	3,658.89	3,672.61	3,698.35	3,634.11	3,646.14	3,659.68	3,641.66	3,643.98	3,657.50	3,666.76	3,664.33	3,664.65
			Charge per hole (kg)	45			Z1	10211.67	10,211.34	10,210.93	10,211.08	10,211.60	10,180.17	10,179.90	10,178.57	10,152.71	10,153.13	10,152.55	10,152.63	10,090.41	10,088.37
							X2	9743.779	9,727.15	9,710.37	9,702.75	9,692.18	9,754.61	9,737.86	9,725.96	9,769.64	9,752.75	9,740.06	9,728.70	9,776.05	9,759.16
			k	1500			Y2	3645.014	3,658.89	3,672.31	3,698.35	3,731.76	3,646.13	3,659.68	3,671.91	3,643.98	3,657.04	3,666.76	3,680.73	3,664.65	3,677.68
			b	-1.45			Z2	10211.341	10,210.90	10,211.24	10,211.60	10,212.30	10,179.90	10,178.57	10,179.62	10,153.15	10,152.55	10,152.63	10,152.99	10,088.37	10,088.33
							X3	9745.021	9,728.51	9,712.96	9,704.96	9,693.15	9,755.56	9,739.86	9,727.65	9,770.52	9,753.79	9,742.39	9,730.56	9,776.94	9,760.03
			Downhle stopes				Y3	3649.013	3,663.28	3,680.66	3,705.46	3,734.86	3,649.23	3,666.13	3,677.39	3,646.83	3,660.41	3,674.25	3,686.73	3,667.50	3,680.48
			Uphole stopes				Z3	10211.285	10,210.85	10,211.19	10,211.72	10,212.36	10,179.87	10,179.35	10,178.44	10,152.97	10,152.52	10,151.93	10,151.76	10,088.37	10,088.35
							X4	9757.201	9,745.02	9,728.25	9,712.96	9,704.96	9,767.45	9,755.56	9,739.86	9,785.17	9,770.52	9,753.79	9,742.39	9,796.60	9,776.94
			Max PPV exceeds limit				Y4	3637.597	3,649.01	3,663.39	3,680.66	3,705.46	3,637.00	3,649.23	3,666.13	3,643.43	3,646.83	3,660.40	3,674.25	3,665.84	3,667.50
							Z4	10211.637	10,211.29	10,210.87	10,211.19	10,211.72	10,180.21	10,179.87	10,179.35	10,151.85	10,152.97	10,152.52	10,151.93	10,088.84	10,088.37
Sensitive Receptors																					
Location	Limit	Closest distance	Sensitive Receptor	X	Y	Z	Max PVPPV														
1	25	744	Filter Plant	9951	2929	10321	2	2	2	2	1	1	2	2	2	2	2	2	1	1	1
2	50	568	Mawson Silo	10318	3574	10297	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	15	488	Perilya Social Club	9640	3172	10310	3	3	3	3	3	2	3	3	3	3	3	3	3	2	2
4	15	559	British Flats	9755	3087	10320	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	10	637	Perilya Prop Square	9671	3013	10313	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	15	873	Cameron Pipe Band Hall	9535	2797	10311	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	5	674	Residence Crystal St	9330	3121	10303	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	15	624	Dans Stockfeed	9409	3127	10304	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9	10	203	Perilya Junction Circle	9508	3733	10295	10	7	8	9	9	10	6	7	7	6	6	7	7	5	5
10	15	1308	LOL Café	9572	2357	10359	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	30	741	EMBK 1d	9758	2902	10317	2	2	2	2	1	1	2	2	2	2	2	2	1	1	1
12	30	402	EMBK 2d	9727	3249	10315	4	4	4	4	3	3	4	4	3	4	4	3	3	3	3
13	30	588	EMBK 3c	9937	3085	10318	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14	25	1130	Mawson Office	10368	2687	10298	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	5	1359	Residence Eyre Street	10322	2404	10301	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16	25	1349	TSF1	10156	2352	10325	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	100	91	Menindee Road	9751	3633	10302	34	34	33	29	25	20	22	22	21	16	17	16	16	10	10
18	100	95	Railway Line	9770	3608	10301	31	31	27	23	19	15	21	20	18	16	16	15	14	10	9
19	50	149	Thompsons Shaft	9824	3549	10311	16	16	14	12	10	9	14	12	11	12	11	10	9	8	7
20	25	356	Origin LPG Yard	9430	3466	10299	5	4	4	5	5	4	4	4	4	4	4	4	4	3	3
21	5	329	Residence 533 Chettle St	9374	3723	10294	5	4	4	5	5	5	4	4	4	4	4	4	4	3	3
22	5	394	Silver Haven Hotel	9313	3668	10296	4	3	4	4	4	4	3	3	4	3	3	3	3	3	3
23	50	123	Browns Shaft	9655	3801	10308	20	10	12	13	16	20	9	10	11	8	8	9	10	6	7
24	15	520	North Mine Bowls Club	9,540	3,171	10,307	3	3	3	3	3	2	3	3	3	3	3	2	2	2	2

								1	2	3	4	5	6	7	8	9	10	11	12	17	18
			Diameter (mm)	76			Stope	BRIT 02L 364 DH	BRIT 02L 365 DH	BRIT 02L 367 DH	BRIT 02L 369 DH	BRIT 02L 372 DH	BRIT 03L 364 DH	BRIT 03L 365 DH	BRIT 03L 367 DH	BRIT 04L 364 DH	BRIT 04L 365 DH	BRIT 04L 366 DH	BRIT 04L 367 DH	BRIT 06L 366 DH	BRIT 06L 367 DH
			Explosive density (g/cc)	1.00			Coords (top)	23	23	23	23	23	23	23	23	23	23	23	23	23	23
			Charge density (kg/m)	4.5			X1	9756.297	9,743.78	9,727.15	9,710.46	9,702.75	9,766.57	9,754.60	9,737.86	9,784.62	9,769.64	9,752.85	9,740.06	9,796.90	9,776.05
			Charge column length (m)	10			Y1	3634.621	3,645.01	3,658.89	3,672.61	3,698.35	3,634.11	3,646.14	3,659.68	3,641.66	3,643.98	3,657.50	3,666.76	3,664.33	3,664.65
			Charge per hole (kg)	45			Z1	10211.67	10,211.34	10,210.93	10,211.08	10,211.60	10,180.17	10,179.90	10,178.57	10,152.71	10,153.13	10,152.55	10,152.63	10,090.41	10,088.37
							X2	9743.779	9,727.15	9,710.37	9,702.75	9,692.18	9,754.61	9,737.86	9,725.96	9,769.64	9,752.75	9,740.06	9,728.70	9,776.05	9,759.16
			k	1000			Y2	3645.014	3,658.89	3,672.31	3,698.35	3,731.76	3,646.13	3,659.68	3,671.91	3,643.98	3,657.04	3,666.76	3,680.73	3,664.65	3,677.68
			b	-1.45			Z2	10211.341	10,210.90	10,211.24	10,211.60	10,212.30	10,179.90	10,178.57	10,179.62	10,153.15	10,152.55	10,152.63	10,152.99	10,088.37	10,088.33
							X3	9745.021	9,728.51	9,712.96	9,704.96	9,693.15	9,755.56	9,739.86	9,727.65	9,770.52	9,753.79	9,742.39	9,730.56	9,776.94	9,760.03
			Downhle stopes				Y3	3649.013	3,663.28	3,680.66	3,705.46	3,734.86	3,649.23	3,666.13	3,677.39	3,646.83	3,660.41	3,674.25	3,686.73	3,667.50	3,680.48
			Uphole stopes				Z3	10211.285	10,210.85	10,211.19	10,211.72	10,212.36	10,179.87	10,179.35	10,178.44	10,152.97	10,152.52	10,151.93	10,151.76	10,088.37	10,088.35
							X4	9757.201	9,745.02	9,728.25	9,712.96	9,704.96	9,767.45	9,755.56	9,739.86	9,785.17	9,770.52	9,753.79	9,742.39	9,796.60	9,776.94
			Max PPV exceeds limit				Y4	3637.597	3,649.01	3,663.39	3,680.66	3,705.46	3,637.00	3,649.23	3,666.13	3,643.43	3,646.83	3,660.40	3,674.25	3,665.84	3,667.50
							Z4	10211.637	10,211.29	10,210.87	10,211.19	10,211.72	10,180.21	10,179.87	10,179.35	10,151.85	10,152.97	10,152.52	10,151.93	10,088.84	10,088.37
Sensitive Receptors																					
Location	Limit	Closest distance	Sensitive Receptor	X	Y	Z	Max PVPPV														
1	25	744	Filter Plant	9951	2929	10321	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	50	568	Mawson Silo	10318	3574	10297	2	2	2	1	1	1	2	2	1	2	2	2	1	2	2
3	15	488	Perilya Social Club	9640	3172	10310	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	15	559	British Flats	9755	3087	10320	2	2	2	2	1	1	2	2	1	1	1	1	1	1	1
5	10	637	Perilya Prop Square	9671	3013	10313	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	15	873	Cameron Pipe Band Hall	9535	2797	10311	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	5	674	Residence Crystal St	9330	3121	10303	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	15	624	Dans Stockfeed	9409	3127	10304	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	10	203	Perilya Junction Circle	9508	3733	10295	7	5	5	6	6	7	4	5	5	4	4	4	5	3	3
10	15	1308	LOL Café	9572	2357	10359	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	30	741	EMBK 1d	9758	2902	10317	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	30	402	EMBK 2d	9727	3249	10315	3	3	3	2	2	2	3	2	2	2	2	2	2	2	2
13	30	588	EMBK 3c	9937	3085	10318	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14	25	1130	Mawson Office	10368	2687	10298	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	5	1359	Residence Eyre Street	10322	2404	10301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	25	1349	TSF1	10156	2352	10325	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	100	91	Menindee Road	9751	3633	10302	23	23	22	19	16	13	15	15	14	11	11	11	10	6	6
18	100	95	Railway Line	9770	3608	10301	21	21	18	15	13	10	14	13	12	11	11	10	9	6	6
19	50	149	Thompsons Shaft	9824	3549	10311	11	11	9	8	7	6	9	8	7	8	7	7	6	5	5
20	25	356	Origin LPG Yard	9430	3466	10299	3	3	3	3	3	3	3	3	3	2	3	3	3	2	2
21	5	329	Residence 533 Chettle St	9374	3723	10294	3	3	3	3	3	3	3	3	3	2	3	3	3	2	2
22	5	394	Silver Haven Hotel	9313	3668	10296	3	2	2	3	3	3	2	2	2	2	2	2	2	2	2
23	50	123	Browns Shaft	9655	3801	10308	13	7	8	9	10	13	6	7	7	5	6	6	7	4	5
24	15	520	North Mine Bowls Club	9,540	3,171	10,307	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Figure 4f – 'Heat maps' of peak vector PPV compliance with applicable limits, for 89mm blastholes in up-hole stopes at full depth (23m), 0.8g/cc density bulk explosive. K=1500 / b=-1.45 (left) and K=1000 / b=-1.45 (right).

								13	14	15	16
			Diameter (mm)	**89**			**Stope**	**BRIT 05L 365 BUHS**	**BRIT 05L 366 BUHS**	**BRIT 05L 367 BUHS**	**BRIT 05L 369 BUHS**
			Explosive density (g/cc)	0.80			**Coords (top)**	**23**	**23**	**23**	**23**
			Charge density (kg/m)	5.0			**X1**	9,792.43	9,773.34	9,755.75	9,738.93
			Charge column length (m)	23			**Y1**	3,649.95	3,655.91	3,666.69	3,680.03
			Charge per hole (kg)	**114**			**Z1**	10,123.45	10,122.02	10,121.77	10,122.19
							X2	9,777.74	9,760.07	9,743.10	9,720.62
			k	**1500**			**Y2**	3,653.50	3,663.76	3,676.71	3,688.46
			b	**-1.45**			**Z2**	10,122.12	10,121.61	10,122.09	10,120.61
							X3	9,778.75	9,761.26	9,745.03	9,722.04
			Downhle stopes				**Y3**	3,656.47	3,667.58	3,682.77	3,693.02
			Uphole stopes				**Z3**	10,122.12	10,121.70	10,121.17	10,122.51
							X4	9,792.63	9,774.24	9,756.72	9,740.83
			Max PPV exceeds limit				**Y4**	3,651.86	3,658.81	3,669.84	3,686.11
							Z4	10,122.41	10,122.01	10,121.79	10,122.26
Sensitive Receptors											
Location	**Limit**	**Closest distance**	**Sensitive Receptor**	**X**	**Y**	**Z**	**Max PVPPV**				
1	25	744	Filter Plant	9951	2929	10321	3	3	3	3	3
2	50	568	Mawson Silo	10318	3574	10297	5	5	5	4	4
3	15	488	Perilya Social Club	9640	3172	10310	6	5	5	5	5
4	15	559	British Flats	9755	3087	10320	5	4	4	4	4
5	10	637	Perilya Prop Square	9671	3013	10313	4	4	4	4	3
6	15	873	Cameron Pipe Band Hall	9535	2797	10311	3	2	2	2	2
7	5	674	Residence Crystal St	9330	3121	10303	4	3	3	3	3
8	15	624	Dans Stockfeed	9409	3127	10304	4	4	4	4	4
9	10	203	Perilya Junction Circle	9508	3733	10295	13	10	11	12	13
10	15	1308	LOL Café	9572	2357	10359	1	1	1	1	1
11	30	741	EMBK 1d	9758	2902	10317	3	3	3	3	3
12	30	402	EMBK 2d	9727	3249	10315	8	7	6	6	6
13	30	588	EMBK 3c	9937	3085	10318	4	4	4	4	4
14	25	1130	Mawson Office	10368	2687	10298	2	2	2	2	2
15	5	1359	Residence Eyre Street	10322	2404	10301	1	1	1	1	1
16	25	1349	TSF1	10156	2352	10325	1	1	1	1	1
17	100	91	Menindee Road	9751	3633	10302	67	24	24	24	23
18	100	95	Railway Line	9770	3608	10301	61	24	24	23	22
19	50	149	Thompsons Shaft	9824	3549	10311	31	19	18	17	15
20	25	356	Origin LPG Yard	9430	3466	10299	9	7	7	7	8
21	5	329	Residence 533 Chettle St	9374	3723	10294	8	7	7	7	8
22	5	394	Silver Haven Hotel	9313	3668	10296	7	6	6	6	7
23	50	123	Browns Shaft	9655	3801	10308	38	14	15	16	17
24	15	520	North Mine Bowls Club	9,540	3,171	10,307	5	5	5	5	5

								13	14	15	16
			Diameter (mm)	**89**			**Stope**	**BRIT 05L 365 BUHS**	**BRIT 05L 366 BUHS**	**BRIT 05L 367 BUHS**	**BRIT 05L 369 BUHS**
			Explosive density (g/cc)	0.80			**Coords (top)**	**23**	**23**	**23**	**23**
			Charge density (kg/m)	5.0			**X1**	9,792.43	9,773.34	9,755.75	9,738.93
			Charge column length (m)	23			**Y1**	3,649.95	3,655.91	3,666.69	3,680.03
			Charge per hole (kg)	**114**			**Z1**	10,123.45	10,122.02	10,121.77	10,122.19
							X2	9,777.74	9,760.07	9,743.10	9,720.62
			k	**1000**			**Y2**	3,653.50	3,663.76	3,676.71	3,688.46
			b	**-1.45**			**Z2**	10,122.12	10,121.61	10,122.09	10,120.61
							X3	9,778.75	9,761.26	9,745.03	9,722.04
			Downhle stopes				**Y3**	3,656.47	3,667.58	3,682.77	3,693.02
			Uphole stopes				**Z3**	10,122.12	10,121.70	10,121.17	10,122.51
							X4	9,792.63	9,774.24	9,756.72	9,740.83
			Max PPV exceeds limit				**Y4**	3,651.86	3,658.81	3,669.84	3,686.11
							Z4	10,122.41	10,122.01	10,121.79	10,122.26
Sensitive Receptors											
Location	**Limit**	**Closest distance**	**Sensitive Receptor**	**X**	**Y**	**Z**	**Max PVPPV**				
1	25	744	Filter Plant	9951	2929	10321	2	2	2	2	2
2	50	568	Mawson Silo	10318	3574	10297	3	3	3	3	3
3	15	488	Perilya Social Club	9640	3172	10310	4	3	3	3	3
4	15	559	British Flats	9755	3087	10320	3	3	3	3	3
5	10	637	Perilya Prop Square	9671	3013	10313	3	2	2	2	2
6	15	873	Cameron Pipe Band Hall	9535	2797	10311	2	2	2	2	2
7	5	674	Residence Crystal St	9330	3121	10303	2	2	2	2	2
8	15	624	Dans Stockfeed	9409	3127	10304	3	2	2	2	2
9	10	203	Perilya Junction Circle	9508	3733	10295	9	7	7	8	9
10	15	1308	LOL Café	9572	2357	10359	1	1	1	1	1
11	30	741	EMBK 1d	9758	2902	10317	2	2	2	2	2
12	30	402	EMBK 2d	9727	3249	10315	5	4	4	4	4
13	30	588	EMBK 3c	9937	3085	10318	3	3	3	3	3
14	25	1130	Mawson Office	10368	2687	10298	1	1	1	1	1
15	5	1359	Residence Eyre Street	10322	2404	10301	1	1	1	1	1
16	25	1349	TSF1	10156	2352	10325	1	1	1	1	1
17	100	91	Menindee Road	9751	3633	10302	45	16	16	16	16
18	100	95	Railway Line	9770	3608	10301	40	16	16	15	14
19	50	149	Thompsons Shaft	9824	3549	10311	21	13	12	11	10
20	25	356	Origin LPG Yard	9430	3466	10299	5	5	5	5	5
21	5	329	Residence 533 Chettle St	9374	3723	10294	5	4	5	5	5
22	5	394	Silver Haven Hotel	9313	3668	10296	4	4	4	4	4
23	50	123	Browns Shaft	9655	3801	10308	26	9	10	11	12
24	15	520	North Mine Bowls Club	9,540	3,171	10,307	4	3	3	3	3

Figure 4g – 'Heat map' of peak vector PPV compliance with applicable limits, for 76mm blastholes in <u>up-hole stopes</u> at full depth (23m), 0.8g/cc density bulk explosive. K=1500 / b=-1.45 (left), K=1000 / b=-1.45 (right).

								13	14	15	16
			Diameter (mm)	**76**			**Stope**	**BRIT 05L 365 BUHS**	**BRIT 05L 366 BUHS**	**BRIT 05L 367 BUHS**	**BRIT 05L 369 BUHS**
			Explosive density (g/cc)	0.80			**Coords (top)**	**23**	**23**	**23**	**23**
			Charge density (kg/m)	3.6			**X1**	9,792.43	9,773.34	9,755.75	9,738.93
			Charge column length (m)	23			**Y1**	3,649.95	3,655.91	3,666.69	3,680.03
			Charge per hole (kg)	**83**			**Z1**	10,123.45	10,122.02	10,121.77	10,122.19
							X2	9,777.74	9,760.07	9,743.10	9,720.62
			k	**1500**			**Y2**	3,653.50	3,663.76	3,676.71	3,688.46
			b	**-1.45**			**Z2**	10,122.12	10,121.61	10,122.09	10,120.61
							X3	9,778.75	9,761.26	9,745.03	9,722.04
			Downhle stopes				**Y3**	3,656.47	3,667.58	3,682.77	3,693.02
			Uphole stopes				**Z3**	10,122.12	10,121.70	10,121.17	10,122.51
							X4	9,792.63	9,774.24	9,756.72	9,740.83
			Max PPV exceeds limit				**Y4**	3,651.86	3,658.81	3,669.84	3,686.11
							Z4	10,122.41	10,122.01	10,121.79	10,122.26
Sensitive Receptors											
Location	**Limit**	**Closest distance**	**Sensitive Receptor**	**X**	**Y**	**Z**	**Max PVPPV**				
1	25	744	Filter Plant	9951	2929	10321	3	2	2	2	2
2	50	568	Mawson Silo	10318	3574	10297	4	4	4	3	3
3	15	488	Perilya Social Club	9640	3172	10310	5	4	4	4	4
4	15	559	British Flats	9755	3087	10320	4	3	3	3	3
5	10	637	Perilya Prop Square	9671	3013	10313	3	3	3	3	3
6	15	873	Cameron Pipe Band Hall	9535	2797	10311	2	2	2	2	2
7	5	674	Residence Crystal St	9330	3121	10303	3	3	3	3	3
8	15	624	Dans Stockfeed	9409	3127	10304	3	3	3	3	3
9	10	203	Perilya Junction Circle	9508	3733	10295	10	8	9	9	10
10	15	1308	LOL Café	9572	2357	10359	1	1	1	1	1
11	30	741	EMBK 1d	9758	2902	10317	3	2	2	2	2
12	30	402	EMBK 2d	9727	3249	10315	6	5	5	5	5
13	30	588	EMBK 3c	9937	3085	10318	3	3	3	3	3
14	25	1130	Mawson Office	10368	2687	10298	1	1	1	1	1
15	5	1359	Residence Eyre Street	10322	2404	10301	1	1	1	1	1
16	25	1349	TSF1	10156	2352	10325	1	1	1	1	1
17	100	91	Menindee Road	9751	3633	10302	54	19	19	19	19
18	100	95	Railway Line	9770	3608	10301	48	19	19	18	17
19	50	149	Thompsons Shaft	9824	3549	10311	25	15	14	13	12
20	25	356	Origin LPG Yard	9430	3466	10299	7	5	6	6	6
21	5	329	Residence 533 Chettle St	9374	3723	10294	6	5	6	6	6
22	5	394	Silver Haven Hotel	9313	3668	10296	5	4	5	5	5
23	50	123	Browns Shaft	9655	3801	10308	30	11	12	13	14
24	15	520	North Mine Bowls Club	9,540	3,171	10,307	4	4	4	4	4

								13	14	15	16
			Diameter (mm)	**76**			**Stope**	**BRIT 05L 365 BUHS**	**BRIT 05L 366 BUHS**	**BRIT 05L 367 BUHS**	**BRIT 05L 369 BUHS**
			Explosive density (g/cc)	0.80			**Coords (top)**	**23**	**23**	**23**	**23**
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			Charge column length (m)	23			**Y1**	3,649.95	3,655.91	3,666.69	3,680.03
			Charge per hole (kg)	**83**			**Z1**	10,123.45	10,122.02	10,121.77	10,122.19
							X2	9,777.74	9,760.07	9,743.10	9,720.62
			k	**1000**			**Y2**	3,653.50	3,663.76	3,676.71	3,688.46
			b	**-1.45**			**Z2**	10,122.12	10,121.61	10,122.09	10,120.61
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							Z4	10,122.41	10,122.01	10,121.79	10,122.26
Sensitive Receptors											
Location	**Limit**	**Closest distance**	**Sensitive Receptor**	**X**	**Y**	**Z**	**Max PVPPV**				
1	25	744	Filter Plant	9951	2929	10321	2	2	2	2	1
2	50	568	Mawson Silo	10318	3574	10297	3	3	2	2	2
3	15	488	Perilya Social Club	9640	3172	10310	3	3	3	3	3
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9	10	203	Perilya Junction Circle	9508	3733	10295	7	5	6	6	7
10	15	1308	LOL Café	9572	2357	10359	1	1	1	1	1
11	30	741	EMBK 1d	9758	2902	10317	2	2	2	2	1
12	30	402	EMBK 2d	9727	3249	10315	4	4	3	3	3
13	30	588	EMBK 3c	9937	3085	10318	2	2	2	2	2
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16	25	1349	TSF1	10156	2352	10325	1	1	1	1	1
17	100	91	Menindee Road	9751	3633	10302	36	13	13	13	12
18	100	95	Railway Line	9770	3608	10301	32	13	13	12	11
19	50	149	Thompsons Shaft	9824	3549	10311	17	10	9	9	8
20	25	356	Origin LPG Yard	9430	3466	10299	5	4	4	4	4
21	5	329	Residence 533 Chettle St	9374	3723	10294	4	3	4	4	4
22	5	394	Silver Haven Hotel	9313	3668	10296	3	3	3	3	3
23	50	123	Browns Shaft	9655	3801	10308	20	7	8	9	9
24	15	520	North Mine Bowls Club	9,540	3,171	10,307	3	2	2	2	2

END OF DOCUMENT

Appendix G
Geotechnical Assessment

EMM
creating opportunities

GROUND CONTROL ENGINEERING Pty Ltd
www.groundcontrolengineering.com.au
GEOTECHNICAL AND MINING ENGINEERING SERVICES
PO Box 893 Malanda QLD 4885
ABN 98 124 6688 542

16th December 2025

Attn: Joel Sulicich

Health, Safety, Environment and Training Manager

Broken Hill Mines PTY LTD

Broken Hill, NSW

RE: GEOTECHNICAL ASSESSMENT – BRITISH OREBODY

Please find attached GCE's report for the geotechnical assessment for the British orebody located in the Rasp Mining lease in Broken Hill, New South Wales and is operated by Broken Hill Mines (BHM).

We trust that this report meets your requirements. Should you require further clarification, please do not hesitate to contact the undersigned.

Yours sincerely,

GROUND CONTROL ENGINEERING PTY LTD

Cameron Tucker

Principal Geotechnical Engineer

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BRITISH OREBODY

GEOTECHNICAL ASSESSMENT

FOR

BROKEN HILL MINES PTY LTD

Date	Version	Description	Prepared by:
December 2025	Final	G0409.AA_RE01	Cameron Tucker

EXECUTIVE SUMMARY

Ground Control Engineering Pty Ltd (GCE) has conducted a geotechnical assessment of the mine design and production strategy for the British orebody. The design and production strategy was provided by Broken Hill Mines (BHM).

The block is located within the historic Block 16 with the northern western part extending into Block 39. The access decline will pass through Blocks 13. Blocks 15 and 16 were worked by the British Broken Hill Proprietary company between 1887 and 1929 when it was bought by the North Broken Hill Limited who worked the area until 1972 when it was worked by Minerals Mining Metallurgy (Triple M).

The principal rock unit in the mine sequence stratigraphy at Rasp is the Hores Gneiss. The unit is described as a mainly garnet bearing quartzo-feldspathic gneiss. Locally the unit includes medium to fine grained Potosi Gneiss. The Potosi Gneiss comprises politic and psammitic metasediments with persistent quartz-gahnite, garnet-quartz and quartz-garnet (lode) rocks. The Potosi Gneiss rock types form the dominant host rocks for capital infrastructure development mining at Rasp; these units are generally competent and strong.

The geotechnical assessment completed by GCE is based on core logging data from 18 resource definition diamond drill holes.

Rock Mass Conditions

According to the empirical assessment methods employed for this study, the expected rock mass conditions in the host rocks and ore are predominantly fair to good. Identifying and characterising the macro structural environment is essential for detailed stope design during the production phase. The mine currently does not have a detailed structural model for the British orebody. Structural information should be collected and analysed during development mining and resource definition drilling and incorporated into the final stope designs and production sequence.

Access Development

The proposed development mining designs for accessing the British orebody poses a negligible risk to surface infrastructure. Good rock mass conditions are expected during mining. All development headings and wide span areas designed for underground infrastructure will be reinforced according to industry standards.

Stope Stability Assessment

A stope stability assessment has been conducted using the industry accepted Modified Stability Graph method. The empirical assessment indicates that the stability of the hangingwall will control the overall stope stability. Based on mean weighted Q' values, maximum theoretical unsupported spans of 22 metres are predicted.

The stability assessments are based on the information at hand. The assessments do not account for the presence of unknown large scale faults or shears. The likelihood of encountering large scale structures (>1m width) is low given no major structures were observed in the recent geotechnical logging. However, the geological environment at Broken Hill is complex and encountering major structures during stoping should not be discounted. The effects of major structure on stoping can be mitigated during the development mining stage by conducting routine, detailed geotechnical mapping to identify structures and to characterise the geotechnical environment.

Crown Pillar Stability Assessment

The stability of the crown pillar between the ground surface and the production stopes was assessed using the empirical method derived by Carter1 in 1989. Numerical modelling using non-linear, 2 dimensional modelling techniques was used to investigate potential interaction between the production stopes and the ground surface.

The empirical crown pillar assessment indicates that the crown between the planned longhole stope and the ground surface should be stable. Section 9 describes additional controls planned by BHM to limit disturbance to the crown pillar and surface infrastructure. GCE recommend the top development level for the production sequences is reinforced with long tendon cable bolts to increase long term stability of the access development after production is completed.

The maximum magnitude of vertical displacement predicted by the numerical model occurs as expected after extraction is complete, where the model shows vertical displacement of 2.0mm at the hangingwall interface of the lower lift of the bench stopes. The modelling predicts no vertical displacement at the ground surface following complete extraction.

Based on the results of the model, the risk of interaction between the British orebody production areas and the surface infrastructure is negligible.

Mining Method

Conventional, downhole benching is proposed for the steeply dipping sections of the British orebody ore body. The production sequence is “bottom up” where the lowest level is extracted first followed by subsequent levels in the sequence. Each stope is filled immediately after extraction is completed to limit the potential for hangingwall instability that may impact surface infrastructure.

To limit the potential for surface infrastructure disturbance, BHM plan to incorporate an 80 metre crown pillar between the downhole bench stopes and the ground surface and to incorporate conservative stope design dimensions according to the spatial relationship between surface infrastructure and the production stopes;

Geotechnical Risks

Key geotechnical risks that have been identified include the following:

- Potential for damage to surface infrastructure due to large scale stope overbreak. Design and mining controls are required to minimise the possibility of large scale stope failures.
- A detailed structural model for the British Lode was unavailable for this assessment. This information will be important for calculating final stable spans for stoping and for assessing the risk of stope failure that may impact surface infrastructure.;
- Structurally controlled failures from hangingwall and crown resulting in smaller stope spans than predicted by the empirical stability analysis;
- Sterilisation of ore through stope failure. Hangingwall or crown failures have the potential to sterilise ore in the vicinity of the failure. Ongoing collection and review of geological and geotechnical conditions and stope performance data is recommended;
- Failure of pillars due to presence of unfavourable defects in the pillar;
- Variability in geotechnical parameters used in the stope analysis. There are inherent risks in extrapolating drillhole point data to generalised rock mass conditions across domains. Whilst the host rock mass and the mineralised lenses could be described as close to homogeneous, there are localised variations in rock mass conditions. Assumptions are also made with regards to the presence of the critical defect set within the rock masses forming the stope walls.

[1] Carter, T.J. 2000. An Update on the Scaled Span Concept for Dimensioning Surface Crown Pillars for New and Abandoned Mine Workings. Proc. 4th North American Rock Mechanics Conf., Seattle, pp. 465-472

Recommended future geotechnical work

The following further geotechnical work is recommended:

- Collection and interpretation of structural defect data and geotechnical data is necessary as mining progresses in the British orebody. This will allow validation of design parameters and timely input to the mine design process;
- Develop a comprehensive program to monitor stope stability and potential surface subsidence. The program should be implemented both before and during the extraction of the British orebody;
- Increase the size and quality of the geotechnical database for the British orebody by collecting geotechnical information from future resource drilling programs;

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APPENDICES

Appendix A Laboratory Test Results

1 INTRODUCTION

This report presents the results of a geotechnical assessment British orebody undertaken for Broken Hill Mines (BHM. This assessment focuses on the orebody defined as the British Lode.

The British orebody Lode is located in the north portion of the Rasp mining leases between 80m and 270m below surface. It is approximately 120m in length, strikes ENE-WSW and dips to the NNE.

The block is located within the historic Block 16 with the northern western part extending into Block 39. The access decline will pass through Blocks 13. Blocks 15 and 16 were worked by the British Broken Hill Proprietary company between 1887 and 1929 when it was bought by the North Broken Hill Limited who worked the area until 1972 when it was worked by Minerals Mining Metallurgy (triple M).

The Block will be accessed of the Blackwoods DEC with connections to 7L Western Mineralisation and to the surface incline and portal via the Blackwoods decline.

1.1 Scope of work

The scope of work is outlined below:

- Desktop Review
    - Review of the preliminary Geotechnical Assessment of the area conducted by BHO
    - Review existing geological, geotechnical, and hydrogeological data.
    - Analyse historical mining activity and regional stress fields if relevant.
- Geotechnical Analysis
    - Perform stability assessments using appropriate numerical modelling.
    - Assess surface subsidence potential and failure mechanisms.
- Infrastructure Assessment
    - Evaluate the impact of mining-induced ground movement on infrastructure.
    - Assess risk of settlement, vibration, or other hazards.
    - Provide monitoring or recommendations.

2 AVAILABLE DATA

2.1 Data Supplied to GCE

Data made available to GCE for this study included:

- Electronic files of ore lodes, proposed development and preliminary mine design by Broken Hill Mines
- As built survey data
- Diamond drill hole data (not including rock mass classification)

3 DATA COLLECTION

Rock mass classification was undertaken by GCE by logging the existing core

The following work was undertaken:

- Geotechnical core logging of selected intervals from 17 drillholes totalling 2856.2m of core;

4 DATA ANALYSIS

4.1 Data compilation and processing

The geotechnical data was assembled into geotechnical domains based on its proximity to the British Lode production areas and the pillar between the production areas and the surface footprint. The following geotechnical domains were assigned to the data:

- HW (rock between 0 and 15m from hangingwall)
- ORE
- FW (rock between 0 and 15m from footwall

Data intersecting planned development was collated in a separate domain (DEV). Remaining data that did not directly influence the mining areas was grouped in a domain named HOST.

The following process was undertaken by GCE to calculate Q values for the geotechnical domains:

- The geological model and drillhole traces were used to identify the downhole depth intercepts for hangingwall, ore and footwall contacts and planned decline/access infrastructure contacts;
- Valid structural defect orientations were processed to obtain the number and orientation of main defect sets in the database;
- Q and Q' values were calculated for each of the intervals logged in the individual drillholes. The data from all the drillholes was compiled to allow the geotechnical domaining of the data;
- The resulting Q values for each domain were compiled and statistics for length weighted Q means and quartiles were calculated as inputs to the empirical Matthews stope stability analysis.

Table 1 presents the list of drillholes logged and downhole intervals.

Table 1 List of drillholes used in geotechnical analysis

Hole ID	From (m)	To (m)	Total (m)
MLDD4677	0	264.7	264.7
MLDD4678	0	249.6	249.6
MLDD4679	0	240	240
MLDD4682	0	225.7	225.7
MLDD4683	0	261	261
MLDD4684	160	215	55
MLDD4685	136	221	85
MLDD4723	0	179	179
MLDD4724	105	154	49
MLDD4726	102	148	46
MLDD4729	0	181.9	181.9
MLDD4730	0	192	192
MLDD4754	169	219	50
MLDD4755	0	177.4	177.4

5 GEOLOGICAL SETTING

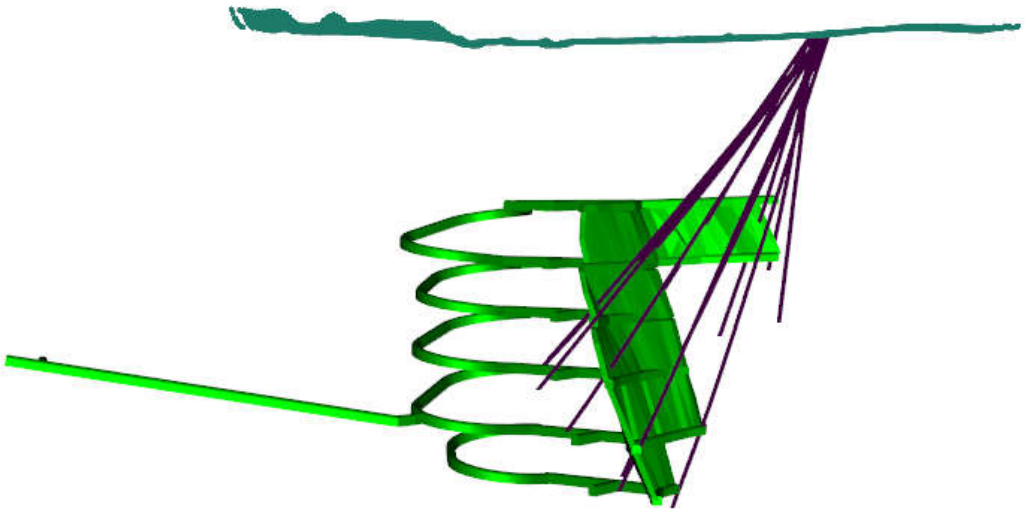
5.1 Geology

The principal rock unit in the mine sequence stratigraphy at Rasp is the Hores Gneiss. The unit is described as a mainly garnet bearing quartzo-feldspathic gneiss. Locally the unit includes medium to fine grained Potosi Gneiss. The Potosi Gneiss comprises politic and psammitic metasediments with persistent quartz-gahnite, garnet-quartz and quartz-garnet (lode) rocks. The Potosi Gneiss rock types form the dominant

host rocks for capital infrastructure development mining at Rasp; these units are generally competent and strong.

Figure 1 shows the location of the British orebody and the diamond drill holes utilised for data collection.

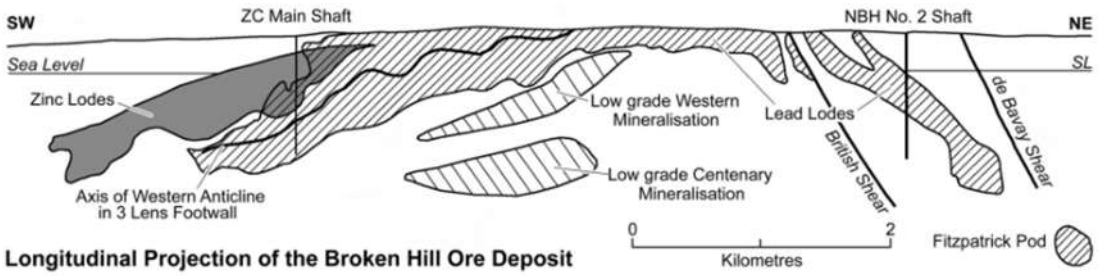
Figure 1 British orebody and diamond drill holes used for the assessment.



5.2 Major Structure

The dominant geological structure that impacts the ground conditions in the vicinity of the British orebody development is a regional fault known as the British Shear. The British Shear offsets the orebody by 325m due to sinistral movement which has in effect stretched the orebody along the shear and deforming the limbs of the orebody. Figure 2 shows the regional location and extent of the British Shear.

Figure 2 Regional location of the British Shear



Grades and gangue minerals of the Broken Hill Lodes (after Haydon and McConachy 1987)

The position of the British Shear with respect to the proposed design is shown in Figure 3. GCE are unable to validate the shear wireframe as there is no information regarding the interpretation of the wireframe or the dataset used. The current logging dataset requires further interpretation to more accurately identify

the development and planned stoping areas that may be affected by poor ground conditions associated with the shear.

Figure 3 Interpretation of the British Shear

The width and physical characteristics of the shear and fault zones were collected during the logging program. Twenty five fault and shear zones ranging from 1 to 4.8 metres in width were recorded in the logging. (Table 2).

Table 2 Shear zones identified from logging

Hole ID	Interval From (m)	Interval To (m)	Length	Weathering	Strength	RQD (%)	Geotech Domain
MLDD4677	108.2	109.4	1.2	FR	0.25	10	HOST
MLDD4678	149.5	151.8	2.3	FR	25	10	ORE
MLDD4678	160.3	164.2	3.9	FR	5	15	FW
MLDD4682	121.5	124	2.5	SW	0.25	16	HW
MLDD4683	199	200	1	SW	5	10	HOST
MLDD4683	128.4	129.5	1.1	FR	5	11	HOST
MLDD4683	155.4	156.8	1.4	FR	5	10	HW
MLDD4724	124	125.6	1.6	FR	50	10	HW
MLDD4724	120	122.2	2.2	FR	1	10	HW
MLDD4726	125	130	5	FR	25	11	ORE
MLDD4726	135.4	136.4	1	FR	5	10	FW
MLDD4729	96.5	102.5	6	FR	25	16	HOST
MLDD4729	121	129	8	FR	25	42	HOST
MLDD4729	140	141	1	FR	25	31	HOST
MLDD4729	142	145	3	FR	25	18	HOST
MLDD4729	149	150	1	FR	25	12	HOST
MLDD4729	31.5	32.7	1.2	FR	50	10	HW
MLDD4729	76.3	78.1	1.8	FR	50	32	HOST
MLDD4730	71	72	1	FR	50	75	HOST
MLDD4730	136	137.2	1.2	FR	5	10	FW
MLDD4730	139.8	141	1.2	FR	5	10	HOST
MLDD4754	198.9	203.7	4.8	FR	0.25	10	FW
MLDD4755	3.5	4.5	1	HW	5	63	HOST
MLDD4755	152	153	1	FR	50	93	HOST
MLDD4755	163	164	1	FR	50	97	HOST

Figure 4 shows the location of the shear zones recorded during the logging program.

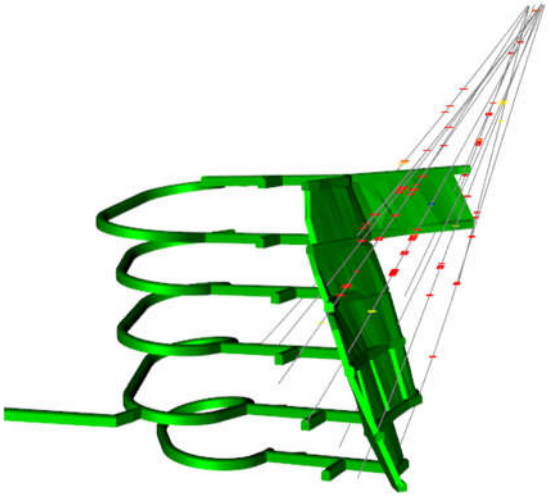
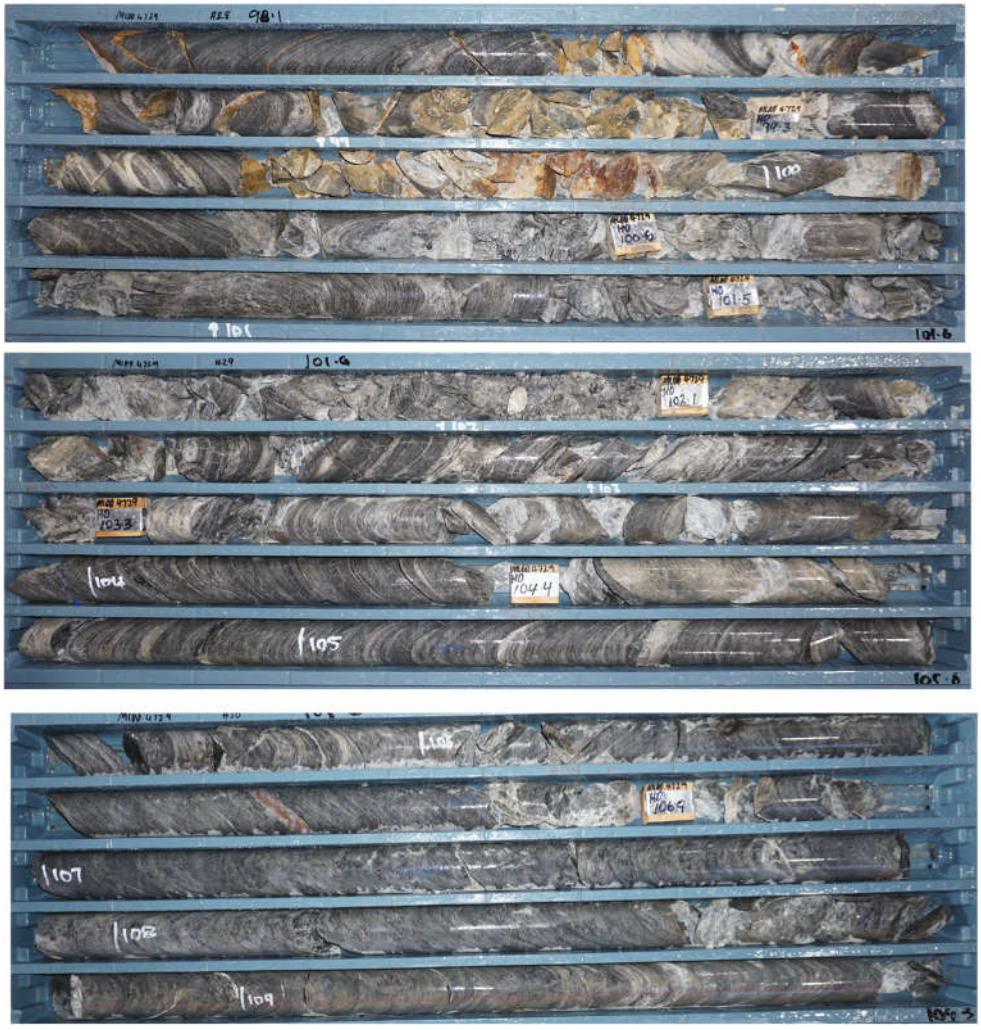


Figure 4 Fault or shear intercepts identified during geotechnical logging

Several significant shear intersections are located in the hangingwall and above the top level of the British design, these intervals are likely to be associated with the British Shear. Figure 5 shows an interval logged as a shear zone in the hangingwall of the British orebody.

Apart from the British shear, the faults and shear zones identified during the logging are generally not considered large enough in terms of width and continuity to contribute to large scale overbreak during development or production. Engineering and design controls will be required where more significant shear zones exist such as that shown in Figure 5 which may include rock reinforcement or isolating poor ground conditions using rock pillars. The distribution of the available geotechnical data throughout the British orebody is insufficient to discount the potential risk that development or stoping could intersect unknown structures with sufficient continuity to influence rock mass stability.

Figure 5 **MLDD 4729 Broken/faulted zone from 95.5m to 104m**



6 GEOTECHNICAL CONDITIONS

6.1 Geotechnical Domains

Geotechnical domains were assigned as detailed in Section 4.1.

6.2 Intact Rock Properties

Uniaxial Compressive Strength (UCS) testing, elastic properties and triaxial tests have conducted previously on samples selected from drill core.

A summary of the results is presented in Tables 3 and 4 with the full laboratory results in Appendix A.

The valid UCS tests indicate that the samples are generally within the strong category (R4) which correlates to the field assessments undertaken during the logging process.

BRITISH OREBODY GEOTECHNICAL ASSESSMENT

Table 3 Intact rock properties database

Lab Sample No	Borehole ID	Depth (m)		Lithology	UCS (MPa)	Wet density (t/m³)	Young's Modulus (GPa)	Poisson Ratio	Mode of Failure Recorded	Comments	Rupture Angle
		From	To								
14090346	ZLDD5002A	71.9	72.1	Pe	17.8	2.78	n/a	n/a	Shear	Appears to have failed on existing plane	
14090348	ZLDD5036	91.2	91.4	S	60.8	2.98	n/a	n/a	Conical	In intact rock	
14090349	ZLDD5017	86.9	87.15	LuQ	103	2.92	57.4	0.03	Shear	Partially in intact rock and on 30deg to core axis defect	
14090350	ZLDD5034	14	14.3	Pe	16	2.64	3.98	0.094	Shear	On defect at 45 deg to core axis	
14090351	ZLDD5034	29.3	29.6	GPm	98	2.95	n/a	n/a	Conical	In intact rock	
14090352	ZLDD5032	83.7	84	Gpe	83.1	3.22	n/a	n/a	Conical	In intact rock	
14090353	ZLDD5009	30.8	31	GPs	34.1	2.96	n/a	n/a	Shear	On foliation	
14090355	ZLDD5029	58.5	58.65	LuQ	35.2	3.33	n/a	n/a	Shear	On defect at 45 deg to core axis	
14090356	ZLDD5001	33.2	33.4	Pe	18.2	2.71	10.7	0.081	Shear	On pre-existing fabric	
14090357	ZLDD5001	70.4	70.6	Gpe	59.4	3.01	53.1	0.007	Shear	On defect at 30 deg to core axis	
14090358	ZLDD5006	90.3	90.5	Peg	88.4	2.68	n/a	n/a	Shear	Appears to be intact failure	
14090359	ZLDD5003	62	62.2	Pm	95.7	3.1	n/a	n/a	Conical	In intact rock	
25110473	MLDD4667	105.5	105.9	GPm	30.2	2.82	37.9	0.307	Shear	Sheared on defect	75
25110475	MLDD4685	59.6	59.8	Gpe	49.8	2.8	13.6	0.078	Shear	Sheared on defect	65
25110476	MLDD4685	8.2	8.5	GPm	79.6	2.97	28.3	0.094	Conical	In intact rock	85

Lab Sample No	Borehole ID	Depth (m)		Lithology	UCS (MPa)	Wet density (t/m³)	Young's Modulus (GPa)	Poisson Ratio	Mode of Failure Recorded	Comments	Rupture Angle
		From	To								
25110477	MLDD4685	125.7	126.1	GPm	37.4	2.77	52.8	0.176	Shear	Sheared on defect	65
25110478	MLDD4685	5.7	6	GPs	44.3	2.94	38.5	0.144	Conical	In intact rock	85
25110481	MLDD4723	66	66.3	GPm	42.1	2.81	8.13	0.296	Conical	In intact rock	65
25110482	MLDD4723	145.6	145.9	rGPe	108	2.79	119	0.232	Shear	Sheared on defect	65
25110484	MLDD4726	161.7	162	GPe	133	2.87	70.6	0.343	Shear	Sheared on defect	70
25110485	MLDD 4726	7.75	7.95	GPm	77.2	2.99	48.2	0.102	Shear	Sheared on defect	60
25110486	MLDD 4726	95.7	96	GPs	208	2.74	115	0.225	Conical	In intact rock	70

Table 4 **Rasp triaxial test results**

Lab Sample No	Borehole ID	Depth (m)		Lithology	Estimated Peak Envelope		Estimated Residual envelope	
		From	To		Friction Angle	Cohesion (MPa)	Friction Angle	Cohesion (MPa)
14090347	ZLDD5036	23.75	26	Gpe	48.3	10.47	13.3	9.19
14090354	ZLDD5022	62.9	63.15	Gpe	53.8	14.59	48.2	2.22
14090360	ZLDD5004	95.4	95.6	S	38.7	27.87	n/a	n/a
25110472	MLDD4667	63.6	63.9	GPe	49	15.09	45.9	2.6
25110479	MLDD46685	14.1	14.4	GPs	51.4	14.39	41.1	1.74
25110483	MLDD4723	163	163.3	rGPm	44.2	17.85	33.5	5.15

6.3 In situ Stress

Historically, the mechanisms for rock failure in development or stoping at Rasp are related to a combination of rock strength, geological structure and confinement loss following stope firings and extraction rather than intact rock failure or seismicity caused by elevated stress. In situ stress measurements have not been conducted at Rasp . The following assumptions for calculating the maximum principal stress (σ_1) was assumed to be a multiple of the overburden pressure, which was calculated using the formula:

$$\sigma 1 = 2.0(\rho\, g\, h)$$

ρ = 2.94 t/m^3 (average wet density from laboratory testing)

g = 9.81 m/s^2

h = depth below surface

As shown above, an approximation of the maximum principal stress (σ_1) was obtained by multiplying the vertical stress by a factor of 1.5, which is has been used in previous studies for the Western Mineralisation area. The estimated σ_1 at the base of the bench stoping area is approximated at 14MPa.

Mining of the nearby Western Mineralisation at the Rasp underground mine has reached depths of over 800 metres with extensive, large scale stoping activities completed without adverse consequences with respect to mining induced stress.

6.4 Rock Defect Analysis

BHM provided oriented structural data from three drillholes which was analysed to identify the orientation of the major defect trends using DIPS. Figure 6 shows a stereonet of the data set, and shows the major defect set orientations identified. This data could not be validated by GCE, it is recommended that representative data is collected from underground mapping.

Figure 6 British Lode defect analysis all data -

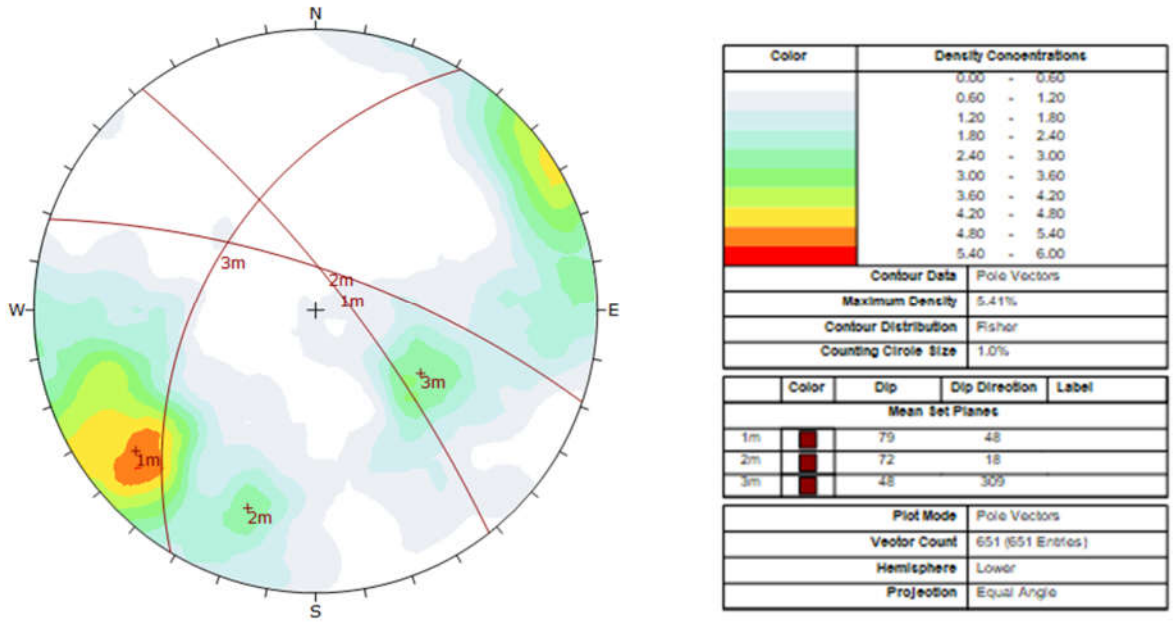


Table 5 presents a summary of the major defect sets identified in the structural assessment.

Table 5 Summary of major defect sets

Defect Set	Dip (deg)	Dip Direction (deg)	Comments
1	79	048	Steeply dipping set, dipping to the southeast
2	72	018	Steeply dipping set, dipping to the east
3	48	309	Minor set, moderately dipping, to the northeast

The core logging identified that the rock mass generally contains three joint sets, with approximately 50% of the intervals logged assessed to have 2 joint sets.

6.5 Rock Mass Quality (Q values)

Rock mass classification used the Tunnelling Quality Index (Q)[2]. The numerical value of the index Q varies on a logarithmic scale from 0.001 to 1000 and is defined as:

$$Q = \frac{RQD}{Jn} * \frac{Jr}{Ja} * \frac{Jw}{SRF}$$

Where:

RQD = Rock Quality Designation index (defined by Deere et al, 1967). RQD is defined as the percentage of intact core pieces longer than 100 mm in the total length of core. RQD is a directionally dependent parameter, and its value might change significantly, depending on the borehole orientation.

Jn = Joint set number. This refers to the number of joint sets identified in the section of core logged. The RQD/Jn parameter is an approximate representation of the block or particle size in the rock mass and logged values varied from 2 (one joint set) to 20 (crushed rock, earthlike). The majority of the data has a Jn of 2 (1 joint set) to Jn of 3 (1 set plus 1 random set).

Ja = Joint alteration number. This refers to the type and thickness of infill in the joint which affects its frictional characteristics. A high value of Ja denotes lower frictional strength of the joint. Ja values ranged from 0.75 (tightly healed, hard filling) to 16 (Thick gouge, low friction or swelling clay >5mm thick). Clay infill has been logged in approximately 4% of the downhole intervals.

Jr =Joint roughness number. This refers to the surface roughness of the joint. It is made up of two components, namely planarity of the surface and its roughness. The higher the Jr value, the higher the expected peak strength of the joint. The majority of defect surfaces were found to be smooth , and planar (Jr value of 1).

Jw = Joint water reduction. Jw is a measure of water pressure, which has an adverse effect on the shear strength of joints by reducing the normal effective stress. Water can also cause softening or wash clay infill from joints. Dry excavation or minor inflow (<5 l/m, Jw=1) has been assumed in the analysis.

SRF = Stress Reduction Factor. SRF is a measure of three parameters; loosening load in an excavation through shear zones and clay bearing rock, rock stress in competent rock and squeezing loads in plastic incompetent rock. The Jw/SRF quotient indicates the conditions of active stress around an excavation. The proposed development is relatively shallow at less than 100m below surface and results from intact rock testing indicate strong rocks. The SRF values relevant to weakness zones intersecting the excavation have been used. The SRF value range from a value of 1 to 2.5.

[2] Barton, N, Lien, R and Lunde, J, 1974 Analysis of rock mass quality and support practice in tunnelling and guide for estimation support requirements. NGI Internal Rept No 54206.

The Q parameters were used to calculate a Q value within each interval logged. The values were weighted by the length of the interval and 1st quartile and weighted means computed. The findings from the rock mass classification are presented in Table 6.

Table 6 Summary Q values for B lode geotechnical domains

Geotechnical Domain	Total length assessed (m)	1st Quartile Q Value	Weighted Mean Q Value	Q value range	Expected Q class
HW	128	5.2	28.6	0-200	Good
ORE	55	4.5	26.3	0-100	Good
FW	129.2	2.9	227.7	0-150	Good
HOST	1755.0	5.9	38.2	0-400	Good to Very Good

Ground conditions for development and stoping are expected to be fair to good with localised intersections of poor zones.

7 Structure

The width and physical characteristics of 25 shear and fault zones were recorded during the logging program (Table 2).

Table 7 Shear zones identified from logging

Hole ID	Interval From (m)	Interval To (m)	Length	Weathering	Strength	RQD (%)	Geotech Domain
MLDD4677	108.2	109.4	1.2	FR	0.25	10	HOST
MLDD4678	149.5	151.8	2.3	FR	25	10	ORE
MLDD4678	160.3	164.2	3.9	FR	5	15	FW
MLDD4682	121.5	124	2.5	SW	0.25	16	HW
MLDD4683	199	200	1	SW	5	10	HOST
MLDD4683	128.4	129.5	1.1	FR	5	11	HOST
MLDD4683	155.4	156.8	1.4	FR	5	10	HW
MLDD4724	124	125.6	1.6	FR	50	10	HW
MLDD4724	120	122.2	2.2	FR	1	10	HW
MLDD4726	125	130	5	FR	25	11	ORE
MLDD4726	135.4	136.4	1	FR	5	10	FW
MLDD4729	96.5	102.5	6	FR	25	16	HOST
MLDD4729	121	129	8	FR	25	42	HOST
MLDD4729	140	141	1	FR	25	31	HOST
MLDD4729	142	145	3	FR	25	18	HOST
MLDD4729	149	150	1	FR	25	12	HOST
MLDD4729	31.5	32.7	1.2	FR	50	10	HW
MLDD4729	76.3	78.1	1.8	FR	50	32	HOST
MLDD4730	71	72	1	FR	50	75	HOST
MLDD4730	136	137.2	1.2	FR	5	10	FW
MLDD4730	139.8	141	1.2	FR	5	10	HOST
MLDD4754	198.9	203.7	4.8	FR	0.25	10	FW
MLDD4755	3.5	4.5	1	HW	5	63	HOST
MLDD4755	152	153	1	FR	50	93	HOST
MLDD4755	163	164	1	FR	50	97	HOST

Figure 7 shows the location of the shear zones recorded during the logging program.

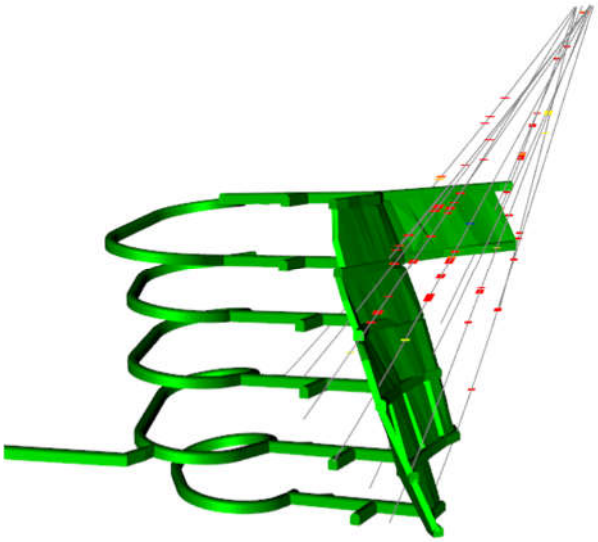
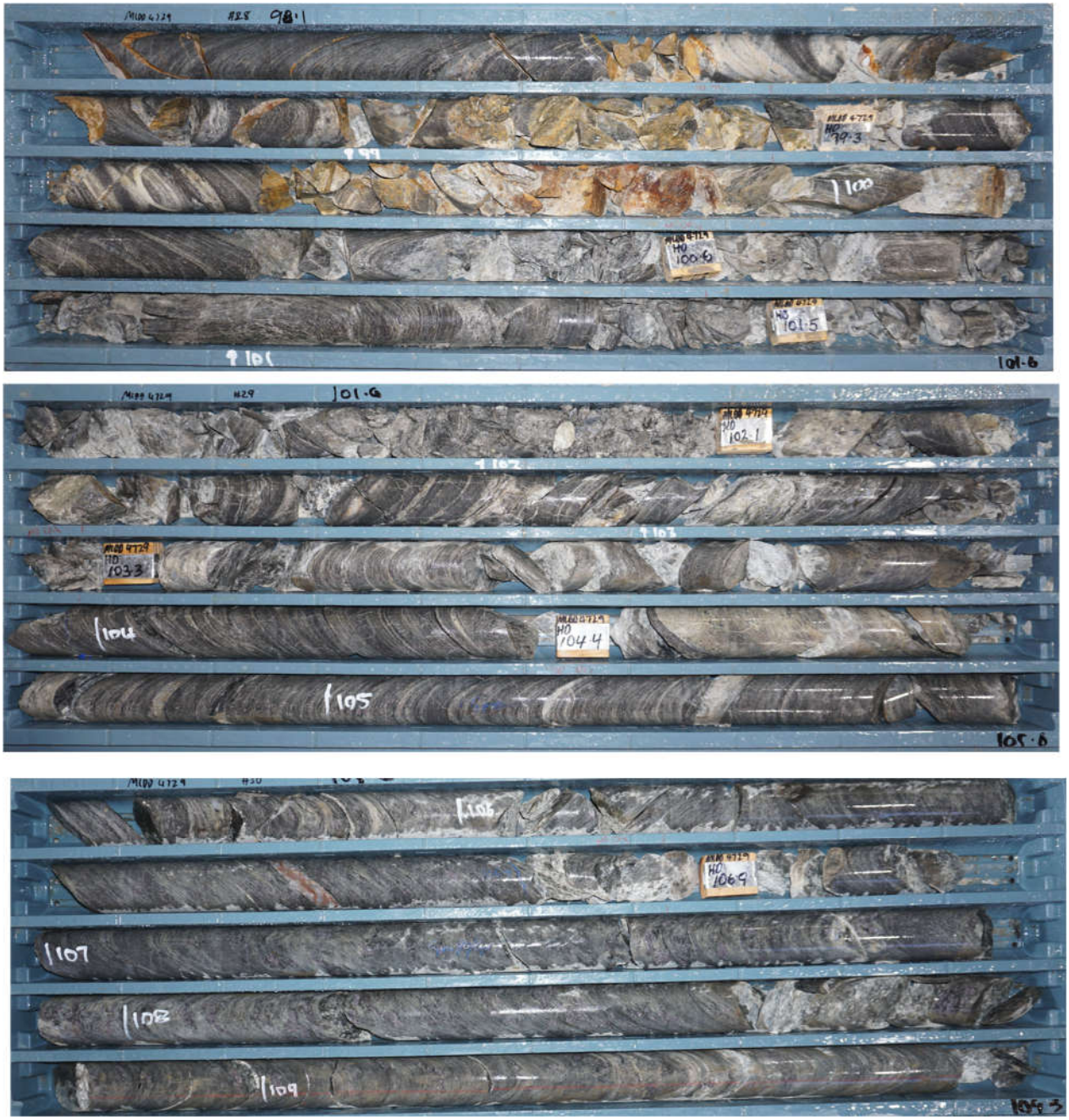


Figure 7 Fault or shear intercepts identified during geotechnical logging

Several significant shear intersections (>1m) are located in the hangingwall and above the top level of the British design, these intervals are likely to be associated with the British Shear and will require special consideration with respect to data capture and interpretation during development mining and stope design. Other shear zones greater than 1m in width were identified during the rock mass classification process, the structures are not continuous on a scale that would result in large scale failure it intersected during development or production.

Figure 4 shows an interval logged as a shear zone in the hangingwall of the British orebody.

Figure 8 MLDD 4729 Broken/faulted zone from 95.5m to 104m

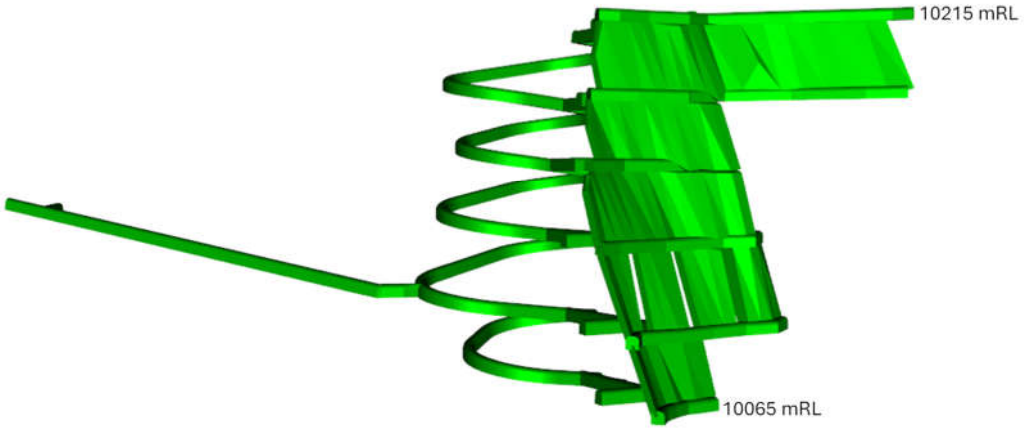


8 MINING DEVELOPMENT AND MINING METHOD

Conventional, downhole benching is proposed for the extraction of the British ore body

The proposed mine design is illustrated in Figure 9

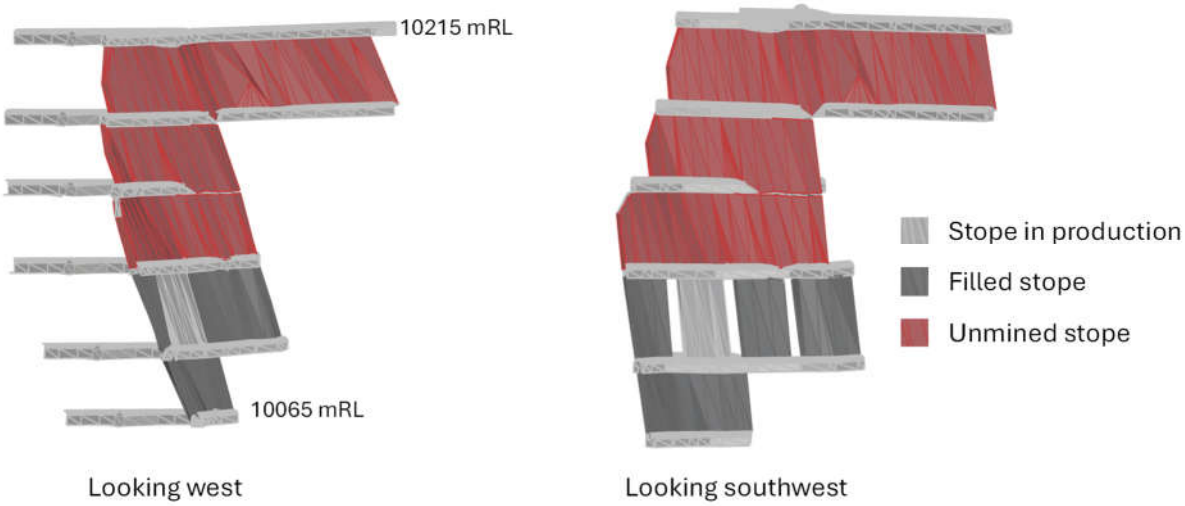
Figure 9 Proposed mining development for the British orebody, looking west



9 PRODUCTION SEQUENCE

The development design for the downhole benching stoping block allows for a single access to the production front limiting the sequencing options to a single stope advance towards the access crosscut. Figure 10 illustrates the development and stoping configuration for the benching stoping block.

Figure 10 Plan view – benching and cut and fill stope development design



The production sequence will be dependent on the availability of mine fill as each stope orebody must be filled immediately following completion. The strike length of the hangingwall will dictate the overall size and stability of each stope. Rib pillars between the downhole benching stopes are not strictly required if fill is placed in the completed stope in a timely manner. Rib pillars may be required if weak ground conditions or a large scale geological structure is encountered. The minimum strike length for reliable rib pillar performance for open stoping is 5 metres in the experience of GCE but is contingent on good mining practices, particularly slot design and firing sequences designed to protect the rib pillar. Larger pillars may be required to control more extensive, poor ground conditions.

10 GEOTECHNICAL ASSESSMENT

10.1 Stope Stability Assessment

Stope stability assessment has been conducted using the Modified Stability Graph method suggested by Potvin (1988) and detailed in Hutchinson and Diederichs (1996)[3]. The method involves the determination of the Modified Stability Number N' which is compared to a database of stope stability performance to derive a Hydraulic Radius (HR). HR is defined as the area of a stope surface divided by the perimeter of the face.

N' is based on Q' values (after Barton et al, 1974) and is defined as:

$$N' = Q' \times A \times B \times C$$

Where:`

$$Q' = \frac{RQD}{Jn} \times \frac{Jr}{Ja}$$

Factor A = ratio of maximum induced compressive stress to Uniaxial Compressive Strength (UCS). A mean UCS value of 88 MPa has been used in the analysis based on the valid UCS results presented in Table 2. The maximum induced stress was estimated using an assumed stress: depth relationship.

Factor B = is a measure of the relative orientation of dominant jointing with respect to the excavation surface. The joints most critical to hangingwall and footwall stability are parallel to sub parallel to the stoping surface (defect set 1, 79°/048°). For crown stability, moderately to flat dipping joints are unfavourable for stability (defect set 3, 48°/309°).

Factor C = is a measure of the influence of gravity on the stability of the face being considered.

Figure 11presents the historical database of unsupported open stopes used to assess resultant N' value and is used to derive the stable unsupported Hydraulic Radius (HR) for the British orebody.

[3] Hutchinson, J D and Diederichs, M S. 1996. Cablebolting in Underground Mines, BiTech Publishers Ltd, British Colombia, Canada

Figure 11 **Modified Stability Graph Method chart showing database of unsupported open stopes (Hutchinson and Diederichs (1996)**

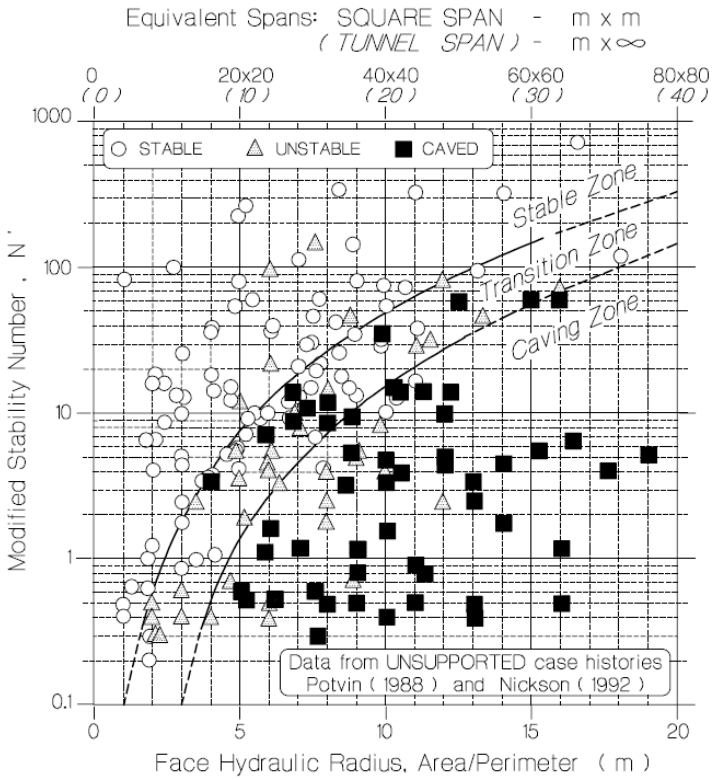


Table 7 presents the maximum unsupported strike spans for 30m level intervals for weighted mean, rock mass conditions for the hangingwall and footwall. The hangingwall is considered the most critical and limiting surface for stope stability. The main influence on hangingwall stability is the influence of defects with orientation sub parallel to the hangingwall surface and weak joint contacts close to the hangingwall surface.

Table 8 **Unsupported stope stability results for HW and FW, weighted mean rock mass conditions**

Stope Wall	Depth	Modified Stability Numbers					Hydraulic radius	Wall dimension
	RL(m)	Q' (mean)	A	B	C	N'	Unsupported stable zone	Max strike span (m)
HW	10065	28.6	0.6	0.2	3.1	10.3	5.6	24
FW	10065	26.2	0.5	0.2	3.1	8.3	5.2	22

The analysis indicates that unsupported hangingwall spans are predicted to be stable at 22m on the deepest level of the current British ore body design.

10.1.1 Draw-Point Support

The requirements for enhanced draw point support will require an assessment of local ground conditions. The presence of major structure that may require localised cable bolt support.

10.2 Crown Pillar Stability Assessment

10.2.1 Empirical Stability Assessment

The stability of the crown pillar between the ground surface and the production stopes was assessed using the empirical method derived by Carter[4] in 1989. The 'scaled span' database includes over 300 case studies.

A crown pillar should remain stable over the life of the mine. A crown pillar has two main functions, it should protect surface land users (infrastructure), and it should protect the mine from inflows of water, soil and rock.

Studies by Carter and others have demonstrated that crown stability is depended primarily on the crown geometry. The *Scaled Crown Span* as formulated by Carter is as follows:

$$C_s = S\left\{\frac{\gamma}{t(1+S_R)(1-0.4cos\theta)}\right\}^{0.5}$$

Where: S=crown pillar span (m)

γ=specific weight of the rock mass (kN/m^3)

S_R= span ratio = S/L (crown pillar span/crown pillar strike length)

θ=dip of the orebody or foliation (degrees)

The analysis of the case studies allowed the comparison of failed versus stable cases which resulted in the development of the "Critical Span S_c" limit line shown on (**Error! Reference source not found.**). The limit line defines the widest stable scaled span value for unsupported ground with relation to Q:

$$S_c = 3.3 \times Q^{0.43} \times sinh^{0.0016}(Q)$$

Where: S_c=Critical Span (m)

Q=NGI-Q value

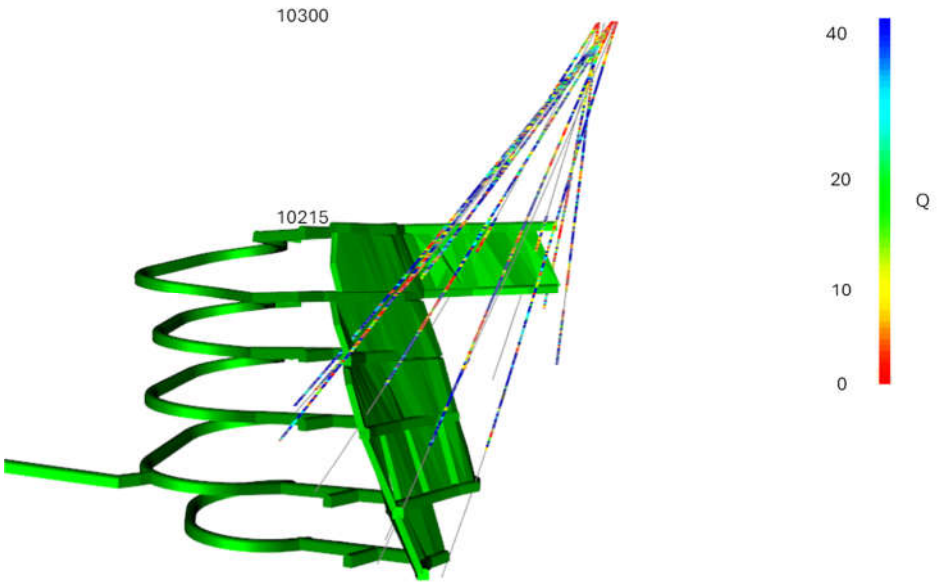
The Scaled Span method is applied by comparing the scaled crown pillar span (C_s) to the critical span value for the controlling rock mass. When the scaled crown pillar span is less than the critical span, the crown pillar would be considered stable.

Rock mass data from the upper British production level (10225mRL) to the surface (10300m RL was used to estimate the stability of the crown pillar using the Carter method. Figure 12 shows the location of the drillholes used in the analysis.

The resulting 1st quartile Q value and weighted mean of the above data set are 5.4 and 30 respectively. The empirical crown pillar assessment represents the results of the assessment within this range of Q values.

[4] Carter, T.J. 2000. An Update on the Scaled Span Concept for Dimensioning Surface Crown Pillars for New and Abandoned Mine Workings. Proc. 4th North American Rock Mechanics Conf., Seattle, pp. 465-472

Figure 12 Location of drillholes used for crown stability assessment



The parameters used to calculate the Scaled Crown Span for the British orebody crown are:

S=20 m

L=25m (maximum 1 stope open along strike)

γ=2.6(kN/m^3)

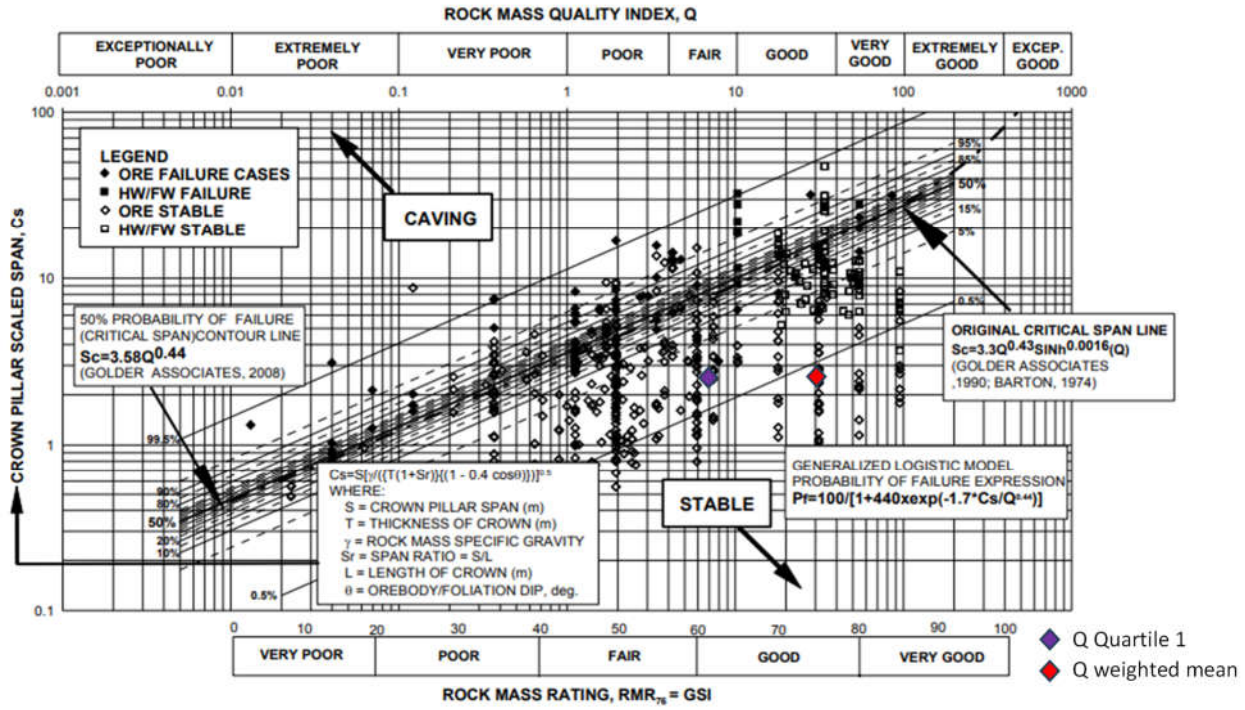
θ=80 degree

Q (Quartile 1) = 5.4

Q (Weighted mean) = 30

The resulting Scaled Crown Span (C_s=2.4m) and the range in ground quality that could be expected within the crown pillar are presented in Figure 13.

Figure 13 British orebody Updated Crown Pillar Scaled Span plotted on the summary of crown-pillar case records (Carter)



The empirical crown pillar assessment indicates that the crown between the planned longhole stope and the ground surface should be stable with a probability of failure of less than 0.5% for expected rock mass conditions.

Section 9 describes additional controls planned by BHM to limit disturbance to the crown pillar and surface infrastructure.

10.2.2 Numerical Stability Assessment

The stability of the crown pillar between the ground surface and the British orebody bench stoping area was undertaken utilising numerical modelling techniques. A simple, 2 dimensional, non-linear numerical model of the British orebody mining geometry was created using the Rocscience program, Phase2.

The purpose of the numerical modelling exercise was to gain an appreciation of the potential interaction between the British orebody mining operation and surface infrastructure. The main area of interest is the potential for vertical displacement or settlement within the crown pillar following stope extraction.

Limitations of the model

Numerical models are limited by the information available to construct the model. The model constructed to investigate potential interaction between the British orebody bench stoping area and the ground surface incorporates the following assumptions;

- An absence of significant geotechnical structure linking the stoping area to the rock mass.
- The rock mass is homogenous between the stoping area and the surface.

Constitutive model

The model assumed a homogenous rock mass with strength properties derived from the recent testing program undertaken using rock samples taken from the Rasp database. Backfill was introduced into the model following each stope to accurately depict the production schedule. The function of backfill is to provide passive support, limiting hangingwall failure which may lead to large scale stope overbreak.

A Mohr Coulomb failure criterion was adopted for the model with the following parameters

Elastic Properties

Young's Modulus	30000 MPa
Poisson's Ratio	0.2

Strength Parameters

Tensile strength	5 MPa
Friction angle (peak)	45 degrees
Friction angle (residual)	25 degrees
Cohesion (peak)	10.5 MPa
Cohesion (residual)	1 MPa

Loading Conditions

Loading conditions assigned to the model were the same as those assigned to the empirical stope stability assessment in Section 6.3.

Model Geometry

The mining geometry sequence is represented in the numerical model as shown in Figure 14

Figure 14 Model geometry

Model Sequence

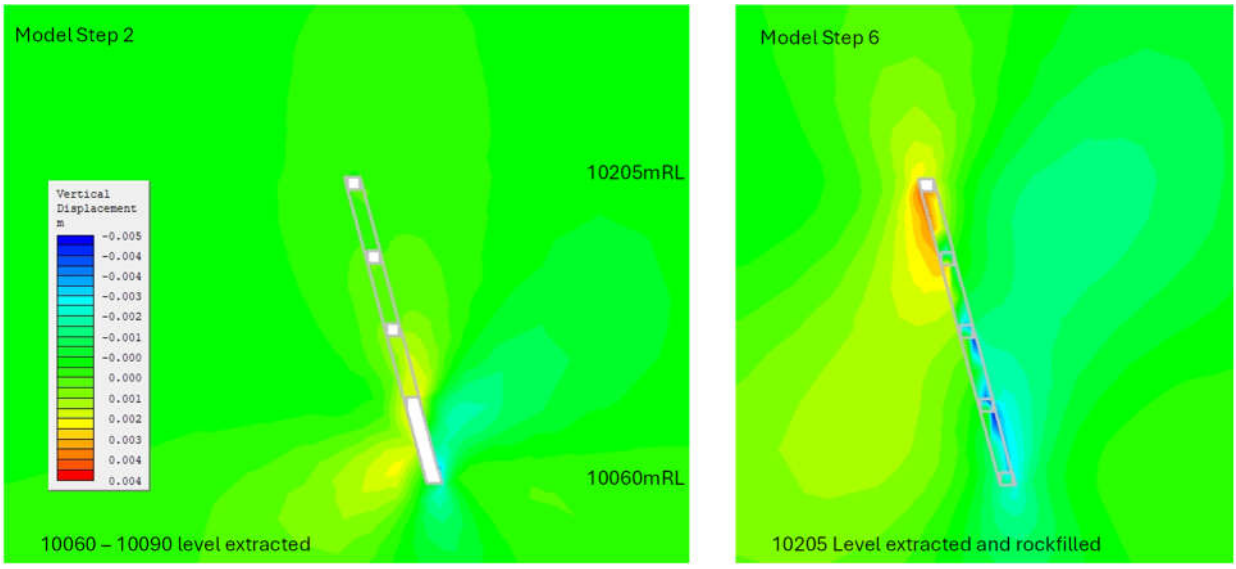
The sequence consists of the following steps;

1. Excavate development drives
2. Excavate each stoping level starting at the lowest level
3. Place fill in each level before commencing the level above.

Model Results

The results of the numerical modelling exercise for mining steps 2 and 6 are shown in Figure 15. The contours represent the magnitude of vertical displacement predicted by the model. Figure 11 does not show the stoping area in relation to the surface which is shown in Figure 12

Figure 15 Numerical model results – Vertical displacement (m)



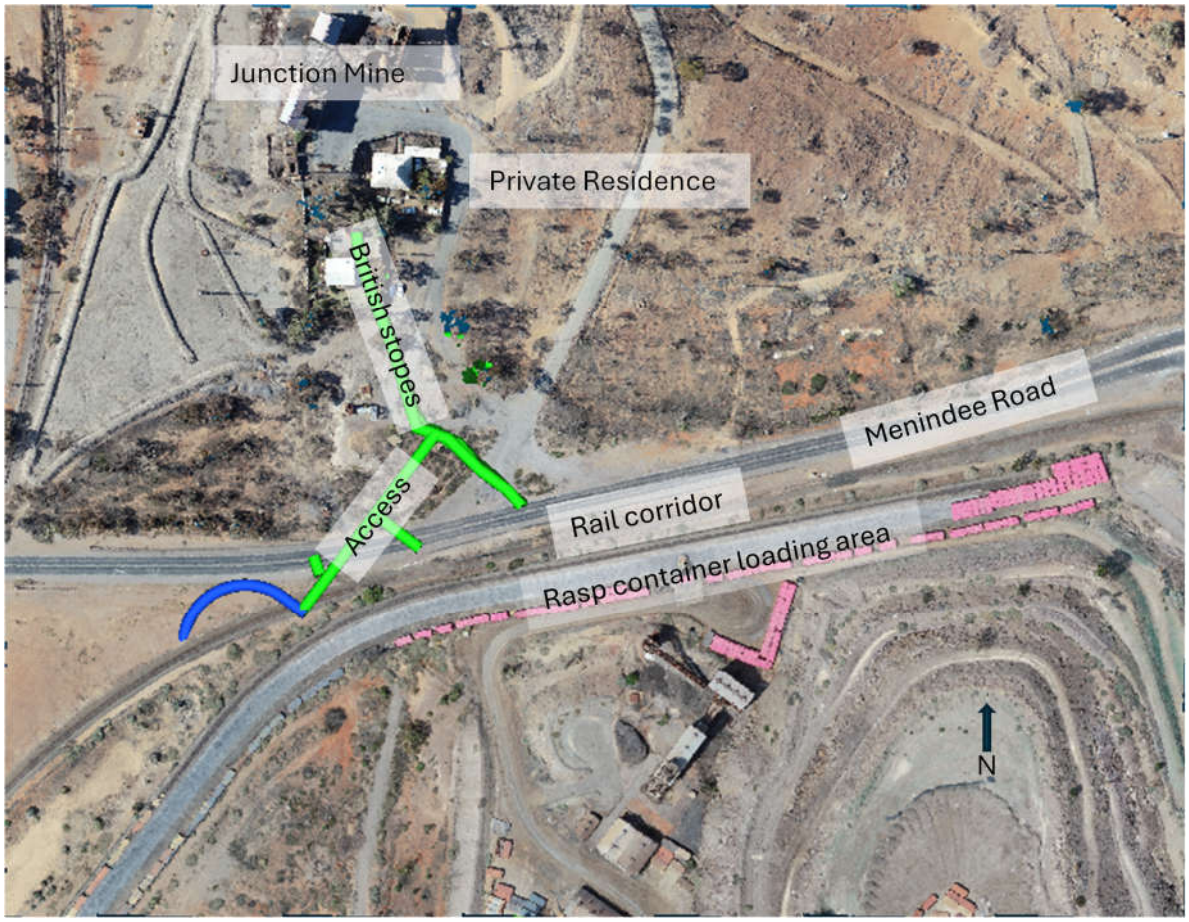
The maximum magnitude of vertical settlement predicted by the model is 2mm after extraction is complete at the hangingwall interface of the lower lift of the bench stopes. The modelling predicts no vertical displacement at the ground surface following complete extraction.

Based on the results of the model, interaction between the British orebody production areas and the surface is unlikely. The risk of a subsidence event occurring is reduced by filling each stope after the completion of production and limiting the number of stopes in production at any one time.

11 SURFACE INFRASTRUCTURE

The top level of British orebody is situated approximately 80 meters below major infrastructure including a main railway corridor. Figure 16 shows the spatial relationship between the British orebody and the surface infrastructure.

Figure 16 Spatial relationship between British orebody and surface infrastructure (Plan view).



11.1 Subsidence

A geotechnical risk to the British orebody extraction is uncontrolled stope wall failure which may propagate towards surface infrastructure. In most cases, stope failures which may be significant with respect to mine production, do not impact nearby infrastructure if engineering controls are employed. The progression of stope failures can be accelerated by the stope surface intersecting weak ground or a major geological structure, or the mining of unsupported spans greater in extent than can be naturally supported by the rockmass

Significant stope wall failure is not expected during the extraction of the downhole bench stoping section of the British orebody provided that the rockmass conditions encountered during mining are similar to the conditions expected from this assessment. To limit the potential for surface infrastructure disturbance, GCE recommend the top development level for the production sequences is reinforced with an engineered reinforcement system to increase long term stability of the British production area after production is completed.

11.2 Controls for stope stability

Without appropriate controls in place, damage to surface infrastructure above the British orebody stoping block is remote but theoretically possible. From a mine design and operating perspective, preventing large scale stope wall failure will be contingent on the following factors;

- Data collection and detailed characterisation of ground conditions in the hangingwall and crown of the ore lens.
- Sufficient and ongoing testing of representative samples of the rock mass to characterise the engineering properties.
- Ensuring that stope production spans do not exceed stable dimensions.
- Ensure that ongoing monitoring and back analysis of the performance of stope spans is carried out.
- Ensure that stope performance data is recorded and applied to stope design.
- Ensure that a complete strategy to extract each stope is in place that incorporates appropriate infrastructure to fill each stope after the completion of extraction.
- Ensure that ground support designs are appropriate to control stope overbreak.
- Ensure ground control strategies are in place to protect the crown between surface infrastructure and the planned downhole benching stoping block.
- Subsidence monitoring points are installed near surface infrastructure, and the data is recorded and analysed on a regular basis.

11.3 Blast vibration

BHM manage blast vibration at the Rasp mine according to the following documents;

- BHO-GDL-MIN-001 Mine Planning and Design Guidelines
- BHO-PLN-ENV-009 Noise and Blast Management Plan

A blast vibration assessment for the proposed British production operations was completed by Fromble Corp Pty LTD in September 2025.

The report confirmed that, based on available site monitoring data and the minimum distances from the proposed Mod 13 stopes to identified sensitive locations, production blasting should be achievable for most production activities in compliance with anticipated ground vibration limits which should be validated by monitored vibration outcomes when operations commence. For a limited number of production blasts, specific engineering and design measures may be required to remain within compliance limits.

12 GEOTECHNICAL RISKS

The prominent geotechnical risks identified in this assessment are as follows:

- Surface infrastructure damage instigated by possible large scale stope failure in the benching stoping section of the orebody.
- Structurally controlled failures from hangingwall and crown resulting in smaller stope spans than predicted by the empirical stability analysis;
- Sterilisation of ore through stope failure. Hangingwall or crown failures have the potential to sterilise ore in the vicinity of the failure. Ongoing collection and review of geological and geotechnical conditions and stope performance data is recommended;
- Failure of pillars due to presence of unfavourable defects in the pillar;
- Variability in geotechnical parameters used in the stope analysis. There are inherent risks in extrapolating drillhole point data to generalised rock mass conditions across domains. Whilst the host rock mass and the mineralised lenses could be described as close to homogeneous, there are

localised variations in rock mass conditions. Assumptions are also made with regards to the presence of the critical defect set within the rock masses forming the stope walls.

13 RECOMMENDED FURTHER GEOTECHNICAL WORK

- Collection and interpretation of structural defect data and geotechnical data is necessary as mining progresses in the British orebody. This will allow validation of design parameters and timely input to the mine design process;
- Develop a program to monitor stope stability and potential surface subsidence. The program should be implemented both before and during the extraction of the British orebody;
- Increase the size and quality of the geotechnical database for the British orebody by collecting geotechnical information from future resource drilling programs;

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APPENDIX A

Rasp Rock test database

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

ASTM D7012

Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

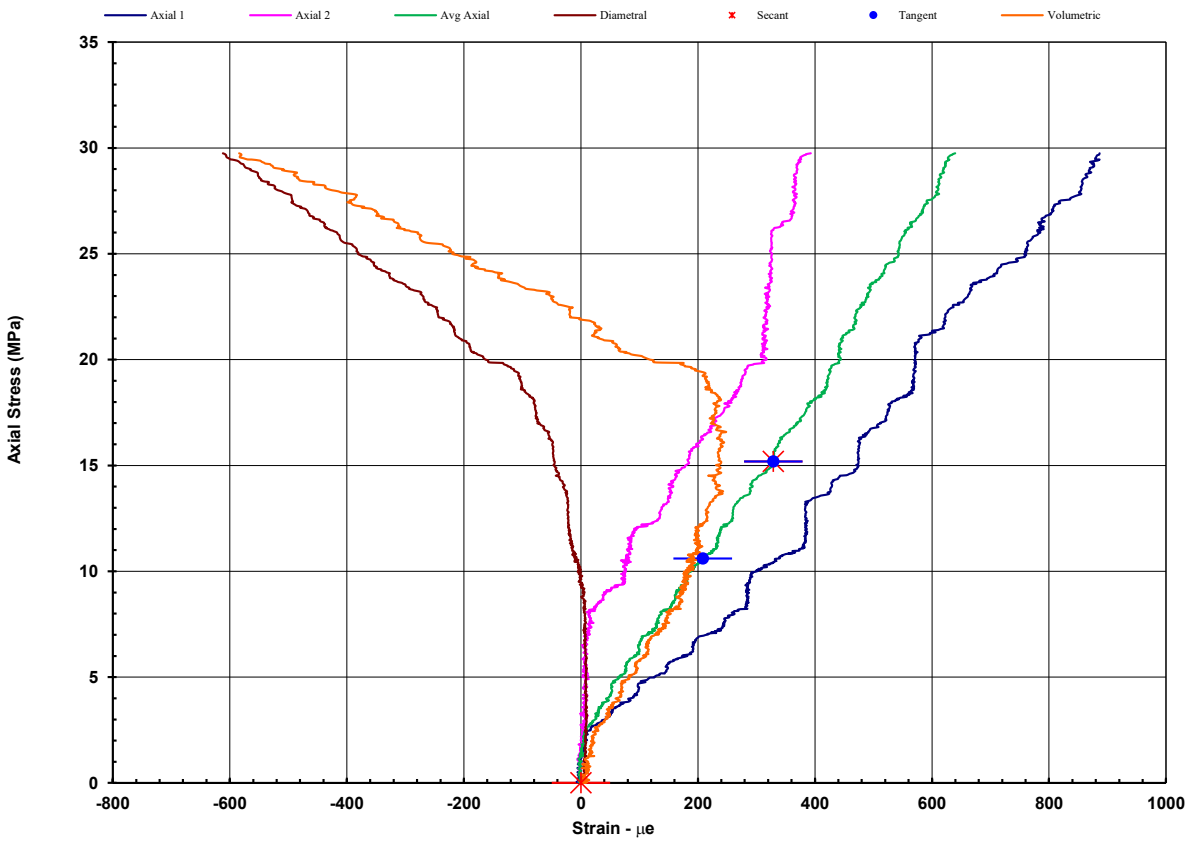
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110473-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	10/12/2025
		Report Date	11/12/2025
Project	MOD13		
Client ID	S3	**Bore Hole** MLDD4667	**Depth (m)** 105.5 - 105.9
Description	GPm		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 30.2 MPa

Young's Modulus	Poisson Ratio	
Tangent 37.9 GPa	0.307	from 35 % to 50 % of Max UCS
Secant 46.2 GPa	0.136	from 0 % to 50 % of Max UCS

Axial Stress vs Strain Plots



Notes/Remarks:

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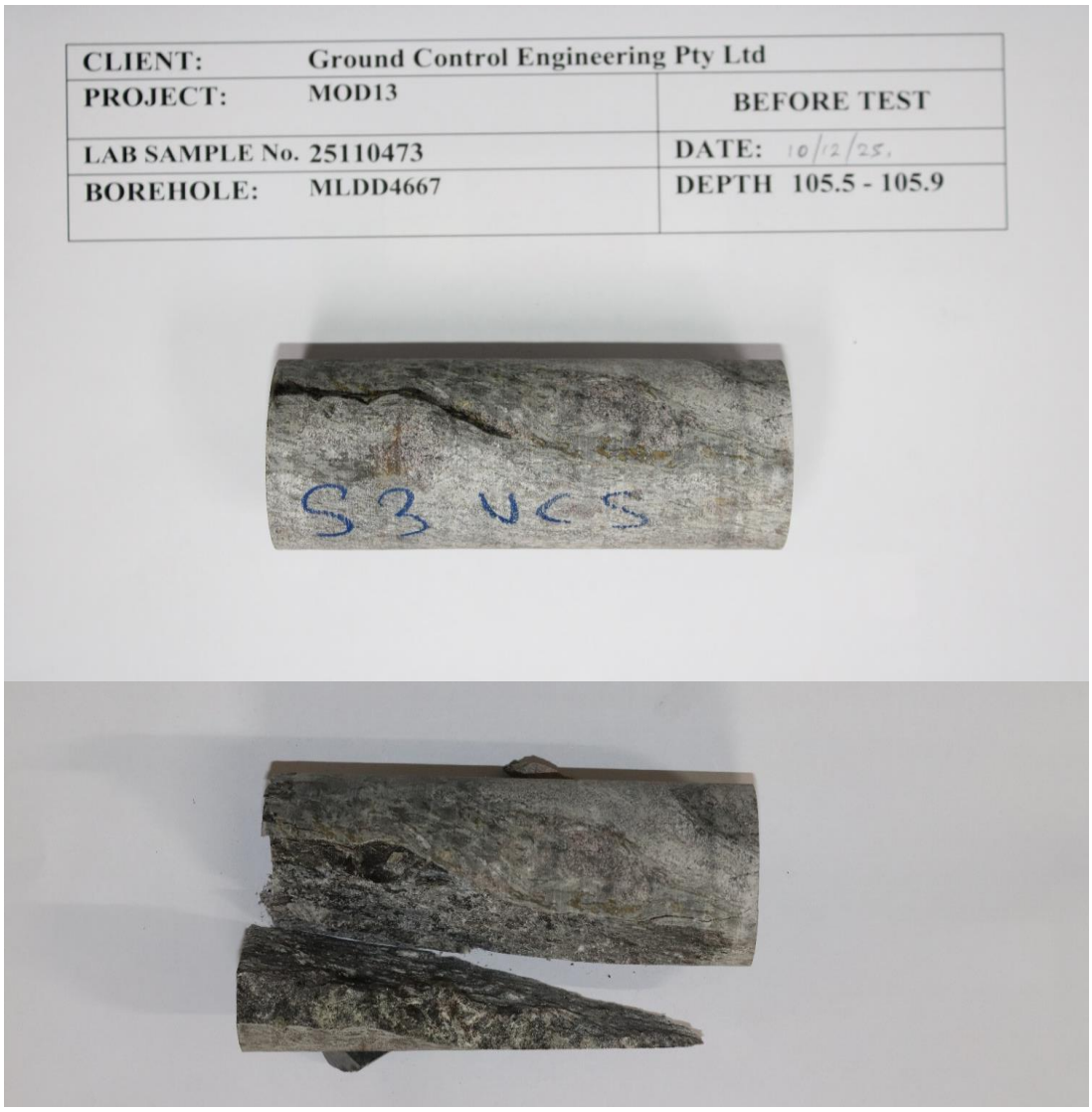
Client	Ground Control Engineering Pty Ltd	**Report No.**	25110473-RMOD

Average Sample Diameter (mm)	50.4	Moisture Content (%)	0.3
Sample Height (mm)	124.3	Wet Density (t/m^3)	2.82
Duration of Test (min)	7.99	Dry Density (t/m^3)	2.81
Rate of Loading (MPa/min)	3.78	Bedding (°)	Nil
Mode of Failure	Shear and Defect	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	75		



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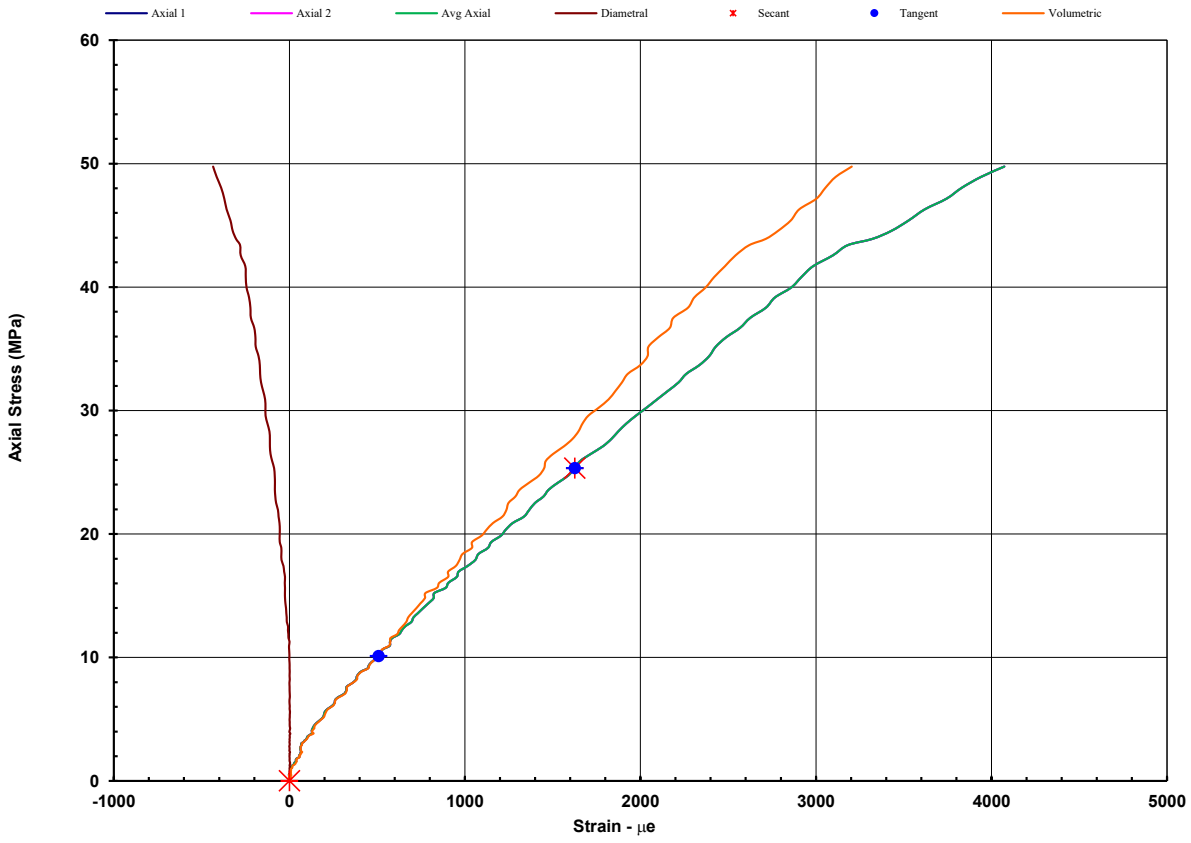
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110475-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	26/11/2025
		Report Date	10/12/2025
Project	MOD13		
Client ID	S5	**Bore Hole** MLDD4685	**Depth (m)** 59.6 - 59.8
Description	GPe		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 49.8 MPa

	Young's Modulus	Poisson Ratio	
Tangent	13.6 GPa	0.078	from 20 % to 50 % of Max UCS
Secant	15.6 GPa	0.054	from 0 % to 50 % of Max UCS

Axial Stress vs Strain Plots



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Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110475-RMOD

Average Sample Diameter (mm)	50.3	Moisture Content (%)	0.3
Sample Height (mm)	108.8	Wet Density (t/m^3)	2.80
Duration of Test (min)	2.22	Dry Density (t/m^3)	2.79
Rate of Loading (MPa/min)	22.41	Bedding (°)	Nil
Mode of Failure	Shear and Defect	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	65		

Notes/Remarks:

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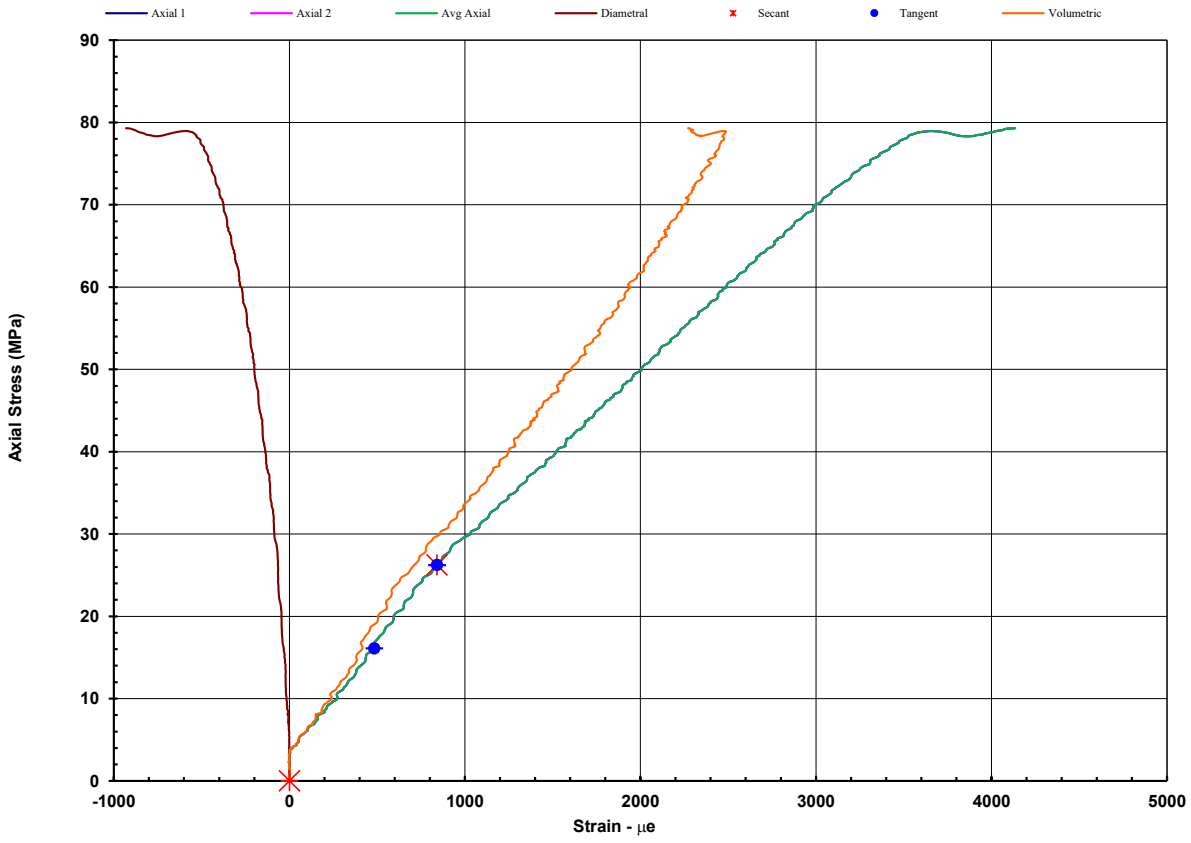
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110476-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	26/11/2025
		Report Date	10/12/2025
Project	MOD13		
Client ID	S6	**Bore Hole** MLDD4685	**Depth (m)** 8.2 - 8.5
Description	GPm		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 79.3 MPa

	Young's Modulus	Poisson Ratio	
Tangent	28.3 GPa	0.094	from 20 % to 33 % of Max UCS
Secant	31.2 GPa	0.078	from 0 % to 33 % of Max UCS

Axial Stress vs Strain Plots



Notes/Remarks:

The length to diameter ratio falls outside the test method limits of 2.0:1 to 2.5:1.

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Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110476-RMOD

Average Sample Diameter (mm)	61.8	Moisture Content (%)	0.2
Sample Height (mm)	116.7	Wet Density (t/m^3)	2.97
Duration of Test (min)	4.04	Dry Density (t/m^3)	2.97
Rate of Loading (MPa/min)	19.63	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	85		

Notes/Remarks:

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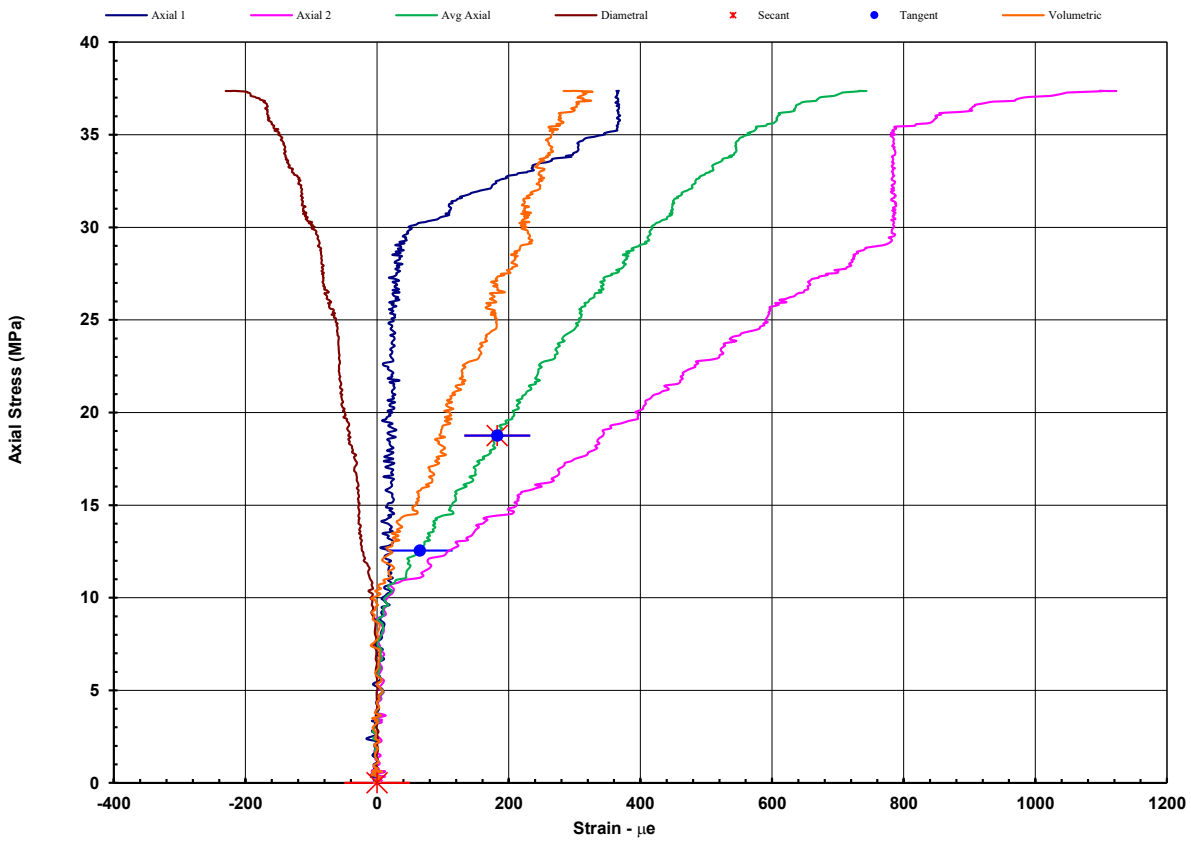
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110477-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	26/11/2025
		Report Date	11/12/2025
Project	MOD13		
Client ID	S7	**Bore Hole** MLDD4685	**Depth (m)** 125.7 - 126.1
Description	GPm		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 37.4 MPa

Young's Modulus	Poisson Ratio	
Tangent 52.8 GPa	0.176	from 33 % to 50 % of Max UCS
Secant 103 GPa	0.240	from 0 % to 50 % of Max UCS

Axial Stress vs Strain Plots



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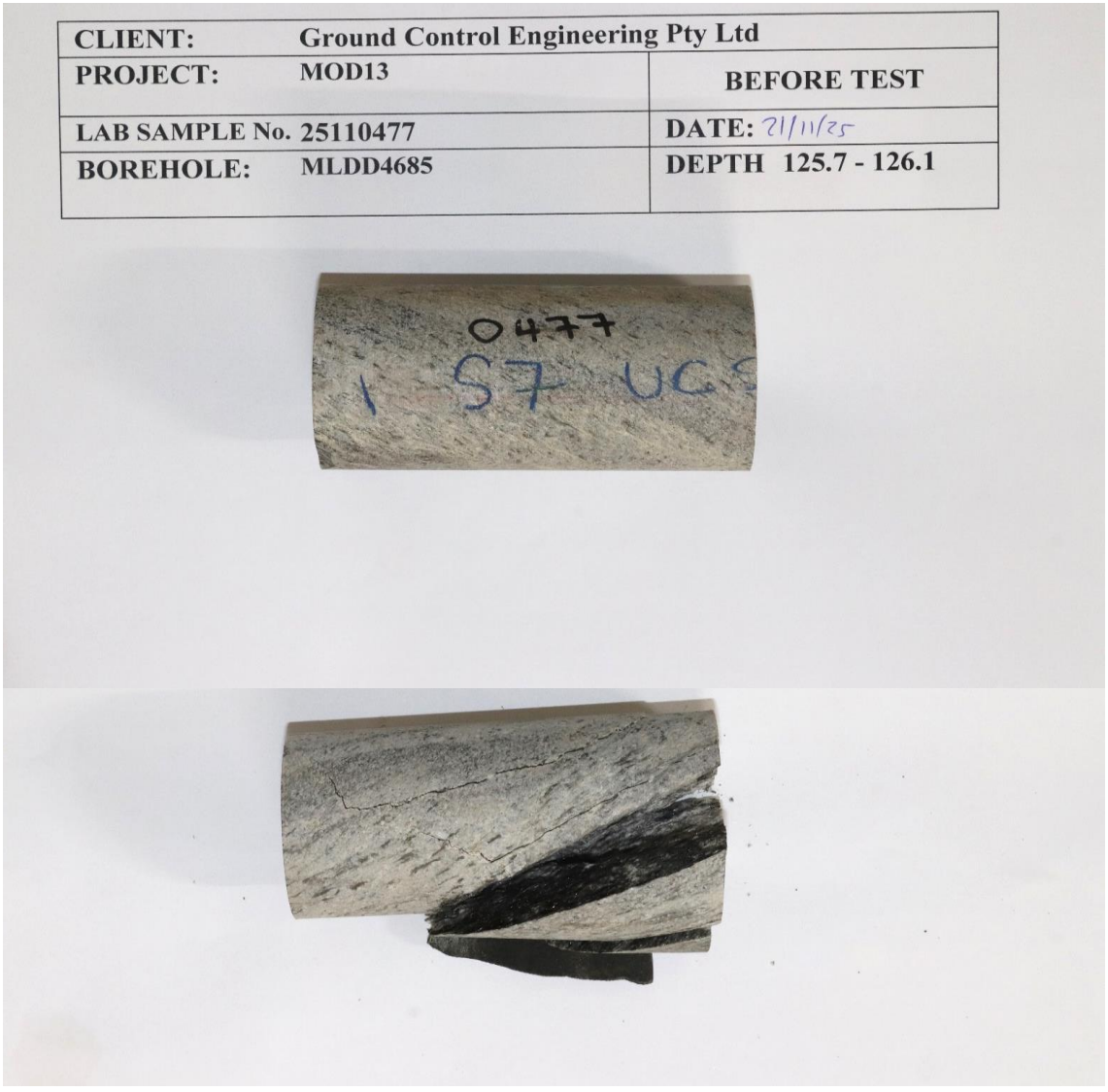
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110477-RMOD

Average Sample Diameter (mm)	50.4	Moisture Content (%)	0.1
Sample Height (mm)	108.7	Wet Density (t/m^3)	2.77
Duration of Test (min)	3.98	Dry Density (t/m^3)	2.77
Rate of Loading (MPa/min)	9.40	Bedding (°)	Nil
Mode of Failure	Shear	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	65		



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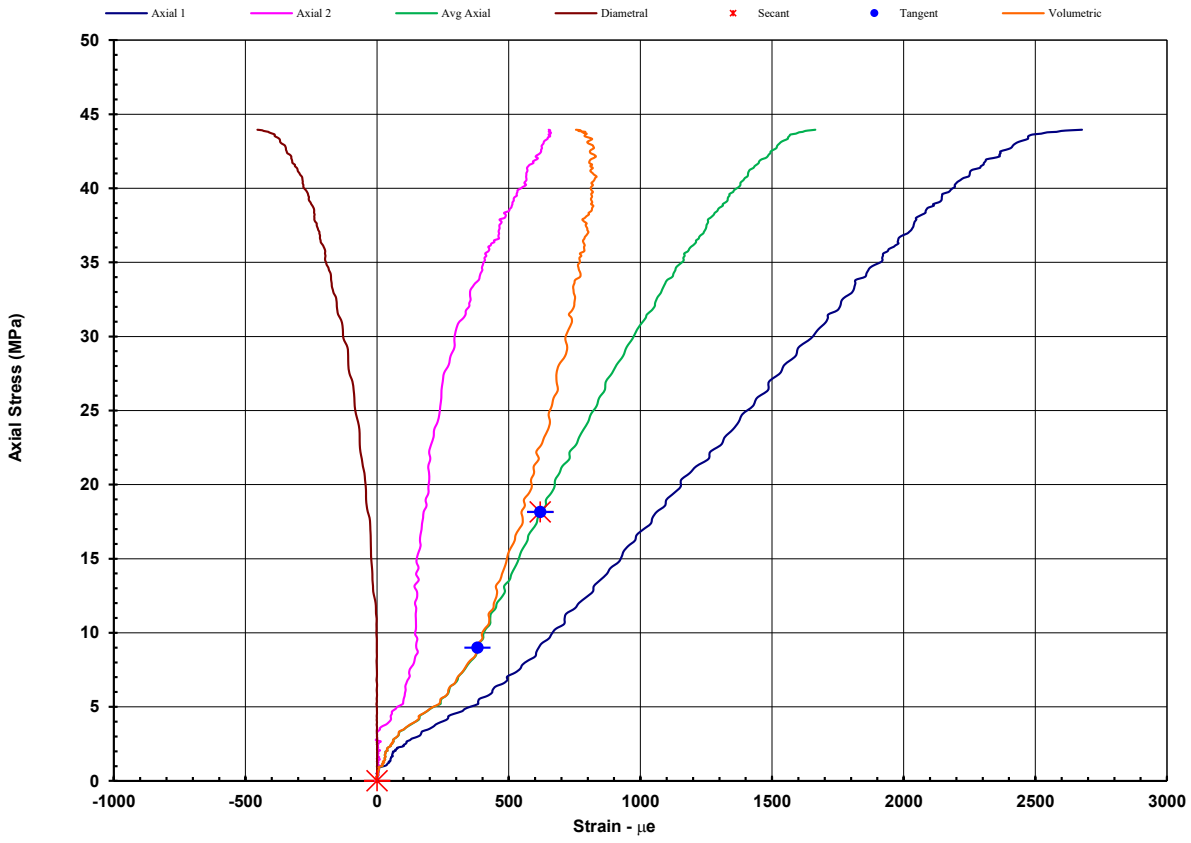
Client	Ground Control Engineering Pty Ltd	**Report No.**	25110478-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	26/11/2025
		Report Date	11/12/2025
Project	MOD13		
Client ID	S8	**Bore Hole** MLDD4685	**Depth (m)** 5.7 - 6
Description	GPs		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 44.3 MPa

	Young's Modulus	Poisson Ratio	
Tangent	38.5 GPa	0.144	from 20 % to 41 % of Max UCS
Secant	29.3 GPa	0.057	from 0 % to 41 % of Max UCS

Axial Stress vs Strain Plots



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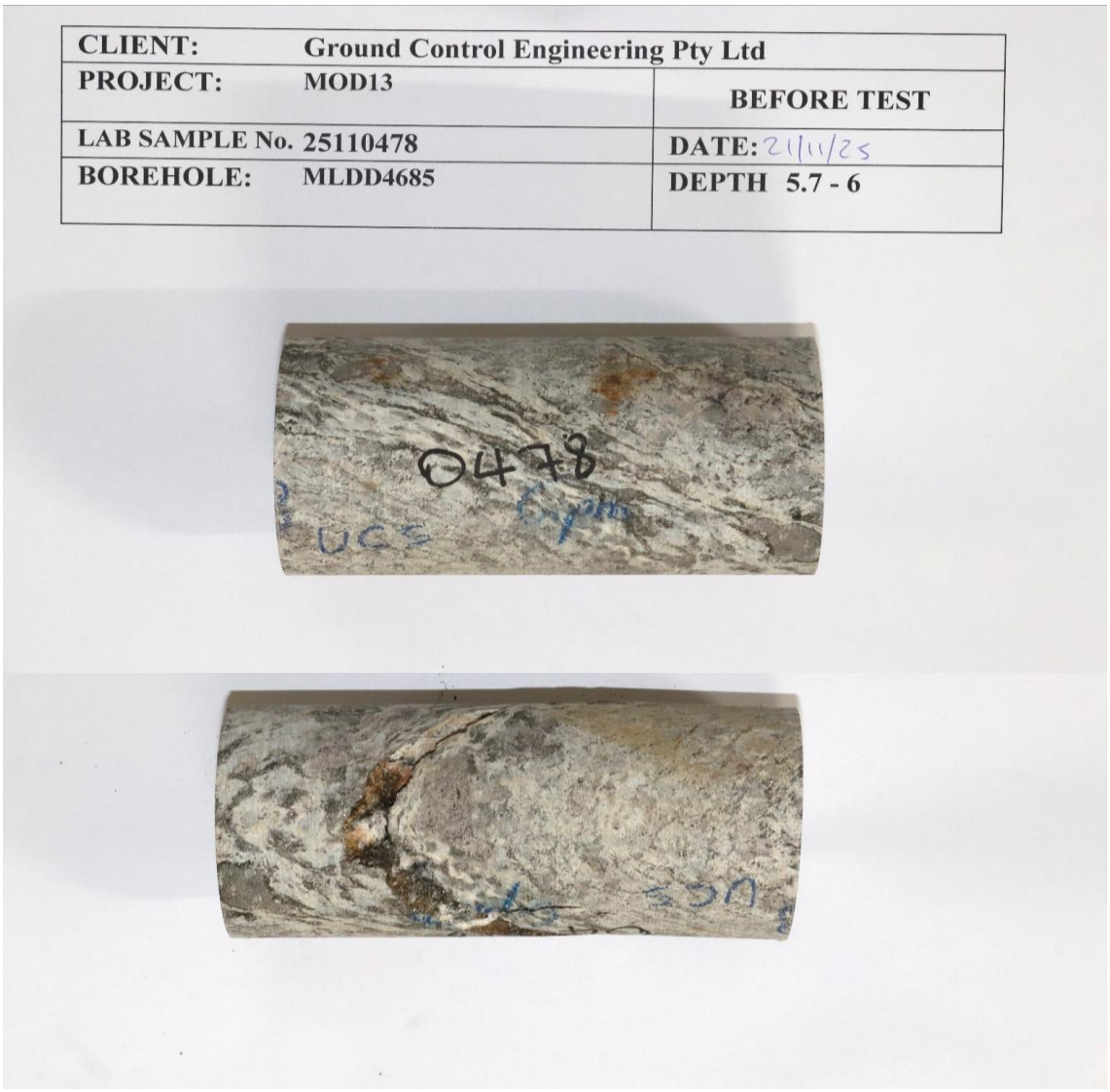
Client	Ground Control Engineering Pty Ltd	**Report No.**	25110478-RMOD

Average Sample Diameter (mm)	63.5	Moisture Content (%)	0.1
Sample Height (mm)	131.4	Wet Density (t/m^3)	2.94
Duration of Test (min)	2.84	Dry Density (t/m^3)	2.94
Rate of Loading (MPa/min)	15.59	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	85		



Notes/Remarks:

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

ASTM D7012

Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

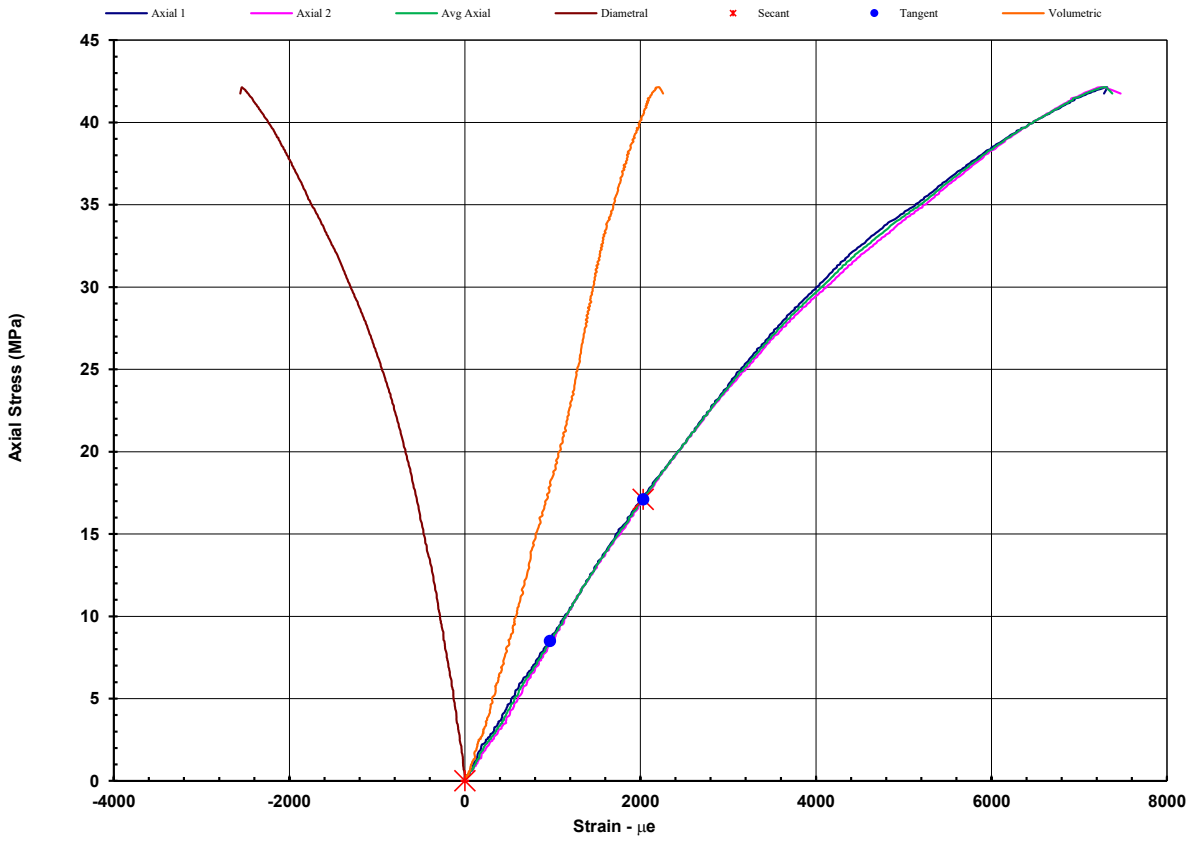
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110481-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	27/11/2025
		Report Date	5/12/2025
Project	MOD13		
Client ID	S11	**Bore Hole**	MLDD4723
		Depth (m)	66 - 66.3
Description	GPm		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 42.1 MPa

	Young's Modulus	Poisson Ratio	
Tangent	8.13 GPa	0.296	from 20 % to 40 % of Max UCS
Secant	8.43 GPa	0.270	from 0 % to 40 % of Max UCS

Axial Stress vs Strain Plots



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Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110481-RMOD

Average Sample Diameter (mm)	50.4	Moisture Content (%)	0.1
Sample Height (mm)	108.7	Wet Density (t/m^3)	2.81
Duration of Test (min)	4.43	Dry Density (t/m^3)	2.80
Rate of Loading (MPa/min)	9.50	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	65		

Notes/Remarks:

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

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Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

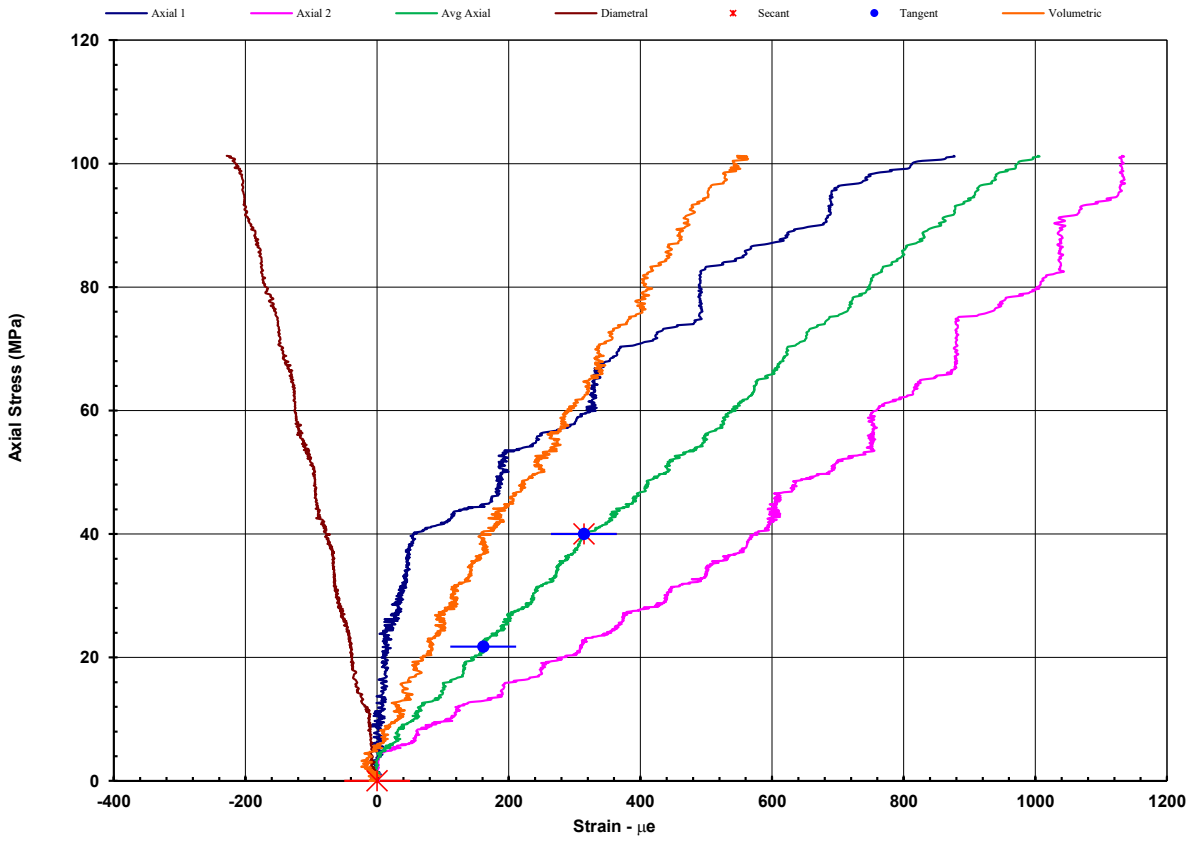
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110482-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	27/11/2025
		Report Date	5/12/2025
Project	MOD13		
Client ID	S12	**Bore Hole** MLDD4723	**Depth (m)** 145.6 - 145.9
Description	rGPe		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 108 MPa

Young's Modulus	Poisson Ratio	
Tangent 119 GPa	0.232	from 20 % to 37 % of Max UCS
Secant 127 GPa	0.244	from 0 % to 37 % of Max UCS

Axial Stress vs Strain Plots



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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

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Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110482-RMOD

Average Sample Diameter (mm)	50.5	Moisture Content (%)	0.1
Sample Height (mm)	111.8	Wet Density (t/m^3)	2.79
Duration of Test (min)	8.23	Dry Density (t/m^3)	2.79
Rate of Loading (MPa/min)	13.17	Bedding (°)	Nil
Mode of Failure	Shear and Defect	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	65		

Notes/Remarks:

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

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Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

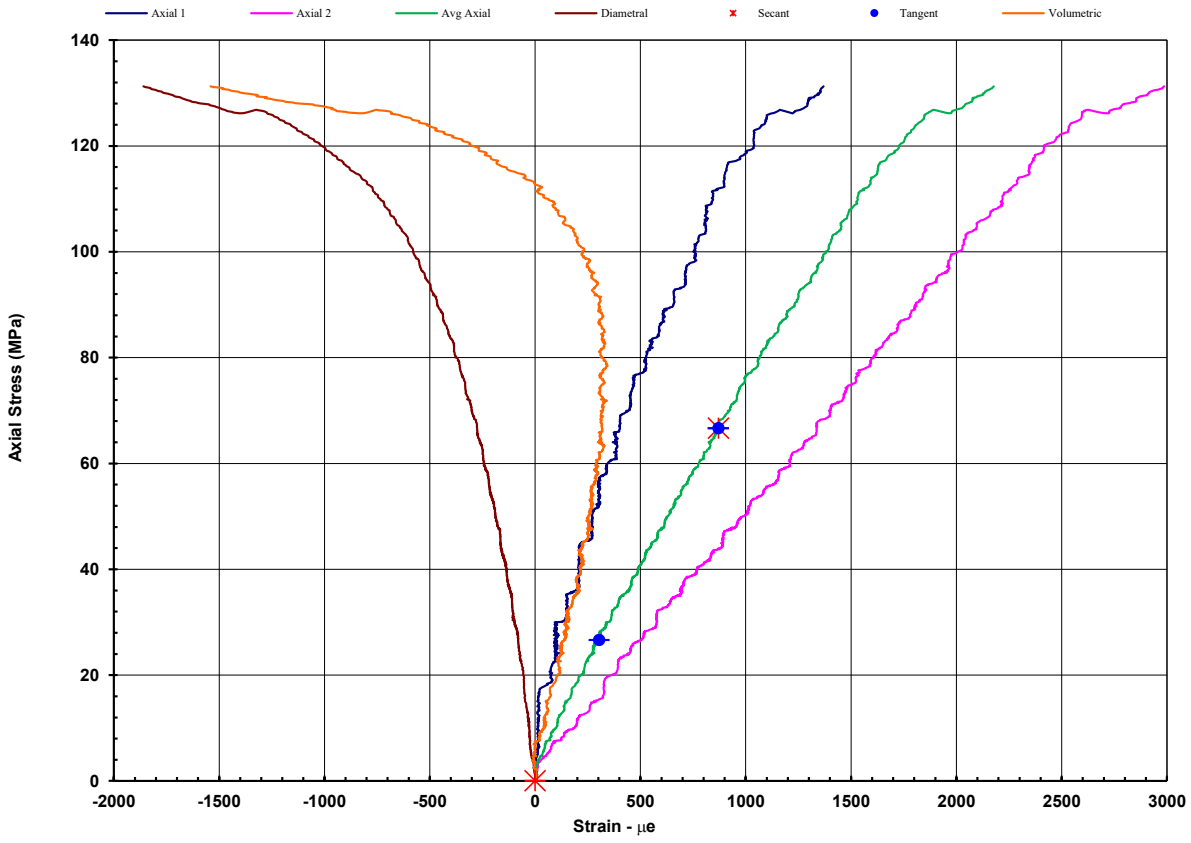
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110484-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	27/11/2025
		Report Date	5/12/2025
Project	MOD13		
Client ID	S14	**Bore Hole**	MLDD 4726
		Depth (m)	161.7 - 162
Description	GPe		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 133 MPa

	Young's Modulus	Poisson Ratio	
Tangent	70.6 GPa	0.343	from 20 % to 50 % of Max UCS
Secant	76.6 GPa	0.316	from 0 % to 50 % of Max UCS

Axial Stress vs Strain Plots



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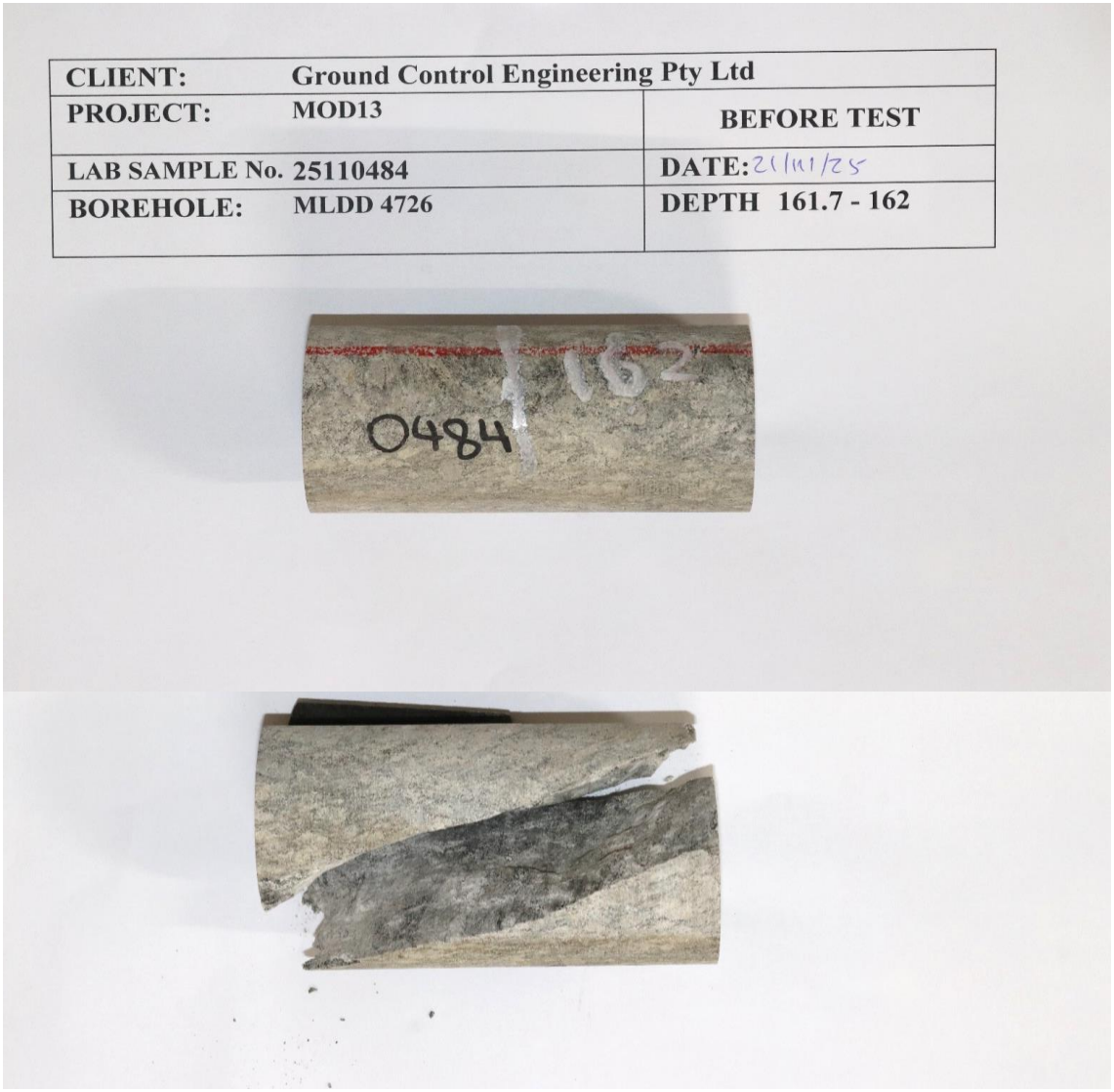
Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110484-RMOD

Average Sample Diameter (mm)	50.5	Moisture Content (%)	0.0
Sample Height (mm)	110.0	Wet Density (t/m^3)	2.87
Duration of Test (min)	11.89	Dry Density (t/m^3)	2.87
Rate of Loading (MPa/min)	11.20	Bedding (°)	Nil
Mode of Failure	Shear	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	70		



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Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

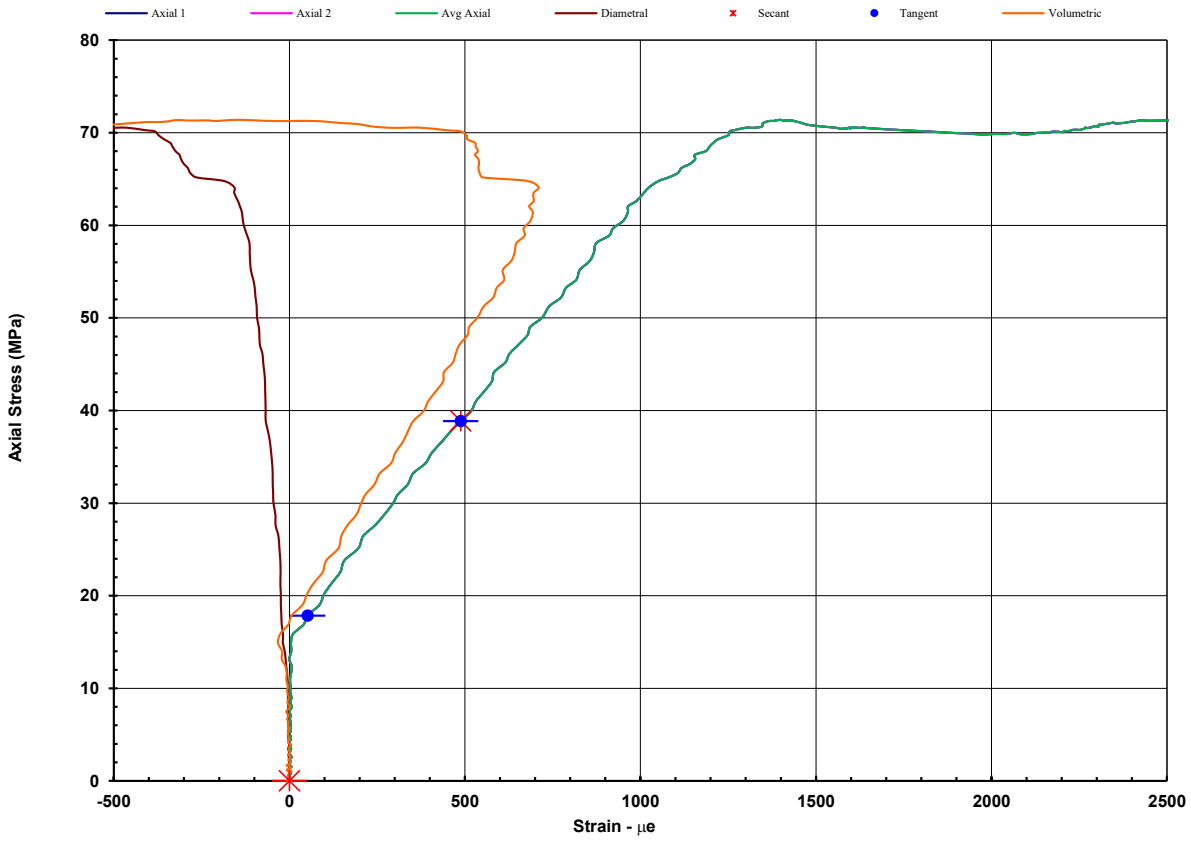
Client	Ground Control Engineering Pty Ltd	**Report No.**	25110485-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	25/11/2025
		Report Date	26/11/2025

Project	MOD13				
Client ID	S15	**Bore Hole**	MLDD 4726	**Depth (m)**	7.75 - 7.95
Description	GPm				
Sample Type	Single Individual Rock Core Specimen				

Uniaxial Compressive Strength 77.2 MPa

	Young's Modulus	Poisson Ratio	
Tangent	48.2 GPa	0.102	from 22 % to 50 % of Max UCS
Secant	79.6 GPa	0.138	from 0 % to 50 % of Max UCS

Axial Stress vs Strain Plots



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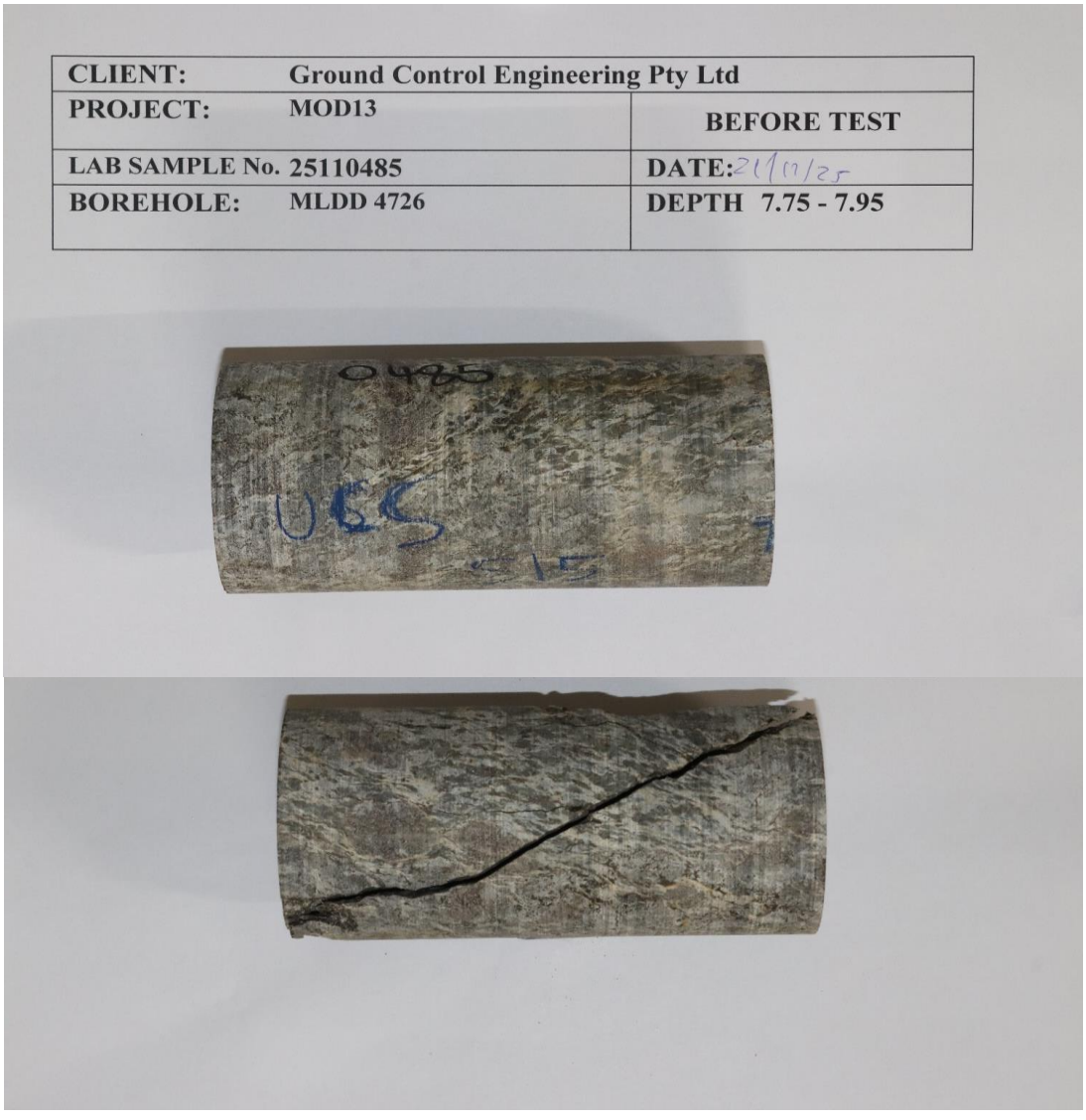
Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110485-RMOD

Average Sample Diameter (mm)	63.2	Moisture Content (%)	0.1
Sample Height (mm)	137.5	Wet Density (t/m^3)	2.99
Duration of Test (min)	2.50	Dry Density (t/m^3)	2.98
Rate of Loading (MPa/min)	30.88	Bedding (°)	Nil
Mode of Failure	Shear	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	60		



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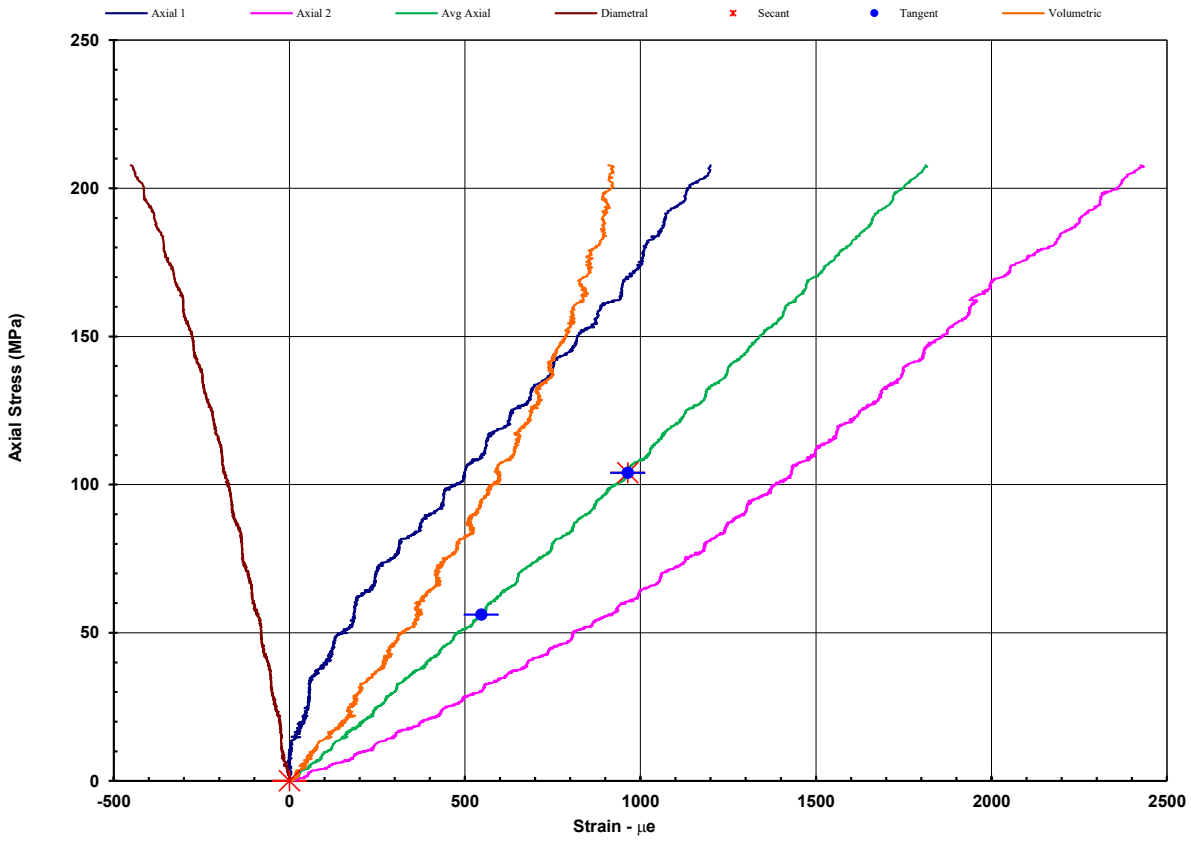
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110486-RMOD
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	27/11/2025
		Report Date	5/12/2025
Project	MOD13		
Client ID	S16	**Bore Hole** MLDD 4726	**Depth (m)** 95.7 - 96
Description	GPs		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 208 MPa

Young's Modulus	Poisson Ratio	
Tangent 115 GPa	0.225	from 27 % to 50 % of Max UCS
Secant 108 GPa	0.195	from 0 % to 50 % of Max UCS

Axial Stress vs Strain Plots



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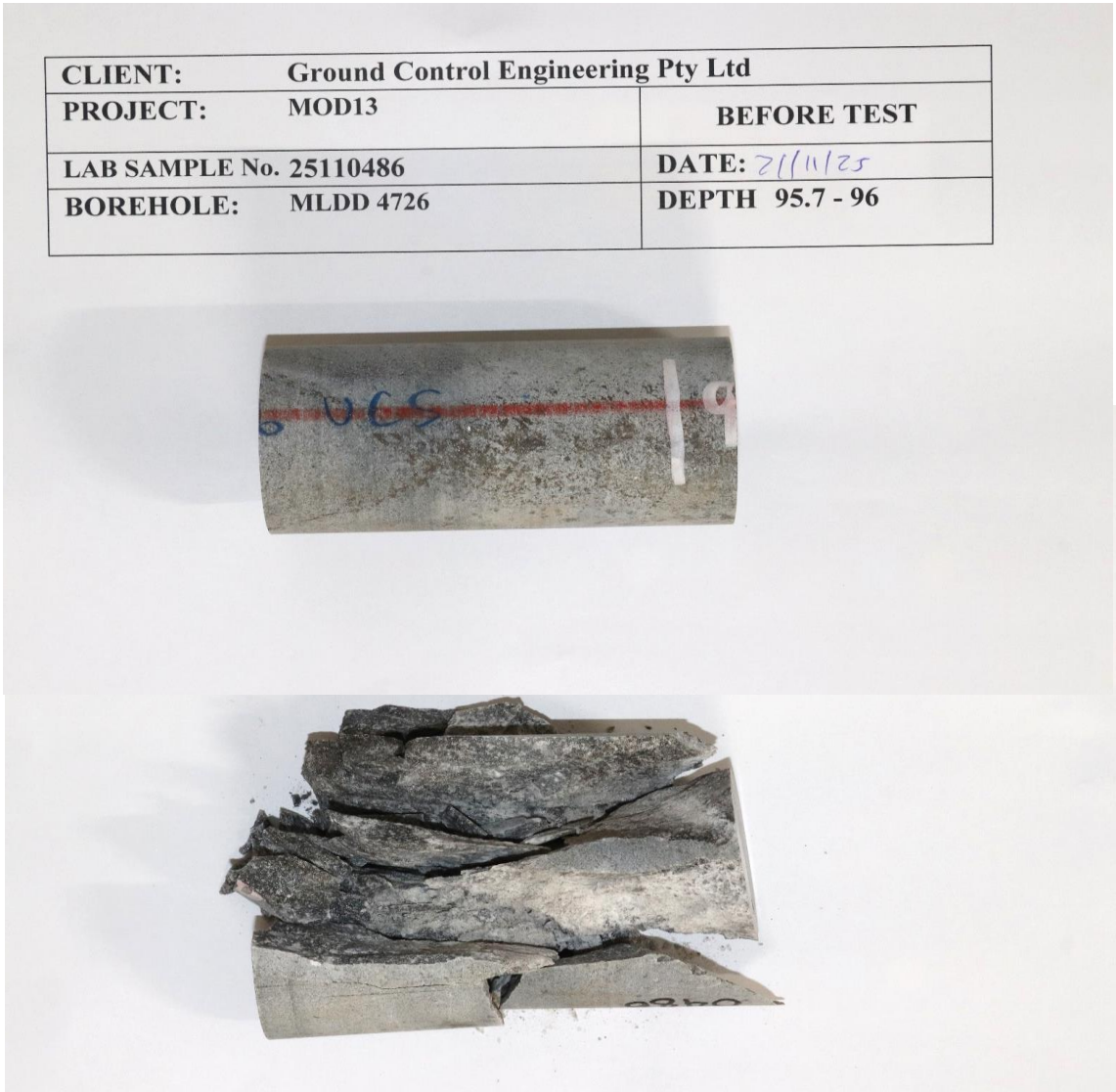
Method D: Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110486-RMOD

Average Sample Diameter (mm)	50.5	Moisture Content (%)	0.0
Sample Height (mm)	116.0	Wet Density (t/m^3)	2.74
Duration of Test (min)	13.60	Dry Density (t/m^3)	2.74
Rate of Loading (MPa/min)	15.30	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	Kelba 1000kN Load Cell
Rupture Angle (°)	70		



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STRENGTH OF ROCK MATERIAL IN TRIAXIAL COMPRESSION

ASTM D7012

Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

Method B : Elastic Moduli of Undrained Rock Core Specimens in Triaxial Compression Without Pore Pressure Measurements

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110472-MHPT
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	8/12/2025
		Report Date	10/12/2025
Project	MOD13		
Client ID	S2	**Bore Hole**	MLDD4667
		Depth (m)	63.6 - 63.9
Description	GPe		
Sample Type	Single Individual Rock Core Specimen		

Sample Details

Average Sample Diameter (mm)	50.4	Moisture Content (%)	0.1
Sample Height (mm)	109.0	Wet Density (t/m^3)	2.80
Duration of Test (min)	40:36:00	Dry Density (t/m^3)	2.79
Rate of Strain (%/min)	0.05	Bedding (^{o})	Nil
Rupture Angle (°)	80	Test Apparatus	RTR2500 Triaxial Machine

Mode of Failure Conical

Intact Test Results

	Value at Plastic Deformation	Value at Plastic Deformation	Value at Plastic Deformation	Peak Value	
Confining Pressure (MPa)	3.00	8.00	11.01	11.00	
Calc'd Peak Deviator Stress (MPa)	103	123	-	-	
Deviator Stress (MPa)	101	121	149	152	
Axial Strain (με)	1982	1818	2427	2627	
Diametral Strain (με)	-581	-486	-631	-726	
Tangent Modulus (GPa)	57.7	65.3	68.8	-	
Poisson's Ratio	0.299	0.267	0.197	-	

Residual Test Results

Confining Pressure (MPa)	11.00	8.01	2.99		
Residual Deviator Stress (MPa)	68.4	54.7	27.8		
Axial Strain (με)	21183	24572	29839		
Diametral Strain (με)	-19845	-23276	-30136		

Notes/Remarks:

Sample/s supplied by client Tested as received

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

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STRENGTH OF ROCK MATERIAL IN TRIAXIAL COMPRESSION

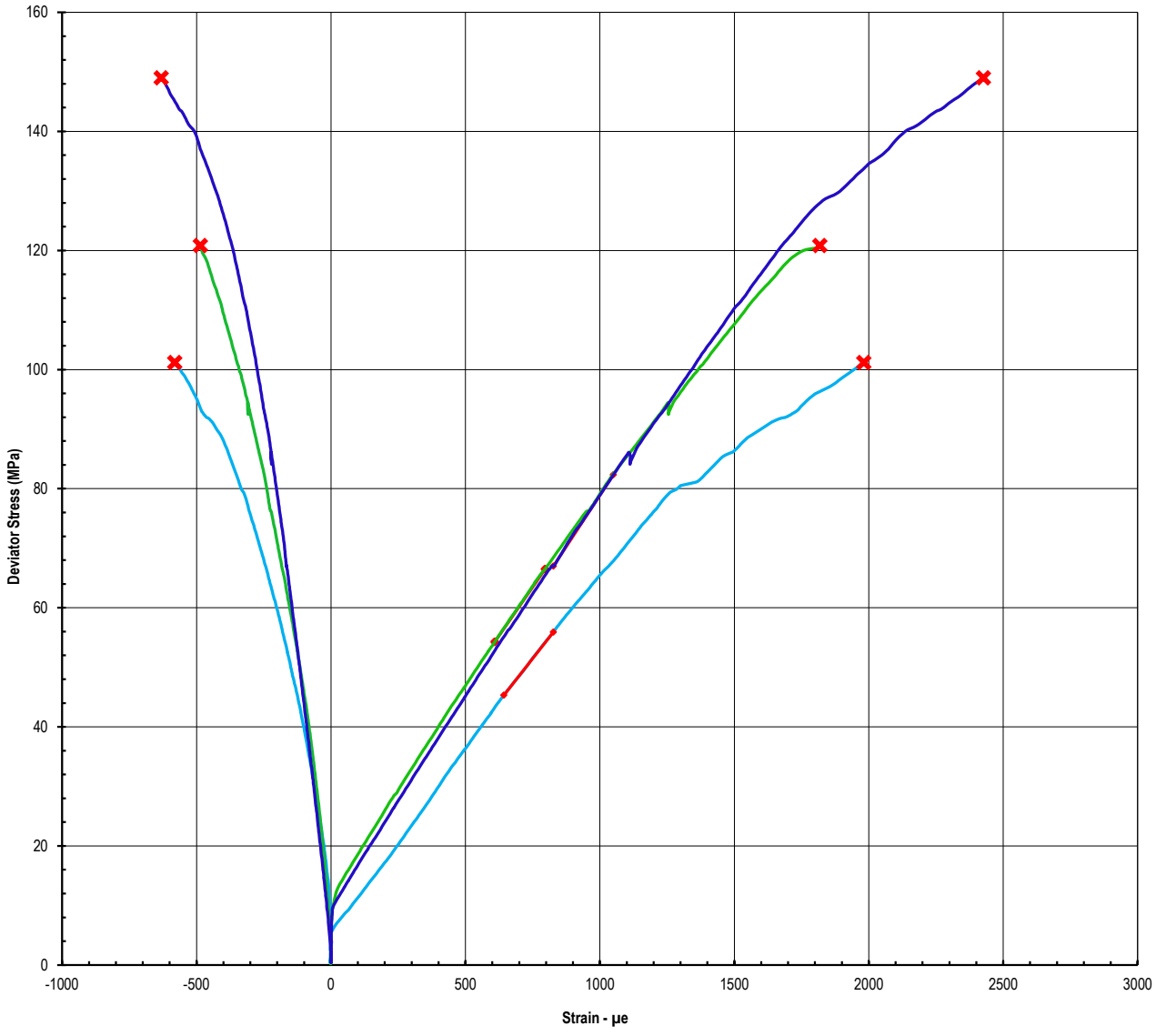
ASTM D7012

Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

Method B : Elastic Moduli of Undrained Rock Core Specimens in Triaxial Compression Without Pore Pressure Measurements

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110472-MHPT

Deviator Stress vs Axial Strain Plots



Notes/Remarks:

Graph not to scale

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Approved Signatory

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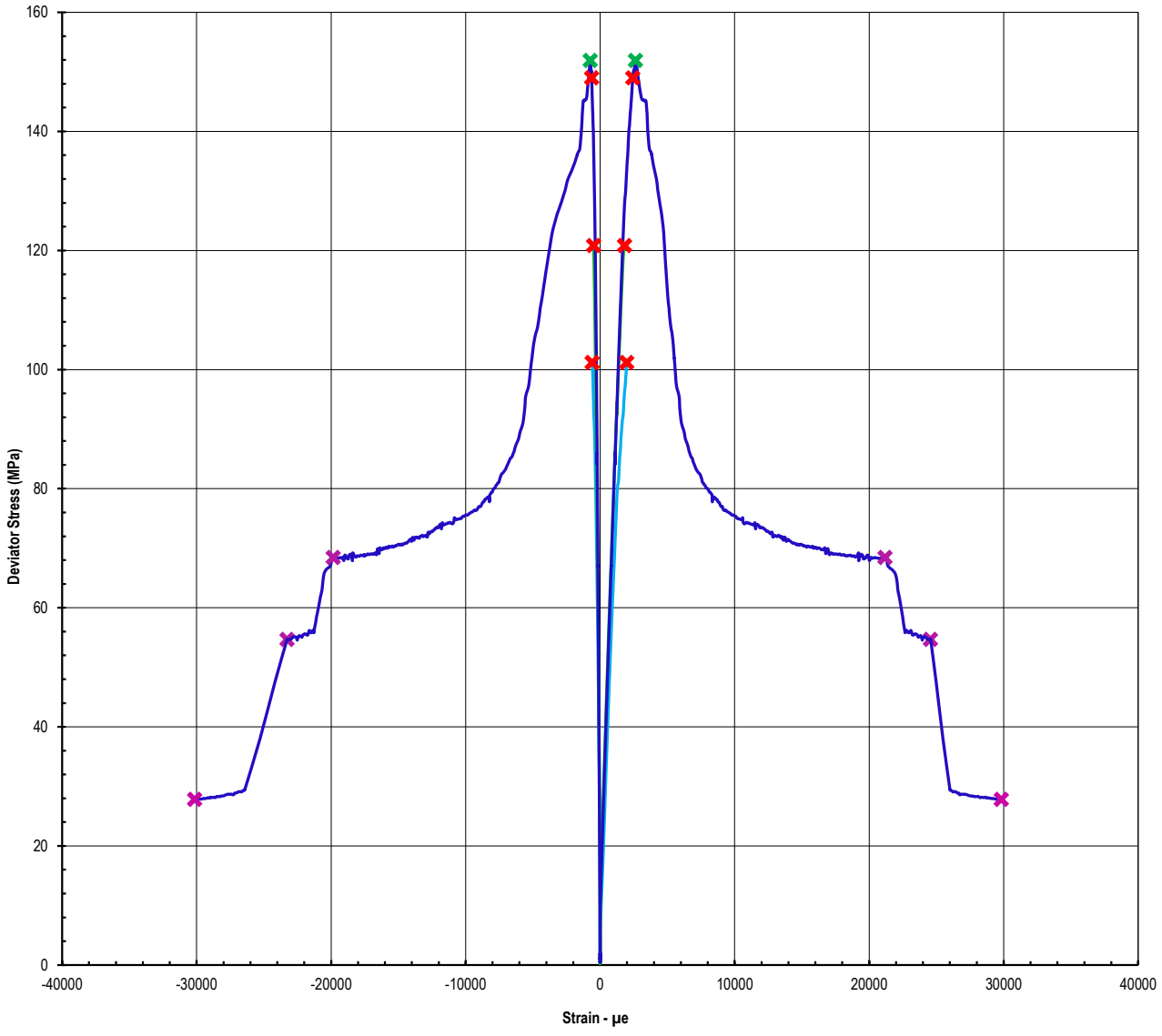

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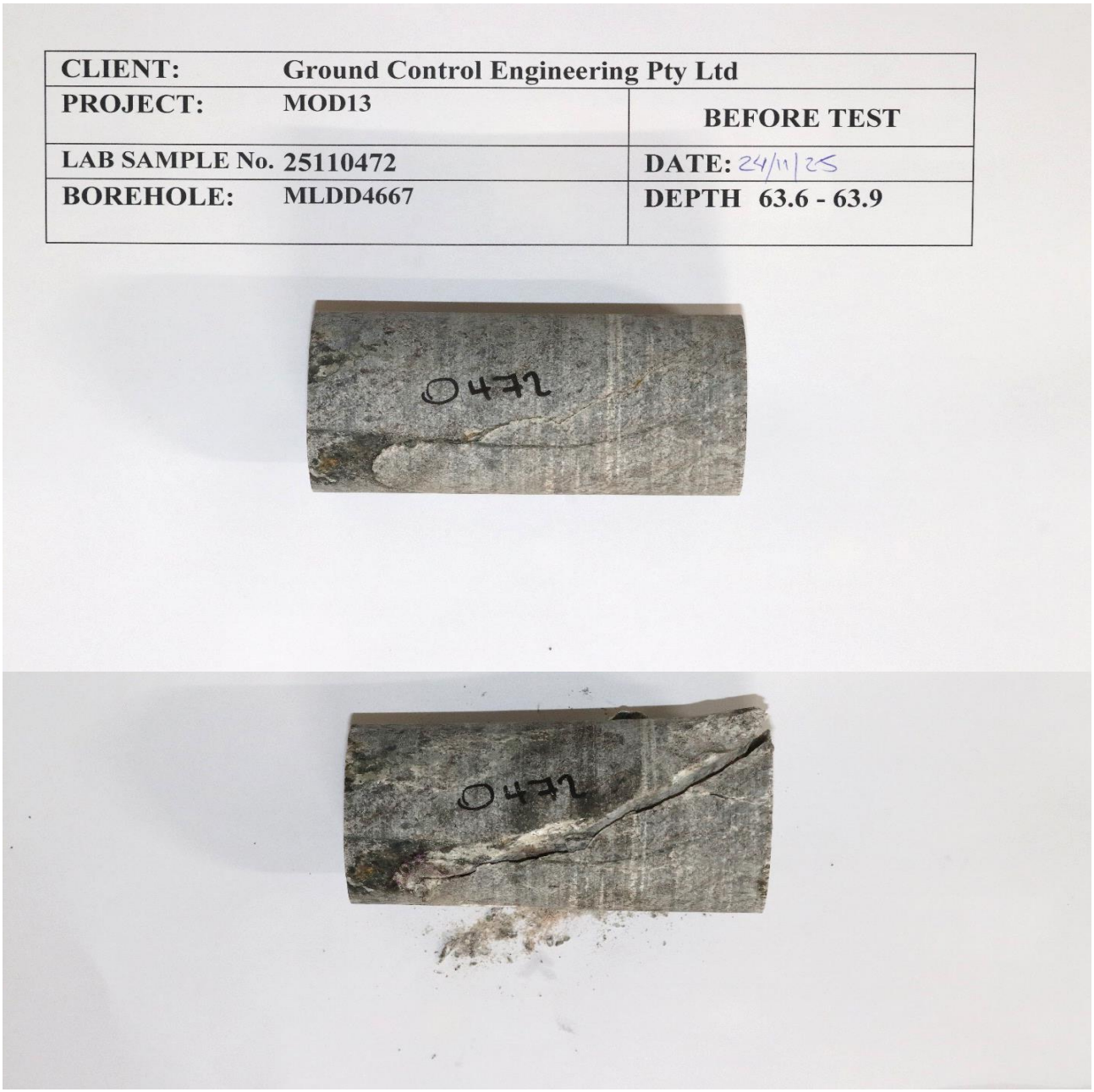
Before and After Test Photos



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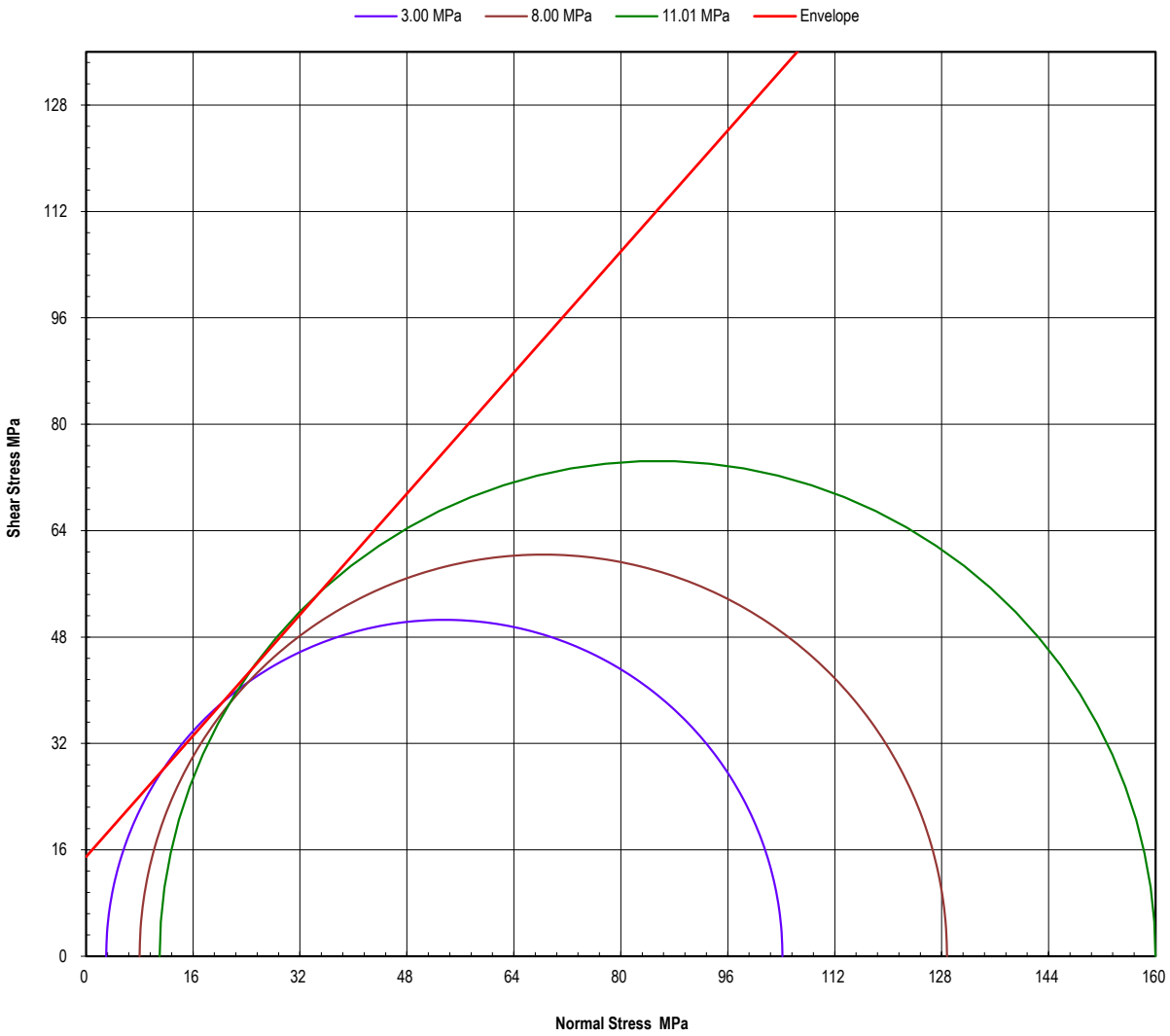
Plastic Deformation - Mohr Circle Plot



Estimated Envelope - **(Calculated at plastic deformation on each Stage)**

Angle	48.7	°
Cohesion	14.96	MPa
Correlation	0.9981	

Notes/Remarks:

Graph not to scale

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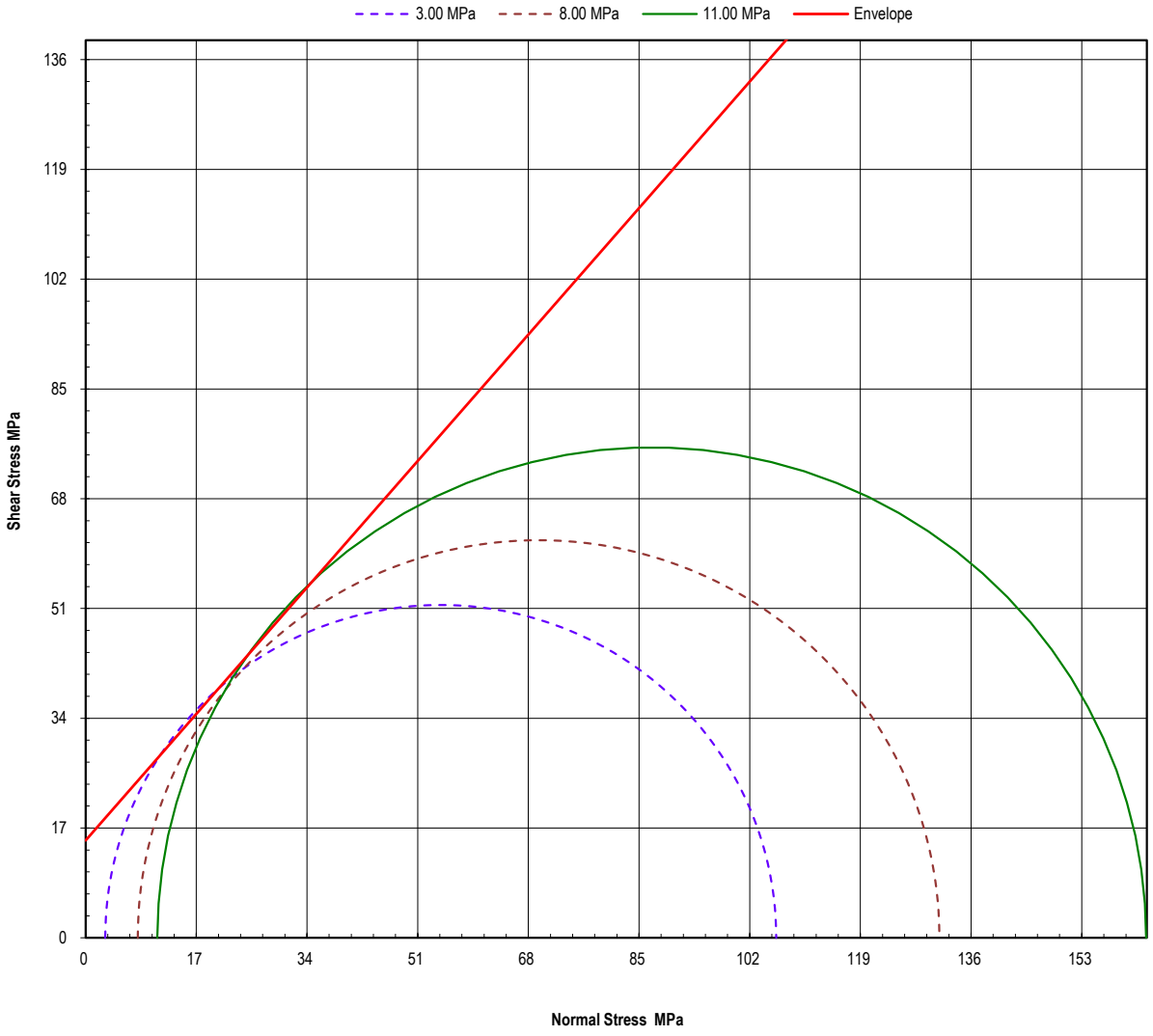
Calculated Peak Stress Mohr Circle Plot



Calculated Peak Envelope

Angle	49.0	°
Cohesion	15.09	MPa
Correlation	0.9982	

Notes/Remarks:

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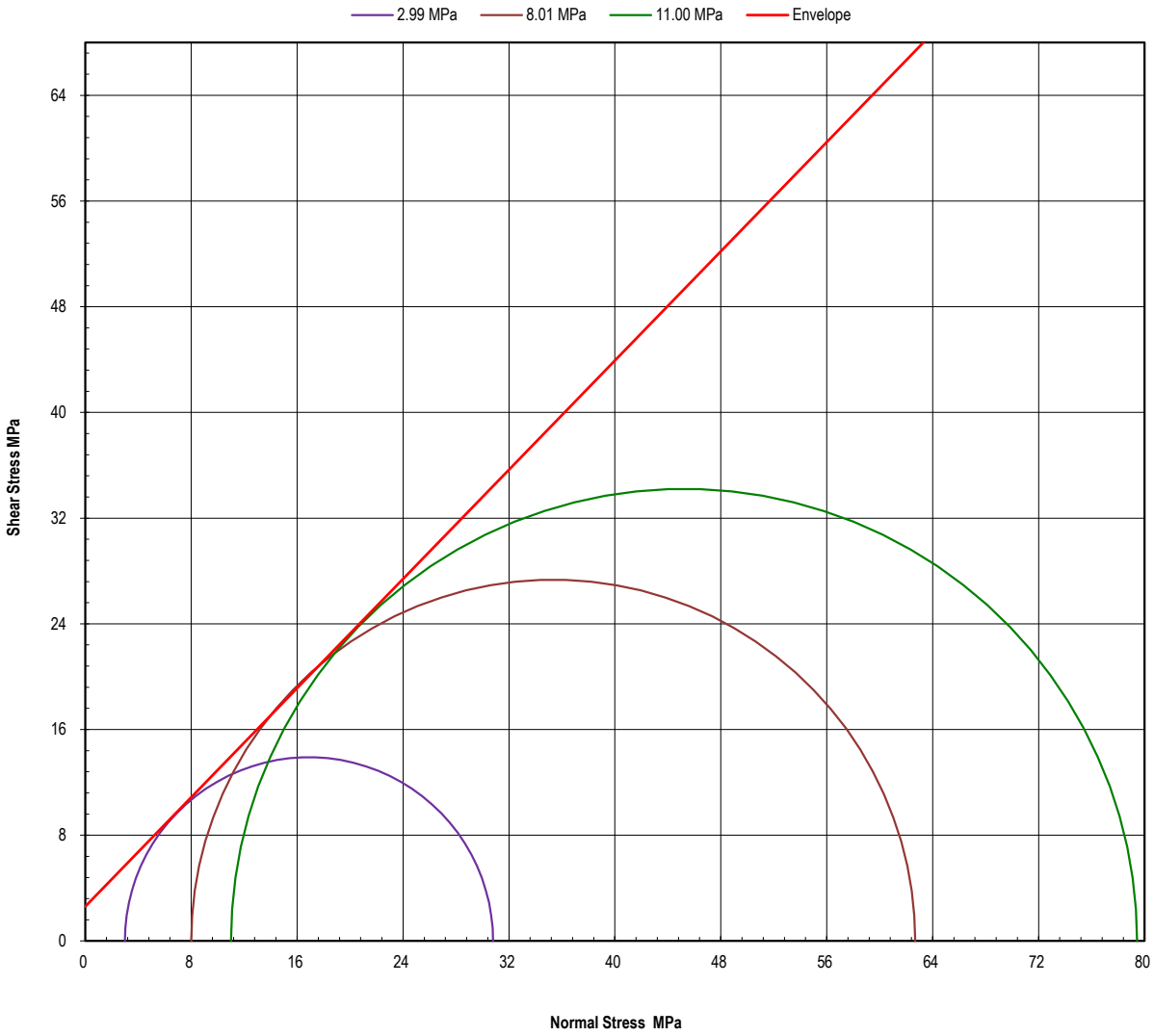
Client	Ground Control Engineering Pty Ltd	**Report No.**	25110472-MHPT

Residual Stress Mohr Circle Plot



Estimated Residual Envelope

Angle	45.9	°
Cohesion	2.60	MPa
Correlation	0.9999	

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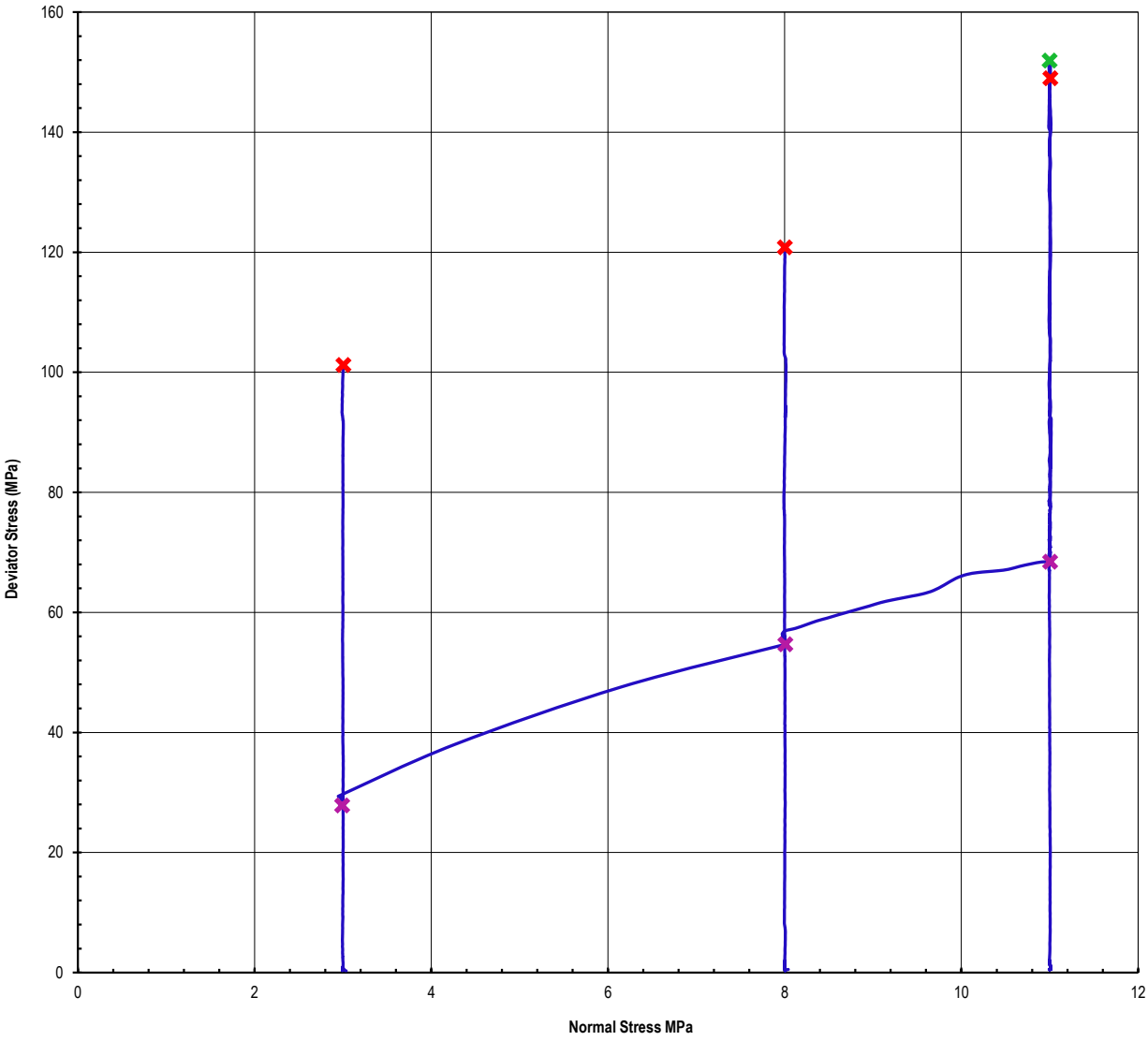
Deviator Stress vs Normal Stress Plot



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Client	Ground Control Engineering Pty Ltd	**Report No.**	25110479-MHPT
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	8/12/2025
		Report Date	10/12/2025
Project	MOD13		
Client ID	S9	**Bore Hole**	MLDD4685
		Depth (m)	14.1 - 14.4
Description	GPs		
Sample Type	Single Individual Rock Core Specimen		

Sample Details

Average Sample Diameter (mm)	63.5	Moisture Content (%)	0.1
Sample Height (mm)	126.8	Wet Density (t/m^3)	2.74
Duration of Test (min)	33:09:00	Dry Density (t/m^3)	2.74
Rate of Strain (%/min)	0.05	Bedding (^{o})	Nil
Rupture Angle (°)	70	Test Apparatus	RTR2500 Triaxial Machine

Mode of Failure Shear

Intact Test Results

	Value at Plastic Deformation	Value at Plastic Deformation	Value at Plastic Deformation	Peak Value	
Confining Pressure (MPa)	2.99	8.00	11.00	11.01	
Calc'd Peak Deviator Stress (MPa)	106	135	-	-	
Deviator Stress (MPa)	83.7	106	128	164	
Axial Strain (με)	2119	2322	2730	4776	
Diametral Strain (με)	-486	-590	-839	-3970	
Tangent Modulus (GPa)	41.7	50.4	51.9	-	
Poisson's Ratio	0.210	0.247	0.283	-	

Residual Test Results

Confining Pressure (MPa)	11.00	8.00	3.00		
Residual Deviator Stress (MPa)	49.8	38.7	19.1		
Axial Strain (με)	3711	3249	2424		
Diametral Strain (με)	-13965	-17050	-20965		

Notes/Remarks:

Sample/s supplied by client Tested as received

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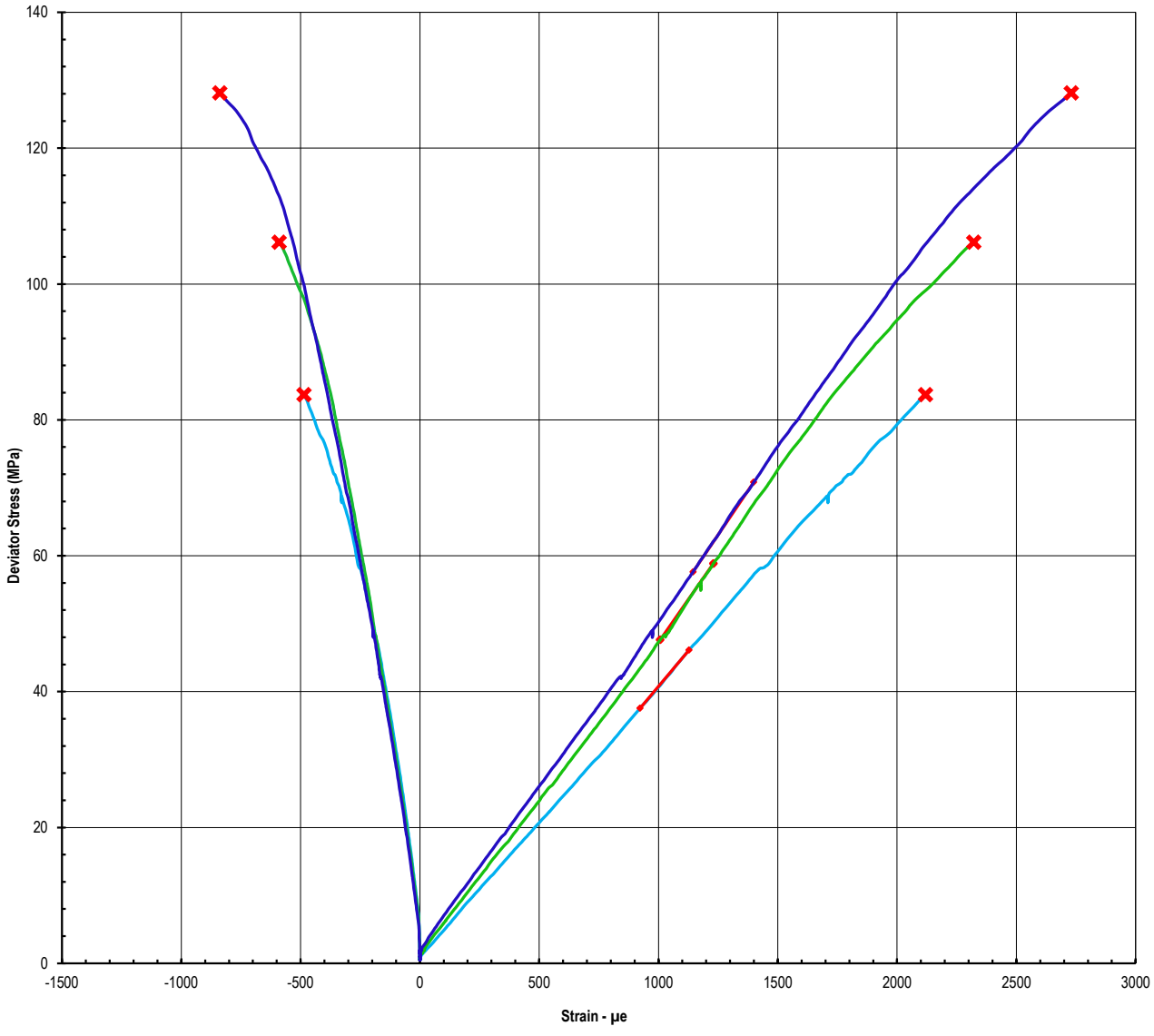
Deviator Stress vs Axial Strain Plots



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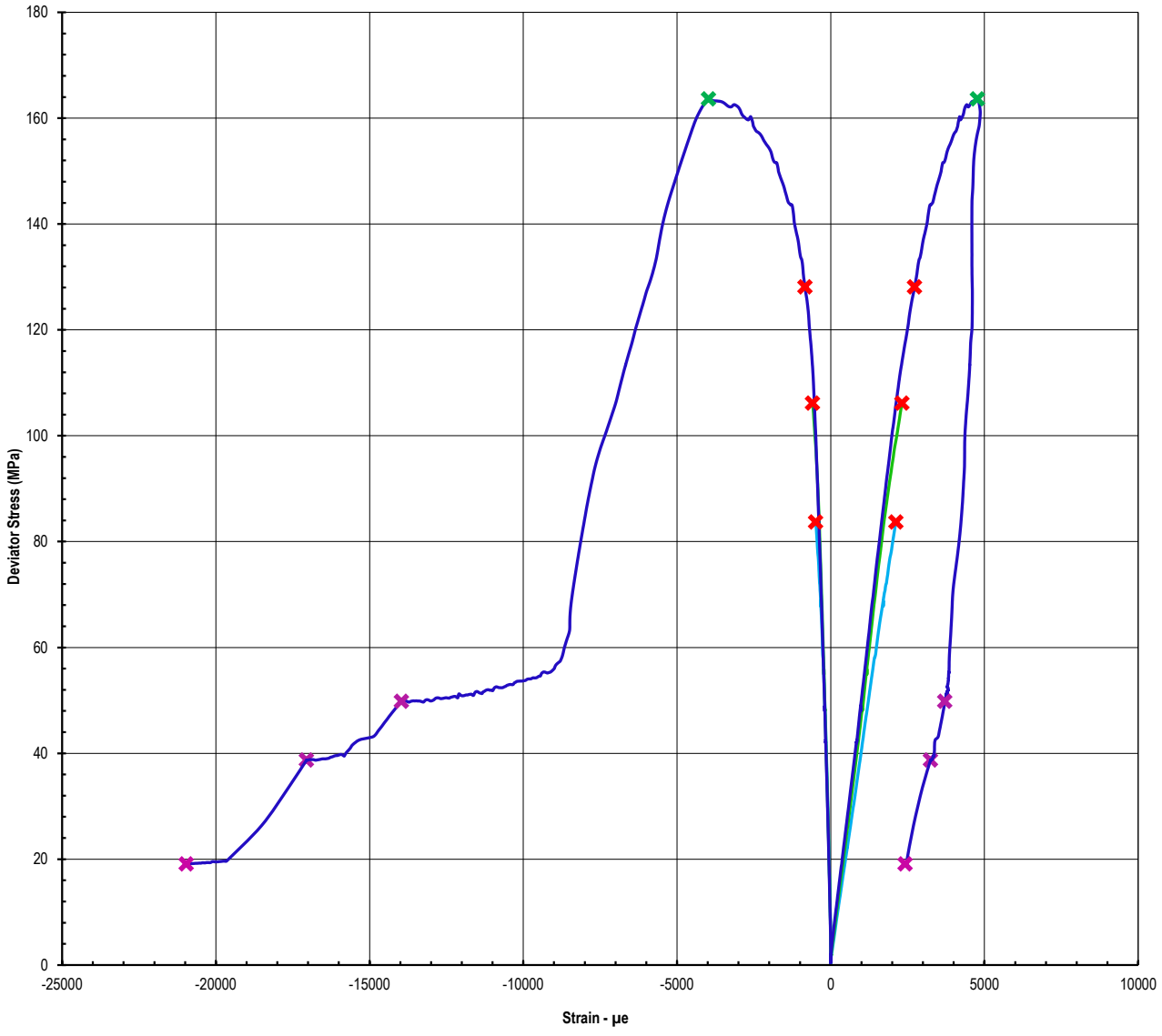

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Before and After Test Photos

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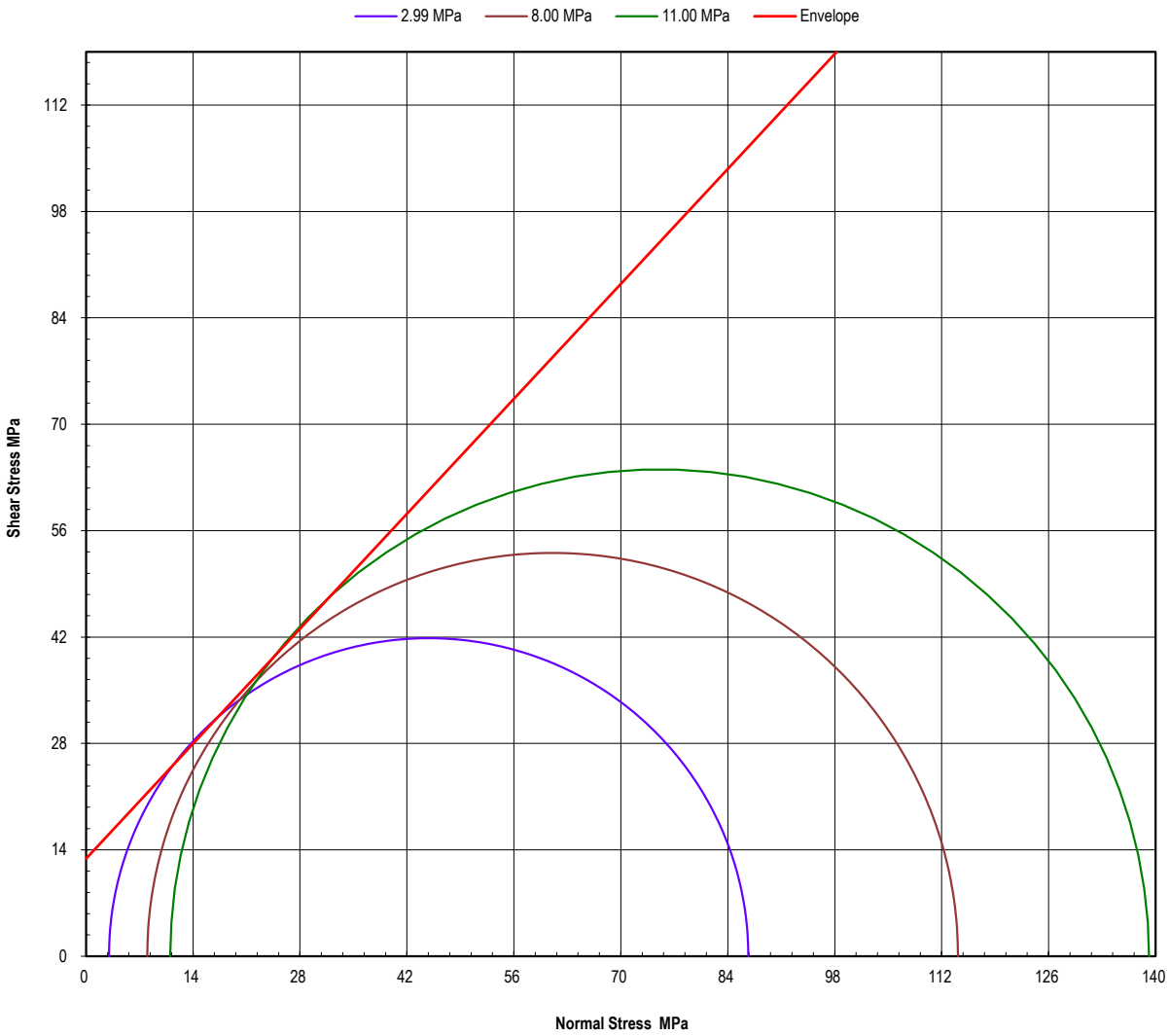
Plastic Deformation - Mohr Circle Plot



Estimated Envelope - **(Calculated at plastic deformation on each Stage)**

Angle	47.2	°
Cohesion	12.84	MPa
Correlation	0.9993	

Notes/Remarks:

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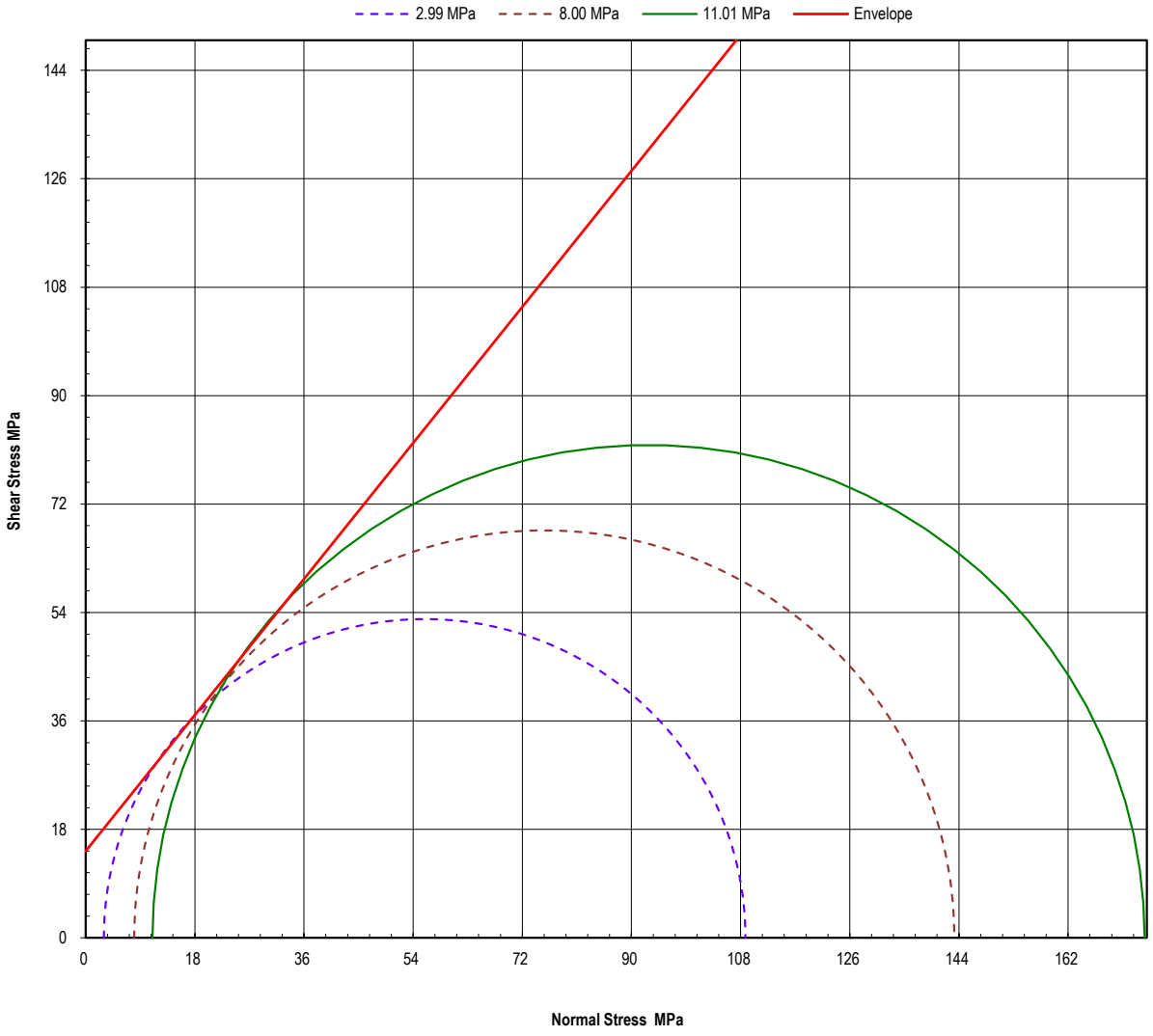
Calculated Peak Stress Mohr Circle Plot



Calculated Peak Envelope

Angle	51.4	°
Cohesion	14.39	MPa
Correlation	0.9996	

Notes/Remarks:

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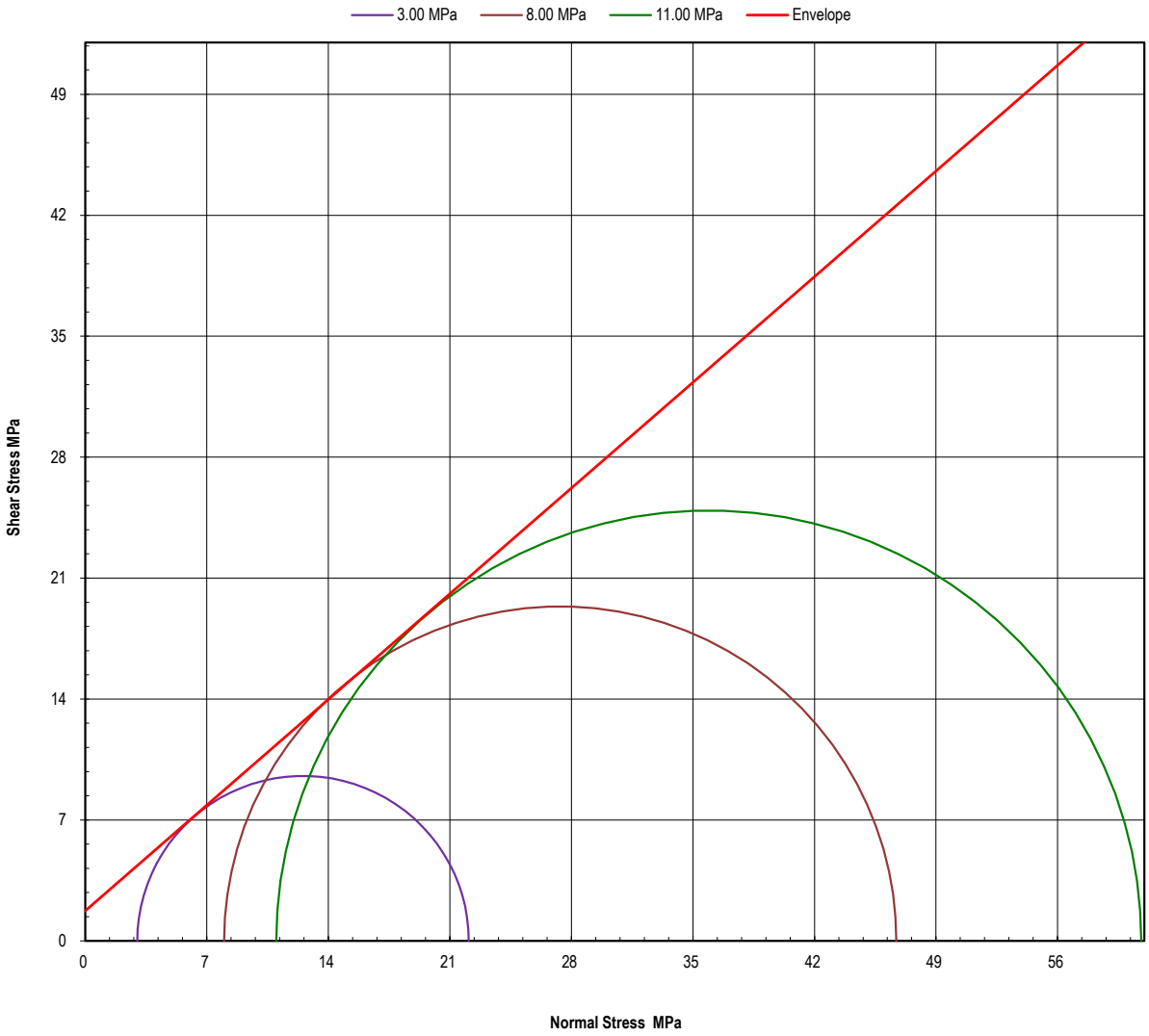
Client	Ground Control Engineering Pty Ltd	**Report No.**	25110479-MHPT

Residual Stress Mohr Circle Plot



Estimated Residual Envelope

Angle	41.1	°
Cohesion	1.74	MPa
Correlation	1.0000	

Notes/Remarks:

Graph not to scale

Sample/s supplied by client

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Approved Signatory

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STRENGTH OF ROCK MATERIAL IN TRIAXIAL COMPRESSION

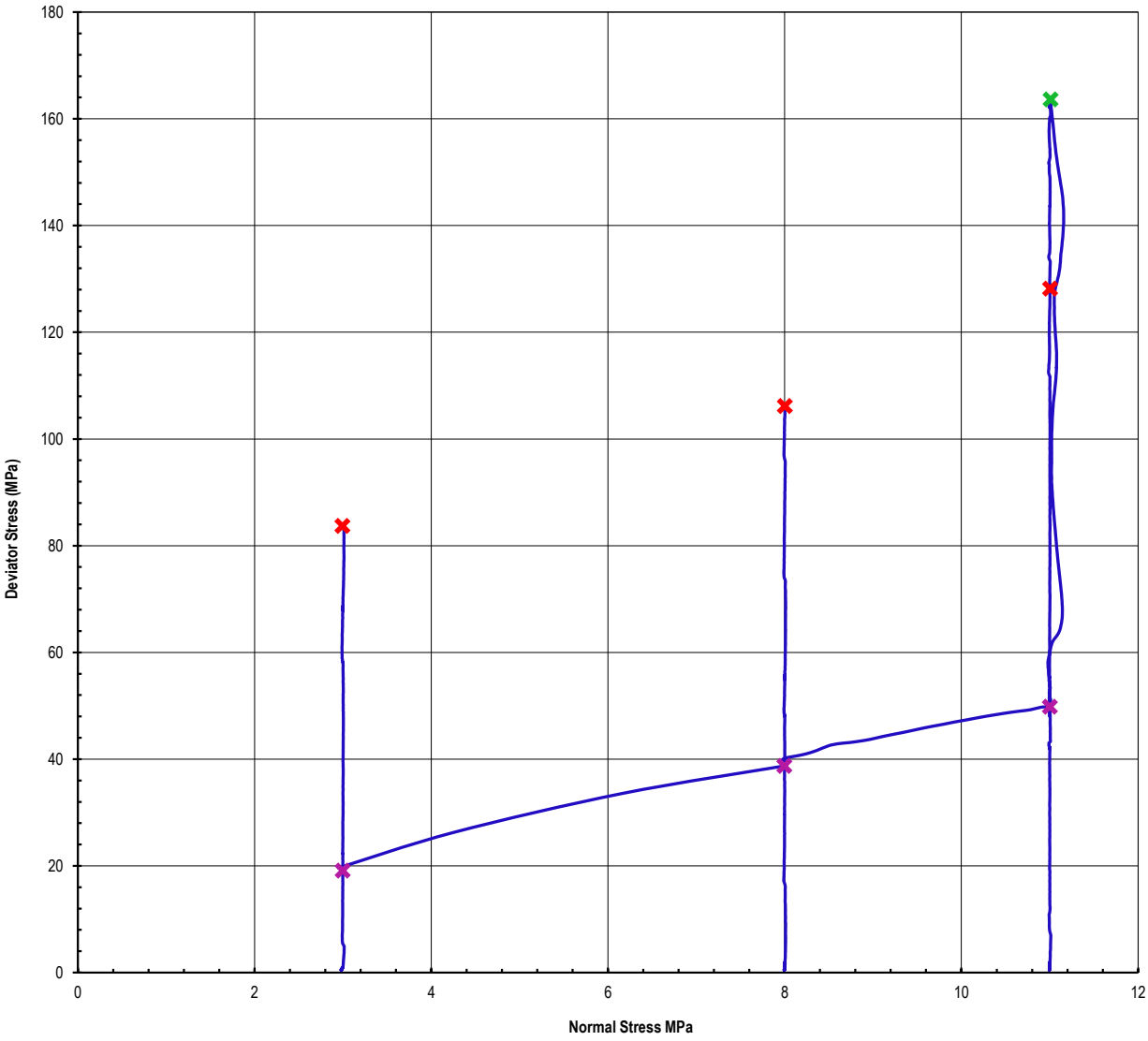
ASTM D7012

Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

Method B : Elastic Moduli of Undrained Rock Core Specimens in Triaxial Compression Without Pore Pressure Measurements

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110479-MHPT

Deviator Stress vs Normal Stress Plot



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Method B : Elastic Moduli of Undrained Rock Core Specimens in Triaxial Compression Without Pore Pressure Measurements

Client	Ground Control Engineering Pty Ltd	**Report No.**	25110483-MHPT
		Workorder No.	9919/T/25-650
Address	PO Box 893 Malanda QLD 4885	**Test Date**	8/12/2025
		Report Date	11/12/2025
Project	MOD13		
Client ID	S13	**Bore Hole**	MLDD4723
		Depth (m)	163 - 163.3
Description	rGPm		
Sample Type	Single Individual Rock Core Specimen		

Sample Details

Average Sample Diameter (mm)	50.5	Moisture Content (%)	0.0
Sample Height (mm)	117.0	Wet Density (t/m^3)	2.85
Duration of Test (min)	22:02:00	Dry Density (t/m^3)	2.84
Rate of Strain (%/min)	0.05	Bedding (^{o})	Nil
Rupture Angle (°)	55	Test Apparatus	RTR2500 Triaxial Machine

Mode of Failure Shear

Intact Test Results

	Value at Plastic Deformation	Value at Plastic Deformation	Value at Plastic Deformation	Peak Value	
Confining Pressure (MPa)	3.00	8.01	10.99	11.01	
Calc'd Peak Deviator Stress (MPa)	98.2	122	-	-	
Deviator Stress (MPa)	96.2	119	132	135	
Axial Strain (με)	1513	1715	1889	1990	
Diametral Strain (με)	-336	-417	-483	-540	
Tangent Modulus (GPa)	69.3	75.2	75.4	-	
Poisson's Ratio	0.190	0.223	0.223	-	

Residual Test Results

Confining Pressure (MPa)	11.00	8.00	3.00		
Residual Deviator Stress (MPa)	45.5	40.0	26.2		
Axial Strain (με)	8378	12758	17207		
Diametral Strain (με)	-4543	-7080	-10106		

Notes/Remarks:

Sample/s supplied by client Tested as received

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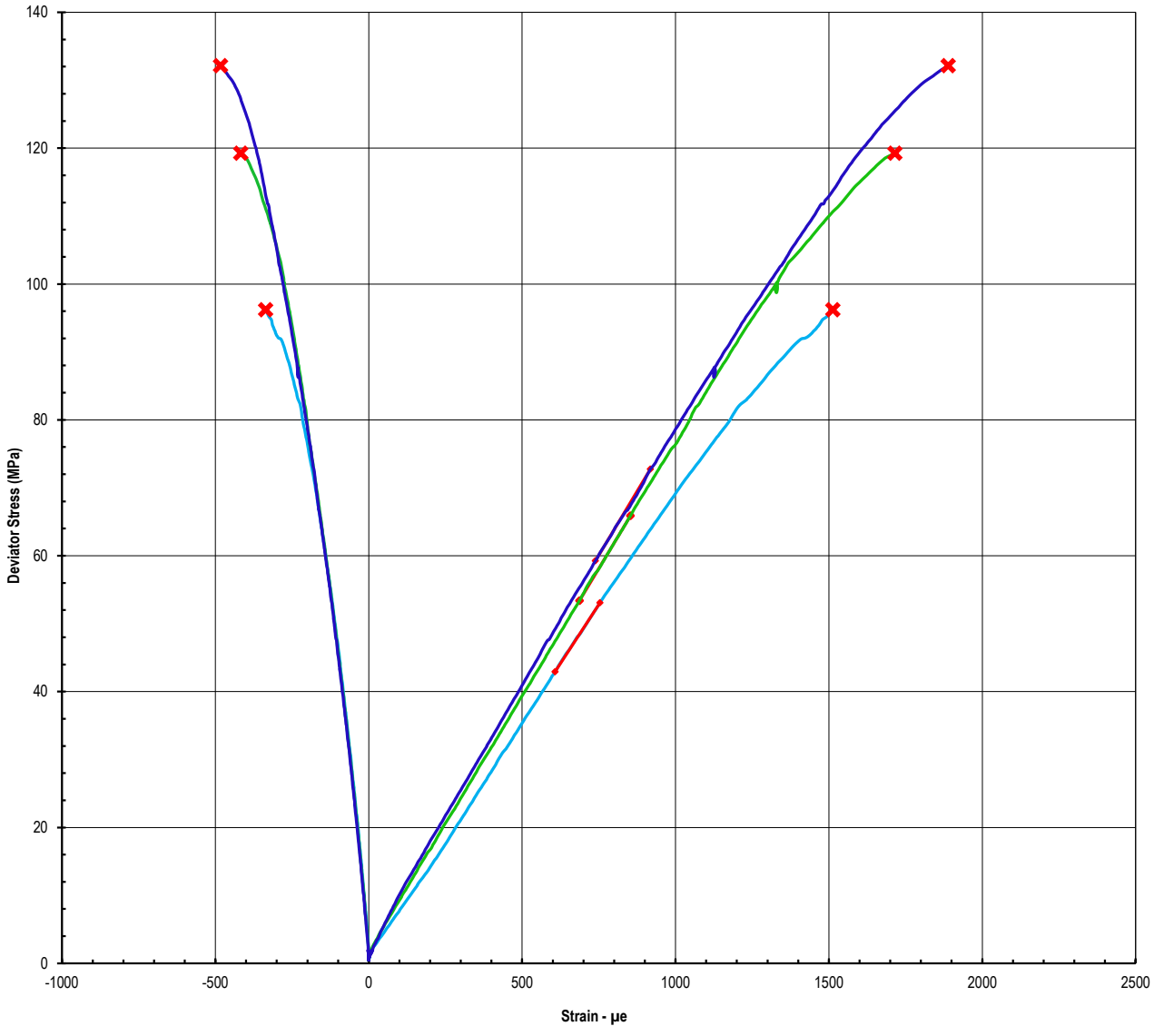
Client	Ground Control Engineering Pty Ltd	**Report No.**	25110483-MHPT

Deviator Stress vs Axial Strain Plots



Notes/Remarks:

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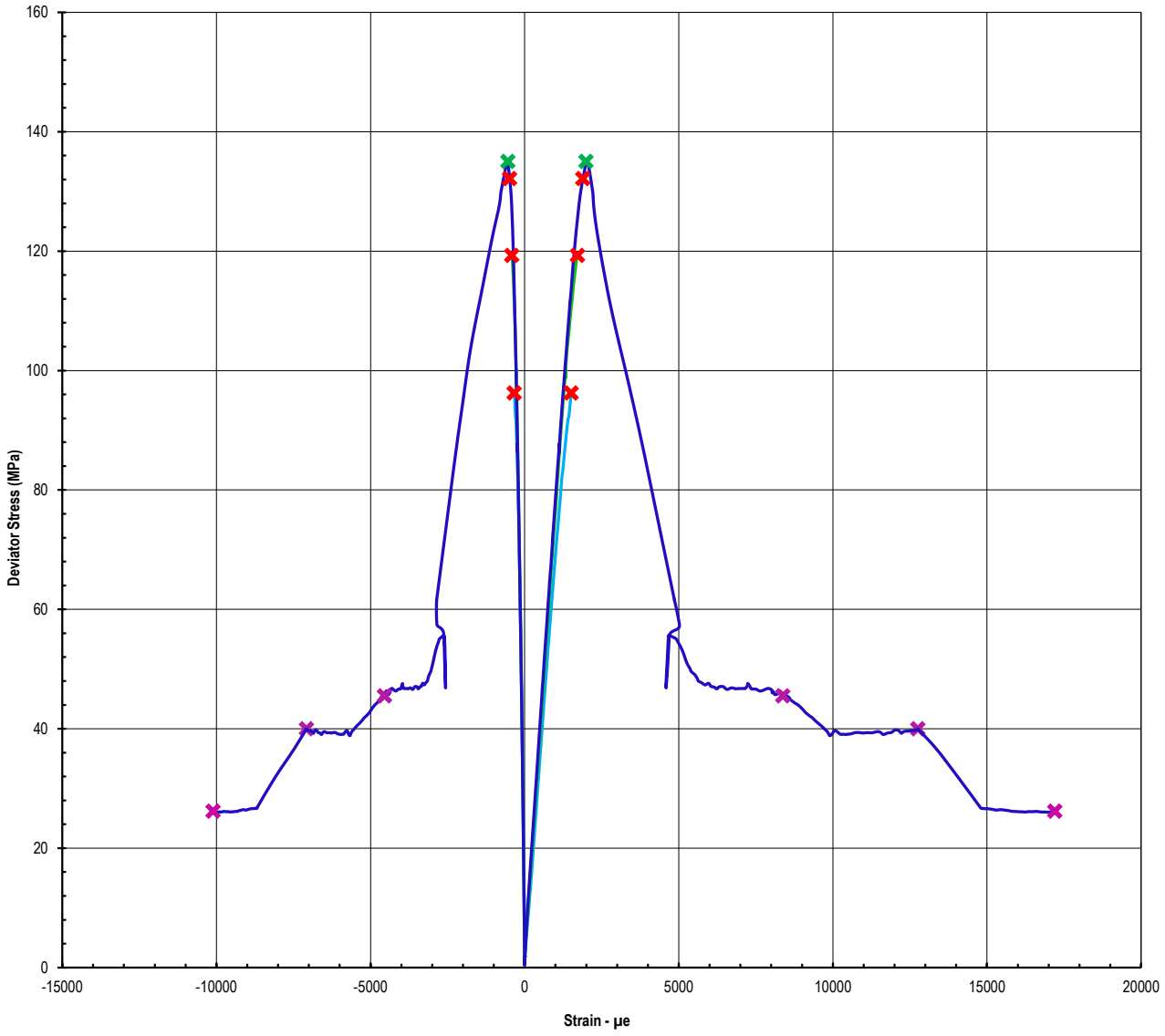
Deviator Stress vs Axial Strain Plots



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Client	Ground Control Engineering Pty Ltd	**Report No.**	25110483-MHPT

Before and After Test Photos

Notes/Remarks:

Photo not to scale

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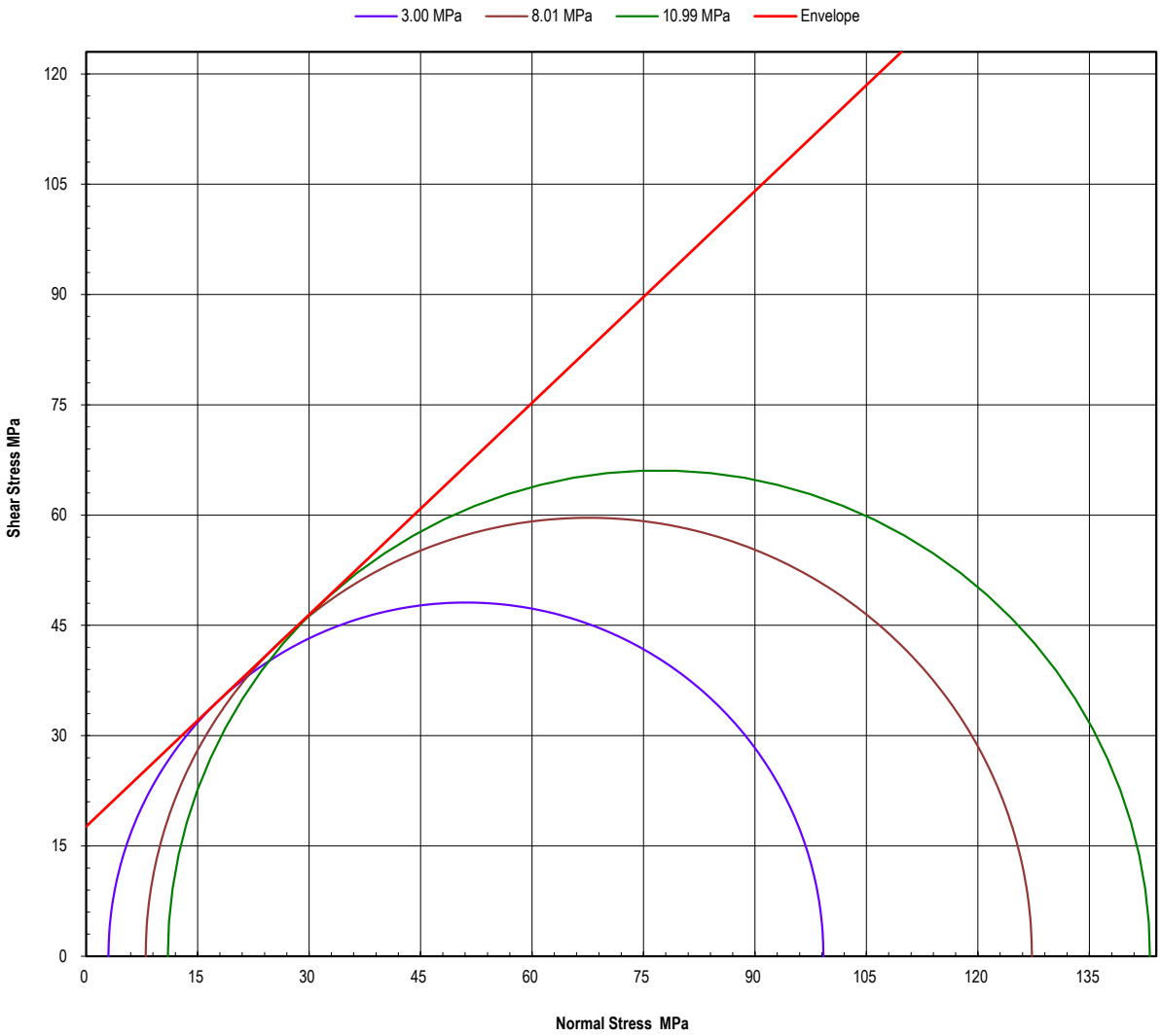
Client	Ground Control Engineering Pty Ltd	**Report No.**	25110483-MHPT

Plastic Deformation - Mohr Circle Plot



Estimated Envelope - **(Calculated at plastic deformation on each Stage)**

Angle	43.8	°
Cohesion	17.65	MPa
Correlation	1.0000	

Notes/Remarks:

Graph not to scale

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Method B : Elastic Moduli of Undrained Rock Core Specimens in Triaxial Compression Without Pore Pressure Measurements

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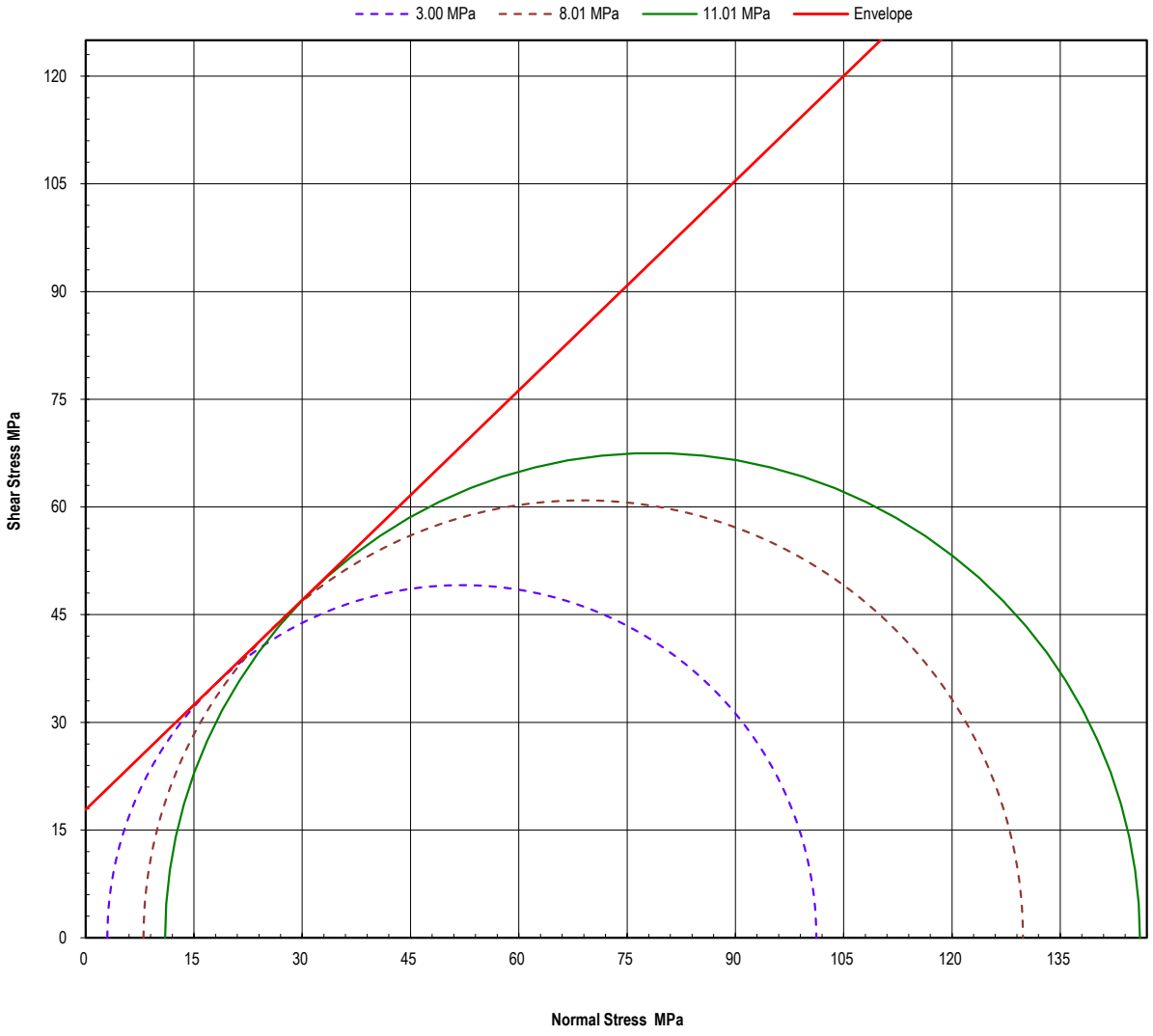
Calculated Peak Stress Mohr Circle Plot



Calculated Peak Envelope

Angle	44.2	°
Cohesion	17.85	MPa
Correlation	1.0000	

Notes/Remarks:

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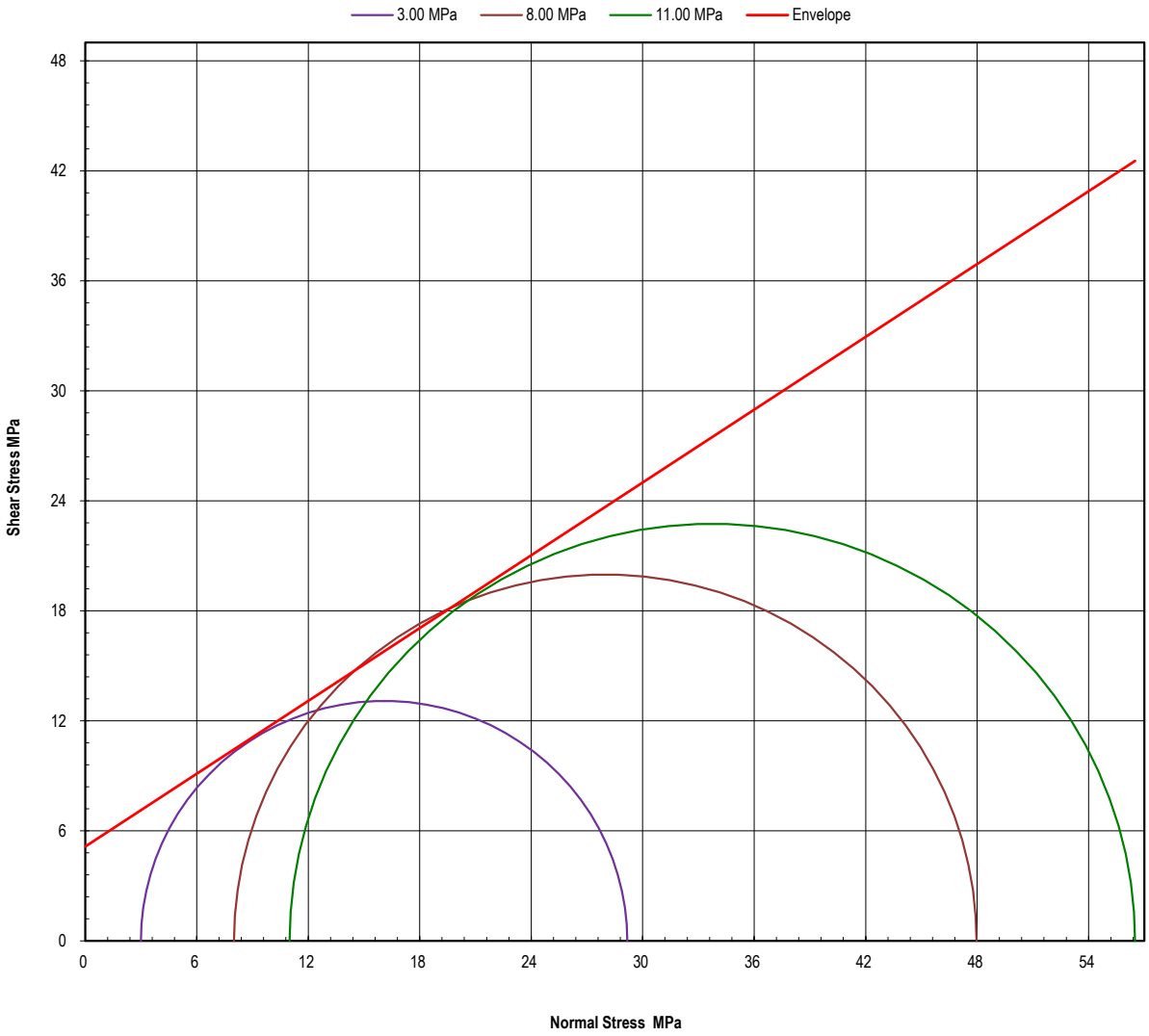
Residual Stress Mohr Circle Plot



Estimated Residual Envelope

Angle	33.5	°
Cohesion	5.15	MPa
Correlation	0.9990	

Notes/Remarks:

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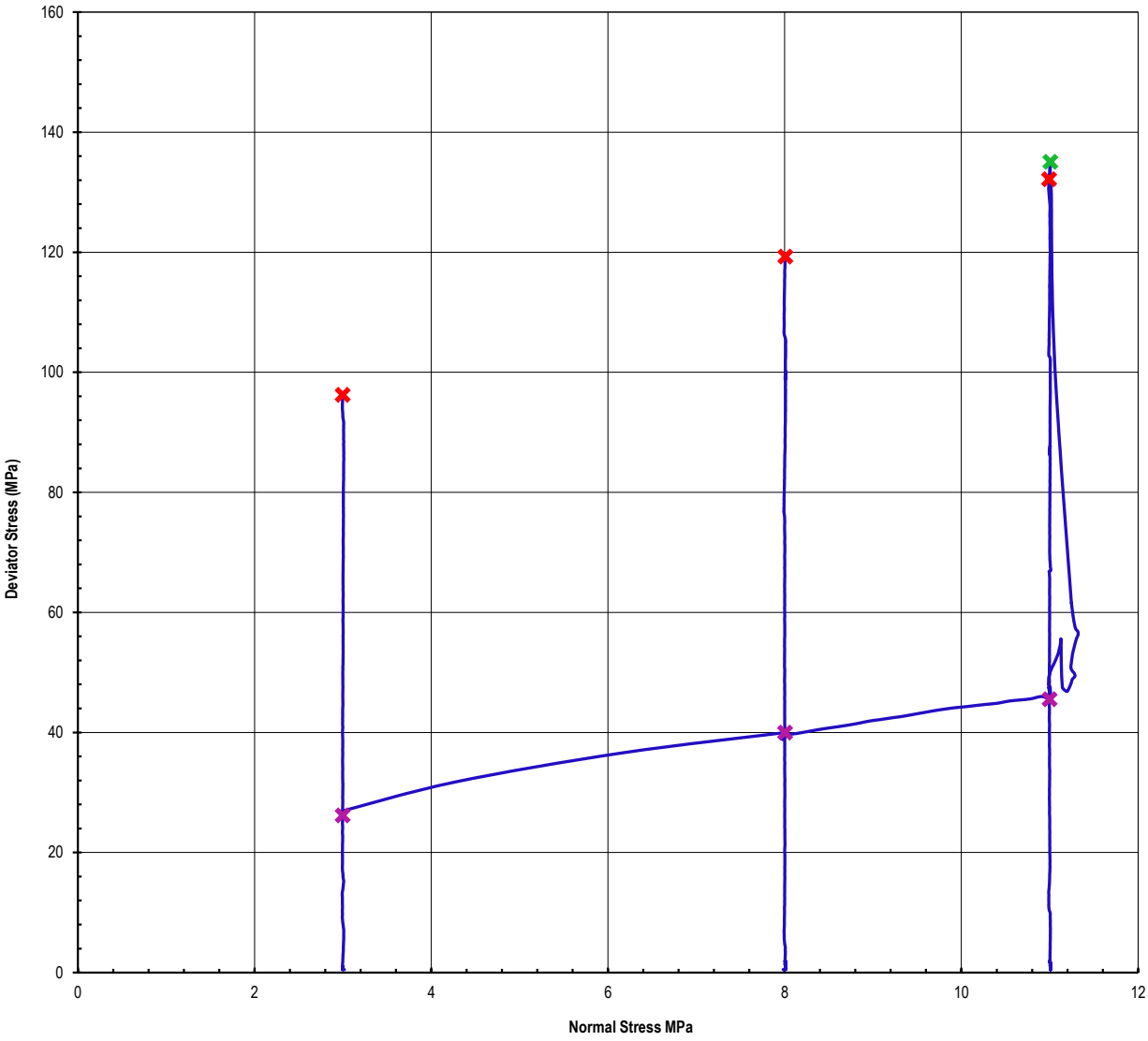
Deviator Stress vs Normal Stress Plot



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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

British Orebody Egress Ladderway Geotechnical Review

1. Introduction

The planned surface egress ladderway will be located in the northern part of the Consolidated Mining Lease (CML7), close to the west of the Rail Loading Facility (refer Figure 1). It will provide a second means of egress for the British Orebody, connecting to the top of the planned British Incline. This egress ladderway is a key emergency response and legislative requirement. It is planned to be a 1.1m diameter raisebored raise 101m in length dipping 62° to the Northwest. It will have a Safescape ladderway installed on completion of raiseboring. RL of the top is 10,302m, base 10,208m.

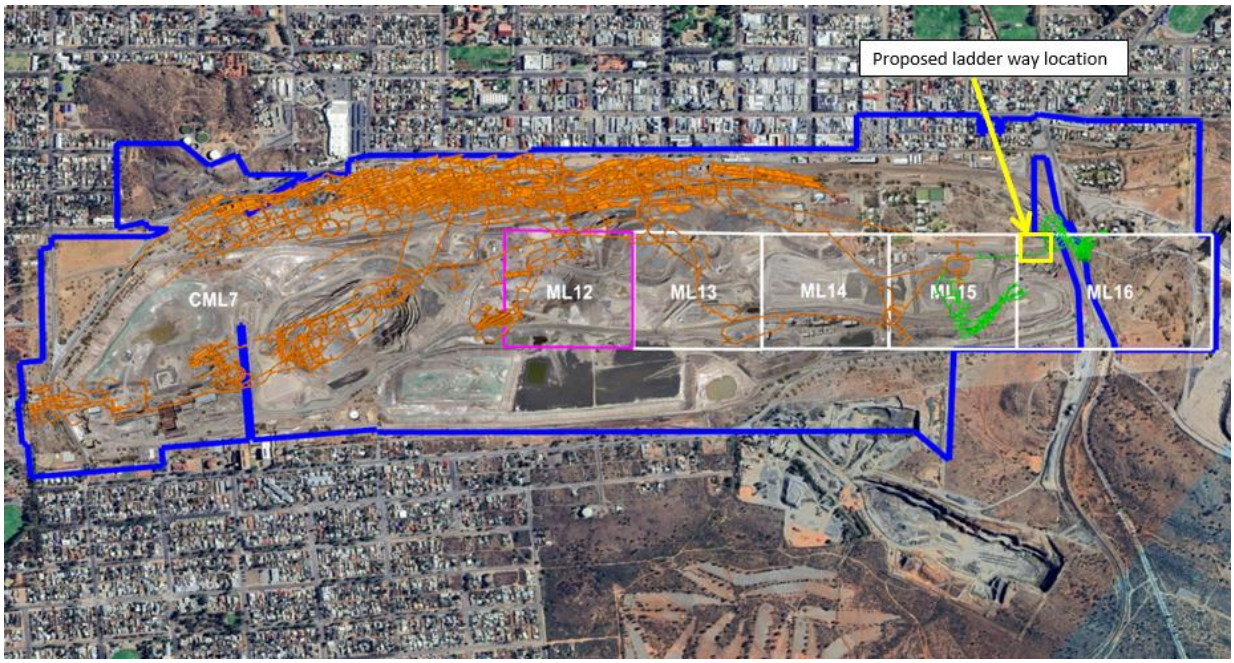

Figure 1: Rasp mine located on CML7 (blue line) and proposed emergency egress ladderway location.

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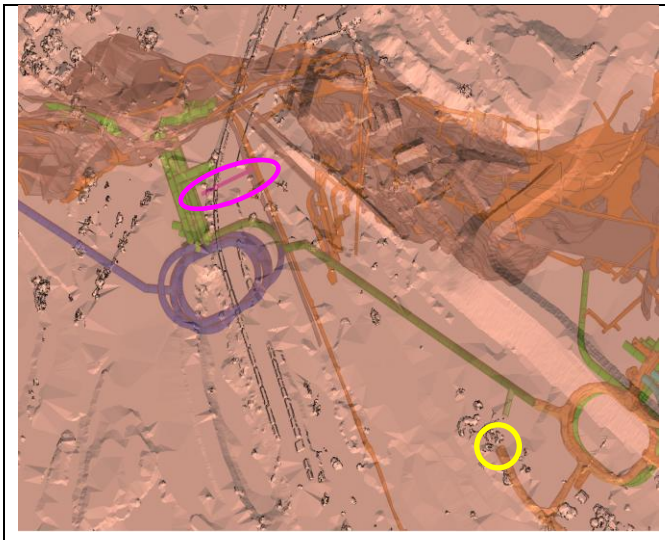

Figure 2: Planned ladderway (pink circle) Previous planned Blackwoods Fresh Air Rise (FAR) location circled in yellow.

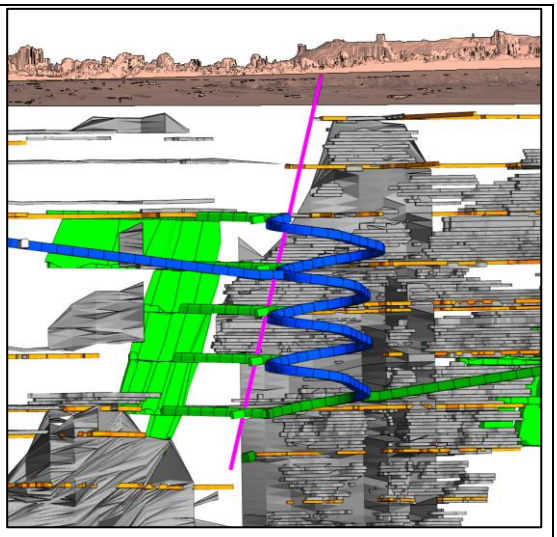

Figure 3: In plan with Diamond Drill Hole (DDH) (pink) and looking Northeast. British orebody and development in green, historic workings in grey and orange.

2. Previous Raises in Area

The only 2 new surface raisebored vertical openings at Rasp Mine are the Surface to 10L Exhaust Shaft which is 5m in diameter and 378m in length with its base on the 10 level underground and the existing Surface ladderway located 50m to the Southeast of the Exhaust shaft. The existing surface ladderway is 1.1m in diameter, 140m in length and dips 78° to the east where it connects to the old Western Mineralisation decline. The geotechnical information gained from the shaft development was used for the proposed ladderway design. This was verified by an assessment of drillcore obtained by a surface diamond drillhole which was then reamed out to 12.5 inches to be used as the pilot hole for the raisebore rig. These raises are located 1.9km to the south of the British Ladderway.

The Blackwoods Fresh Air Rise (approved in MOD11, refer to Figure 2) was to be 4m diameter and 179m in length is located 280m south of the proposed British Ladderway.

3. Available information

3.1. Historic Workings

As Figure 3 shows there are no historic workings in the immediate area of the planned ladderway. The Thompsons No. 3 Level is shown 95m Northeast of the base of the raise, connecting to the top sill of the

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British orebody. Thompsons No. 1 and No. 2 Levels are shown passing 90m Southeast, possibly connecting to the Prospecting Shaft 100m to the south (refer Figure 4). An alternative plot for the Prospecting Shaft is shown in Figure 4 70m SE. Further shafts in the area are shown in figure 6.

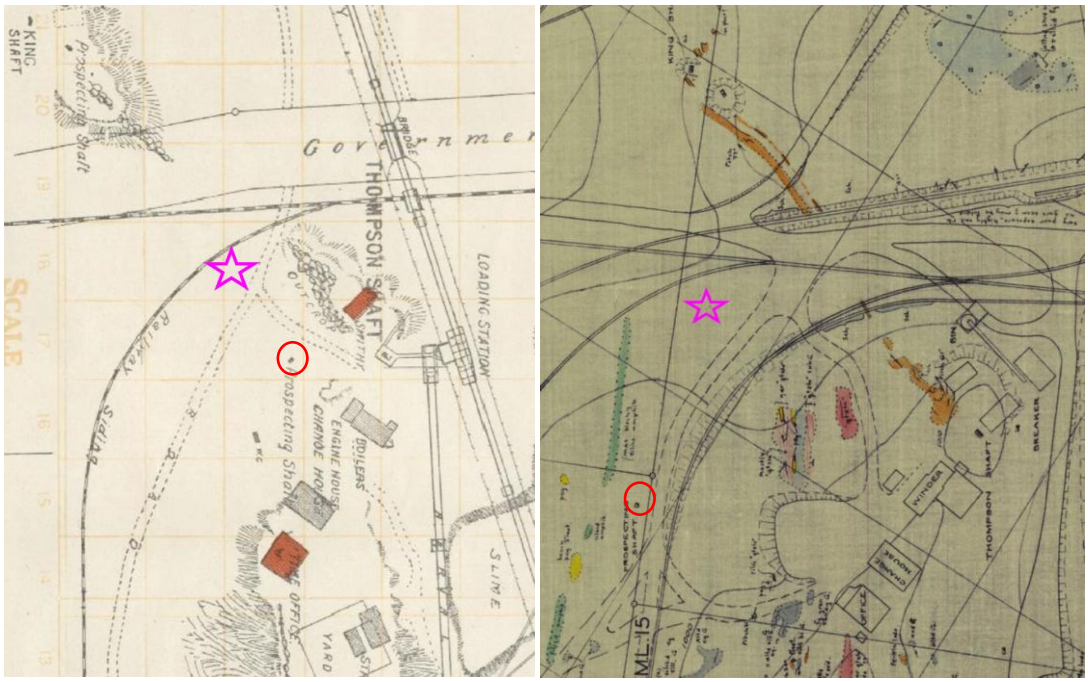

Figure 4: Historic surface plans of area, Prospecting shaft alternate positions circled red, ladderway location represented by the pink star.

The collar position of the proposed ladderway location has been selected with consideration to the following (refer to Figure 5);

- The British orebody location
- CML7 mining lease boundary
- Existing surface infrastructure including public roads and railway line
- Surface exclusion areas

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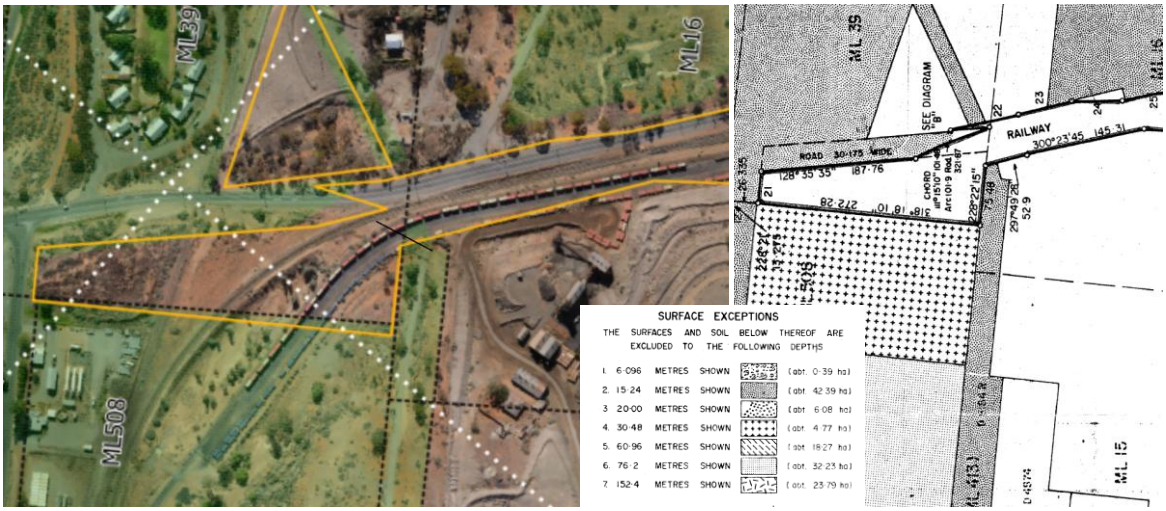

Figure 5: Proposed ladderway location and surface exclusions/mining lease boundary.

3.2. Surface Location

The location for the surface ladderway in the context of CML7 is shown in Figure 1 and a picture of that area is shown in Figure 6.

Figure 6: Proposed surface ladderway exit point location looking west from Thompsons Shaft Waste dump.

It is expected that there will be minimal depth to rock at the collar point, as Figure 6 and 7 shows, the proposed ladderway area is amongst numerous rock outcrops in the area (one of which is amphibolite), including the lode outcrop shown in the orange circle (Figure 6) which can be seen on the northern side of the road, and on top of the Thompsons shaft waste dump.

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Figure 7: Left: Tailings embankment 2 drainage pond – note natural ground on left. Right: Looking south from King shaft area

It is thought that the large amount of overburden noted in Diamond Drill Hole WMDD5580 (10m), N2718 (19.5m) and N2719 (22.8m) is due to a historic water course which passes through the area of those holes and possible fill for the rail junction (see next section). This is shown in the Tails Storage Facility dam break assessment model (Figure 8), where the high risk area is along the historic watercourse.

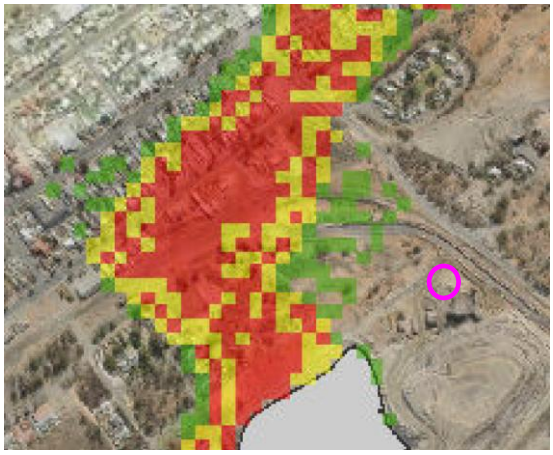

Figure 8: Dam break assessment showing historic water course.

3.3. Drill core

Nearby diamond drill core locations are listed below and positions shown in Figure 9. Photos of core are stored on the company computer network drive.

- WMDD5580 – Blue star 134m West.
- MLDD4723 – Red star, 93m North-Northeast. Shallowest hole in fan comes closest to raise. Top of hole is not assessed as it is the other side of the British Fault and not considered an indicator of raise rockmass.
- MLDD4433 – Purple star, 143m south.
- Normandy drilling 2718 & 2719 – 180m west.

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Currently the nearest underground development to the proposed ladderway is the British Access, off the Blackwoods incline which is 286m south and 82m lower than the base of the planned ladderway.

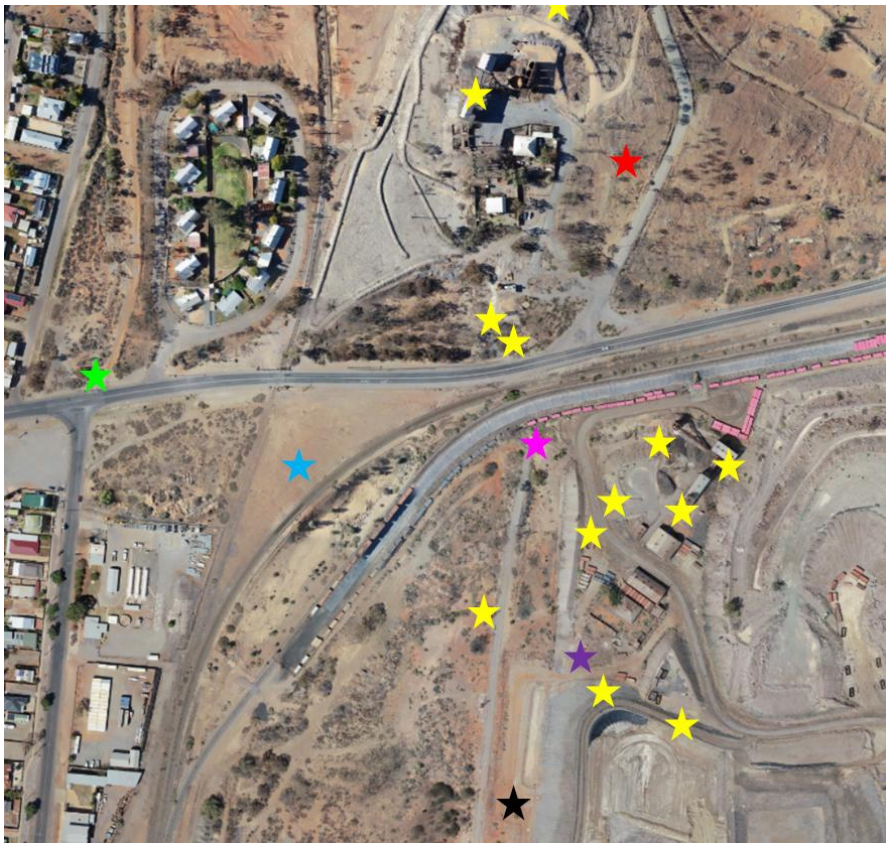

Figure 9: Diamond drillhole locations around planned ladderway (pink star), see text above. Yellow stars are nearby shafts indicating likely suitable ground conditions.

4. Analysis

4.1. Rockmass Classification

Due to the distance to diamond drillholes a precise rockmass classification could not be determined. Therefore the Metasediment Hanging Wall (HW) Domain has been applied. With a Q value of 9.3 or fair to Good. Typical joint sets in this domain are given in the Rasp Mine Principal Hazard Management Plan – Ground or Strat Failure as 68°/122°, 73°/359°, 71°/251° (bedding).

RQD	Jn	Jr	Ja	Jw	SRF	Q
70	6	2	1	1	2.5	9.3

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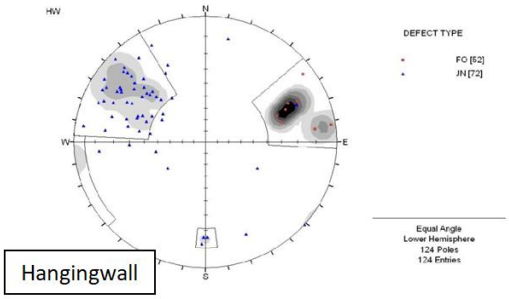

Figure 10: Q rating and stereonet for HW domain.

This classification is confirmed by a review of the surrounding Diamond Drill Hole (DDH) photos and logs. Amphiboles and pegmatites are shown to outcrop in the area in the historic mapping and are noted in the 2718 log. Therefore it is considered that minor pegmatites and Amphiboles may be intersected by the planned ladderway.

No major structures are shown to intersect the raise with the major British Shear shown to pass 76m to the Northeast. No major structures are expected to intersect the raise.

Some minor structures are noted in the DDH photos and logs and some may intersect the raise but would be expected to be 1 to 2m (see 2719 log 66-67.9m) in width and dry.

These classifications are used in the analysis below for the proposed ladderway.

As more diamond drilling is undertaken in the area and as development nears underground this assessment should be reviewed and updated. It is recommended that as with the existing surface ladderway the pilot hole is diamond drilled and reamed out. With the core being assessed before raiseboring. A camera survey after raiseboring is also recommended to confirm these findings.

4.2. Maximum Unsupported Span (MSUS)

The MSUS was calculated according to the McCracken and Stacey method. For this method a number of adjustments are made to the Q value for:

- Wall adjustment to reflect importance of wall stability in raise. An adjustment of 2.5Q was used in the raise where Q>1.
- Orientation adjustment
  - Face orientation adjustment based on number of shallow dipping joint sets to reflect importance of face stability during raise boring. No adjustment of Q was applied as there are no joint sets expected between 0° and 30°.

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- Wall orientation adjustment based on number of steep dipping joint sets for long term stability of raise. An adjustment of 0.6Q was applied throughout the raise for 3 steep joint sets between 60° and 90°.

- Weathering adjustment. An adjustment of 0.75Q (moderate weathering) was applied to the raise

These adjustments are cumulative and applied to the original rating. A Raise Bore Stability Ratio or RSR (which is equivalent to the Excavation Support Ratio or ESR) of 1.3 was assigned for permanent mine opening/circular shaft.

Based on the above the MSUS calculated for the walls of the raise was 6.7m, for the face (temporary) a MSUS of 5.7m was calculated. A hypothetical shear rockmass (red below) has also been plotted of the possible shears noted above with a Q rating of 0.9 or very poor. However, as only the Q values and weathering adjustment were changed and some additional joint sets may also affect the rating this rating should be used as a guide only and be re-assessed once further information is available.

Q	Wall adj	Wall orient	Weath adj	QR wall	Face orient	QR Face	MSUS Wall	MSUS Face
9.39.3 **0.9**	2.5	0.6	0.75 **0.5**	10.5 **0.7**	1	7.00 **0.5**	6.7m **3.4m**	5.7m **1.9m**

4.3. Lower Bound Q_R

The lower bound Q_R method allows comparison of raisebore stability across mine sites. It uses a rolling 3m average based on observations that zones of poor quality rockmass need to be greater than 3m in length to significantly impact raise wall stability. For zones smaller than this overbreak may be experienced but continual unravelling does not tend to occur.

Assuming a 2m shear as mentioned above the lowest lower bound Q_R would be assumed to be 1.9m, well within the stable zone of the chart.

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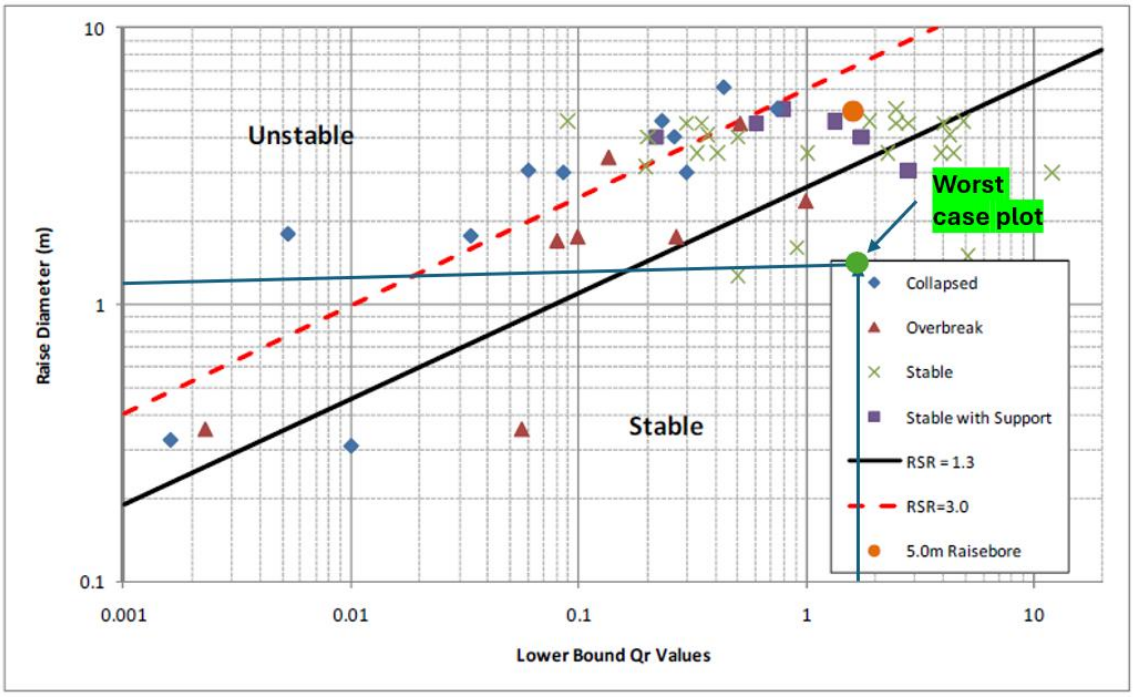

Figure 11: Lower Bound QR for the planned ladderway (Green).

4.4. Stand Up time

Stand up time assessment determines how quickly poor areas of the raise might deteriorate after reaming and assesses the long term stability of the raise independently of the McCracken and Stacey method. The stand-up times should be considered as a risk indicator rather than an absolute time to failure.

By adding a 1.1m line to the chart below and assigned RMR classification of 65 or good rock moved down to that line it can be seen that the raise should not require support using this assessment method.

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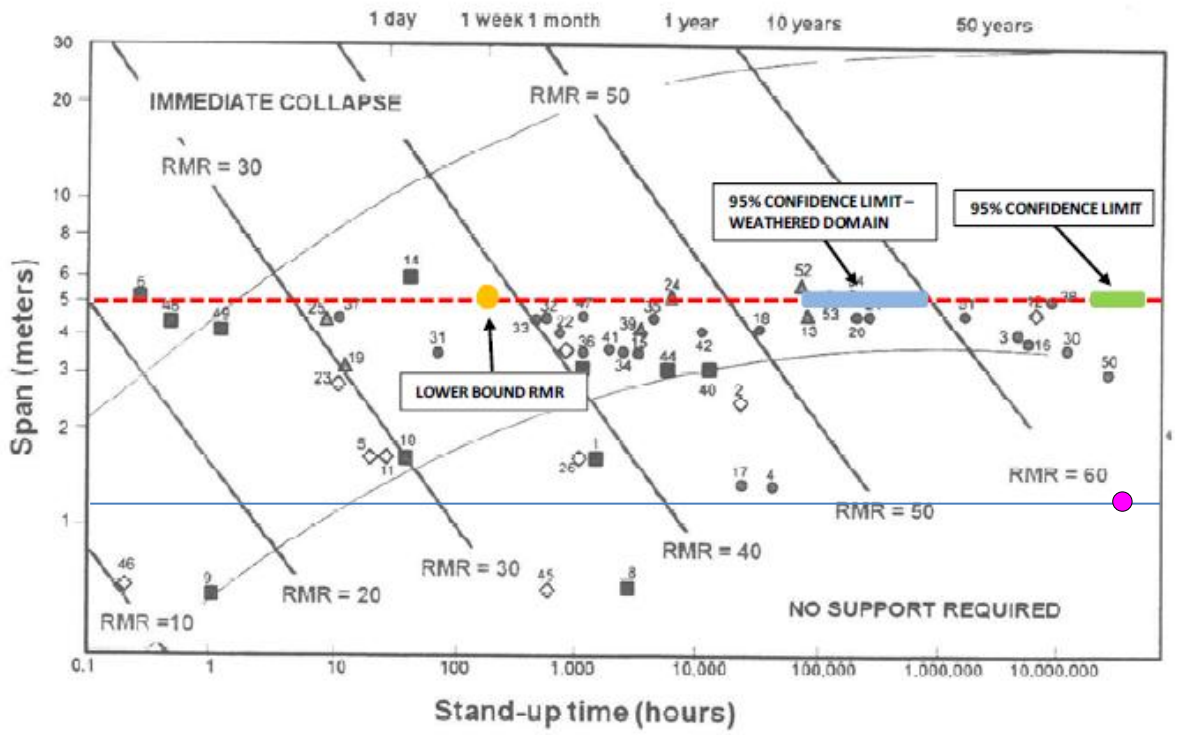

Figure 12: Stand up time assessment for the planned ladderway (pink)

Based on the rock mass characterisation considered, this assessment indicates that the ladderway will be highly likely have no stability issues. The diamond drilling will firm up the design after logging has been completed.

4.5. Further Empirical Assessment

The empirical McCracken and Stacey method discussed above is commonly used for first pass designs of vertical excavations. The McCracken and Stacey method addresses the initial stability of a shaft, but this method requires detailed geomechanics data that for many case studies is not available (Brummer 1998). The stress ratios have been assessed to determine the stability of ladderway. One of the important limits is the stress ratio at which the perimeter of the raise or pilot starts to fail because of the induced tangential stress around the raise bore. Based on failure observations this occurs at a σmax/UCS ratio of about 0.3. The next limit, when severe spalling and crushing occurs, is at a σmax/UCS ratio of about 1.2–1.5, based on industry experience. The pegmatite UCS of 123MPa has been considered in the assessment and a σmax at the base of the ladder estimated to be 9.4Mpa. Therefore, the σmax/UCS ~ 0.1 against a 1.1m diameter ladderway design falls in the stable zone ~ problem free raising.

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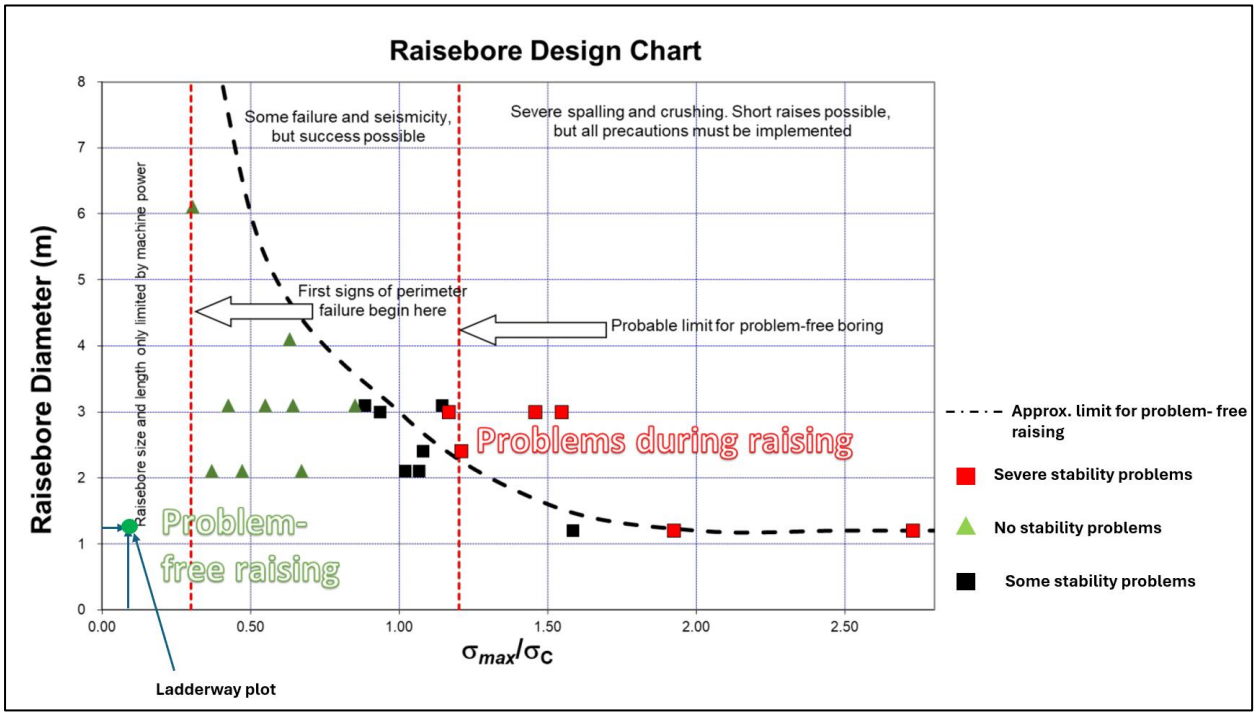

Figure 13: Ladderway Design Chart for Diameter Vs σmax/UCS

The length of the raise also influences the stability of the vertical excavation, thus the length against σmax/UCS has also been considered and shows that it falls in the stable zone.

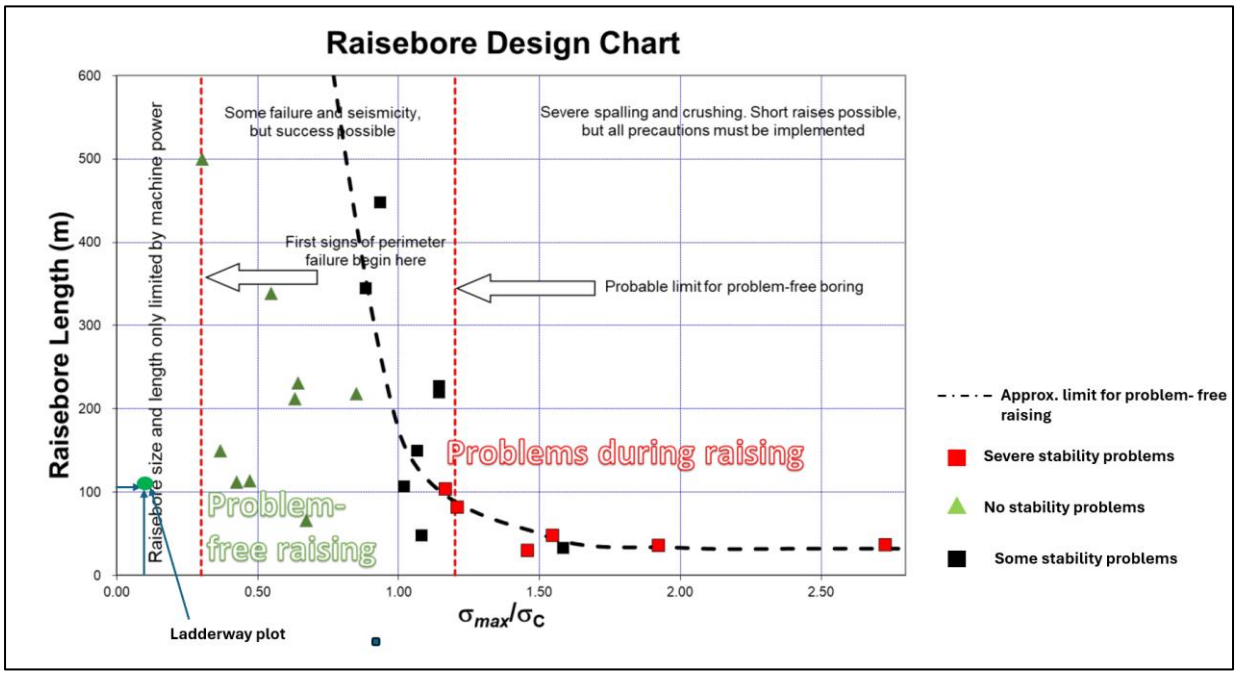

Figure 14: Ladderway Design Chart for Length vs σmax/UCS

From the design approach above, this assessment suggest that no stability issues are likely to arise from stress or spalling. This is mainly because the ladderway will be designed with relatively shorter

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parameters as diameter is to be 1.1m and length 101m, and lower expected stress influence. The smaller diameter is good from the stability perspective as less microfractures get exposed.

4.6. Numerical Modelling Assessment

Numerical modelling was not undertaken for this assessment. As the ladderway is located close to surface and a good distant from stoping no stress/spalling related issues are expected for the raise. This is further augmented by the empirical design approach carried out above.

4.7. Kinematic analysis

A Kinematic analysis was undertaken using discontinuity measurements contained in the Figure 15. The anlysis showed 6 potential wedges around the perimeter of the proposed ladderway but of small size (less than 40kg), some with low factors of safety (FoS). Only one has a FoS of 0 but this only has a 2Kg size.

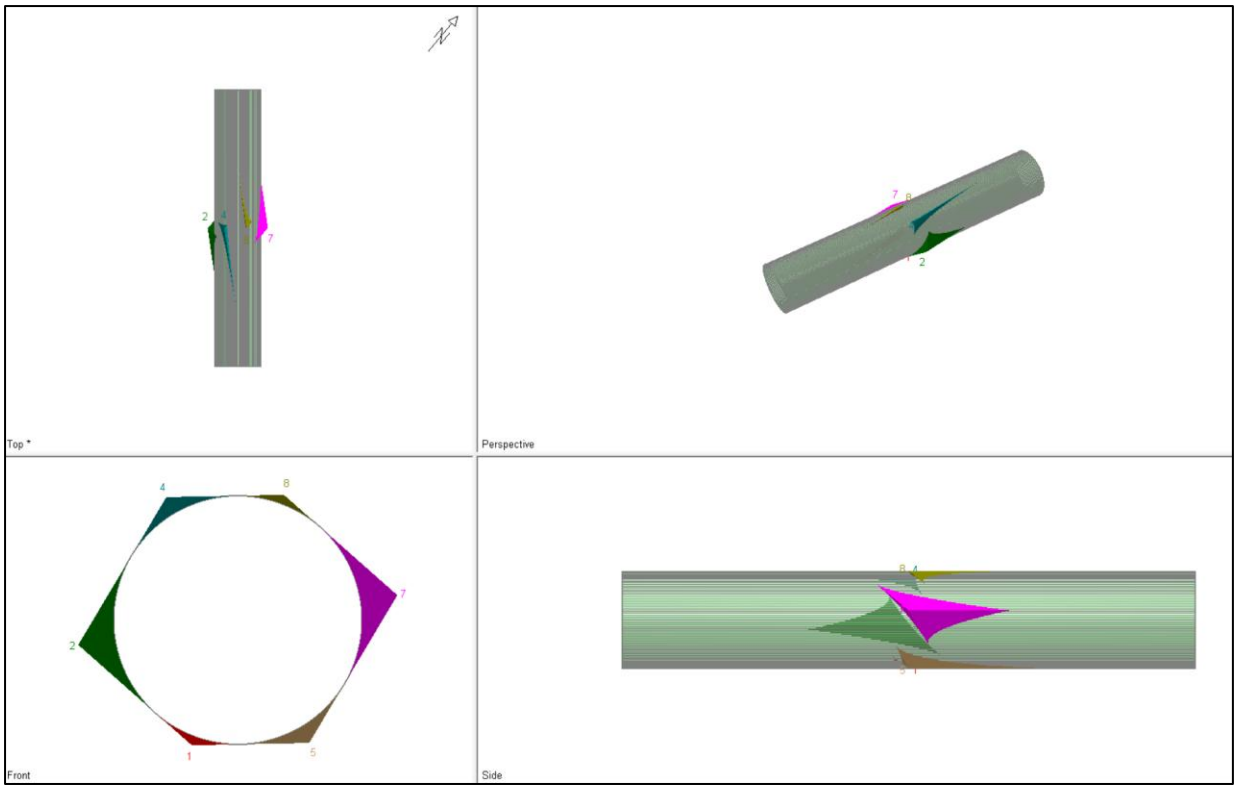

Figure 15: Unwedge analysis for proposed ladderway.

Floor wedge [1] Factor of Safety: stable Wedge Weight: 0.002 tonnes	Lower Left wedge [2] Factor of Safety: 0.483 Wedge Weight: 0.041 tonnes

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Roof wedge [4] Factor of Safety: 0.147 Wedge Weight: 0.008 tonnes	Floor wedge [5] Factor of Safety: 0.315 Wedge Weight: 0.008 tonnes
Upper Right wedge [7] Factor of Safety: 0.125 Wedge Weight: 0.041 tonnes	Roof wedge [8] Factor of Safety: 0.000 Wedge Weight: 0.002 tonnes
Near End wedge [9] Factor of Safety: 0.000 Wedge Weight: 0.146 tonnes	Far End wedge [10] Factor of Safety: stable Wedge Weight: 0.146 tonnes

Figure 16: Wedge information.

A potential roof wedge (near end wedge 9) was shown of 146 Kg with a factor of safety of 0. This may be an issue if the reamer is removed from the face of the raise during boring.

Figure 17: Potential roof wedge.

The minor sidewall structures should not cause major issues as the ladderway will be lined with the Safescape tubing which provides some protection to personnel. If not acceptable steepening the raise or aligning it differently may improve stability as the current orientation is shallow and sub parallel to bedding orientation.

5. Nearby Stoping

The proposed ladderway is located far from active mining areas and 95m Southeast of the closest planned British Block stope. This should not have any effect on the raise but this will be assessed in the relevant stope designs, assessments and block notes.

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6. Ground Support and reinforcement

Using an ESR (=RSR) of 1.3 the proposed ladderway does not plot on the empirical ground support chart. If the calculated rockmass are plotted down to the base of the chart the majority of the ladderway would be expected to lie in the area of the chart which can be left unsupported.

As stated above it is recommended that the drillcore of the pilot hole be reviewed and that a camera survey be taken soon after the completion of raiseboring to assess if support is required before the placement of the ladderway. This would be expected to be limited to the weathered section of the raise, but additional may be required if unmodelled structures are intersected. Annual inspections of the ladderway once installed are recommended.

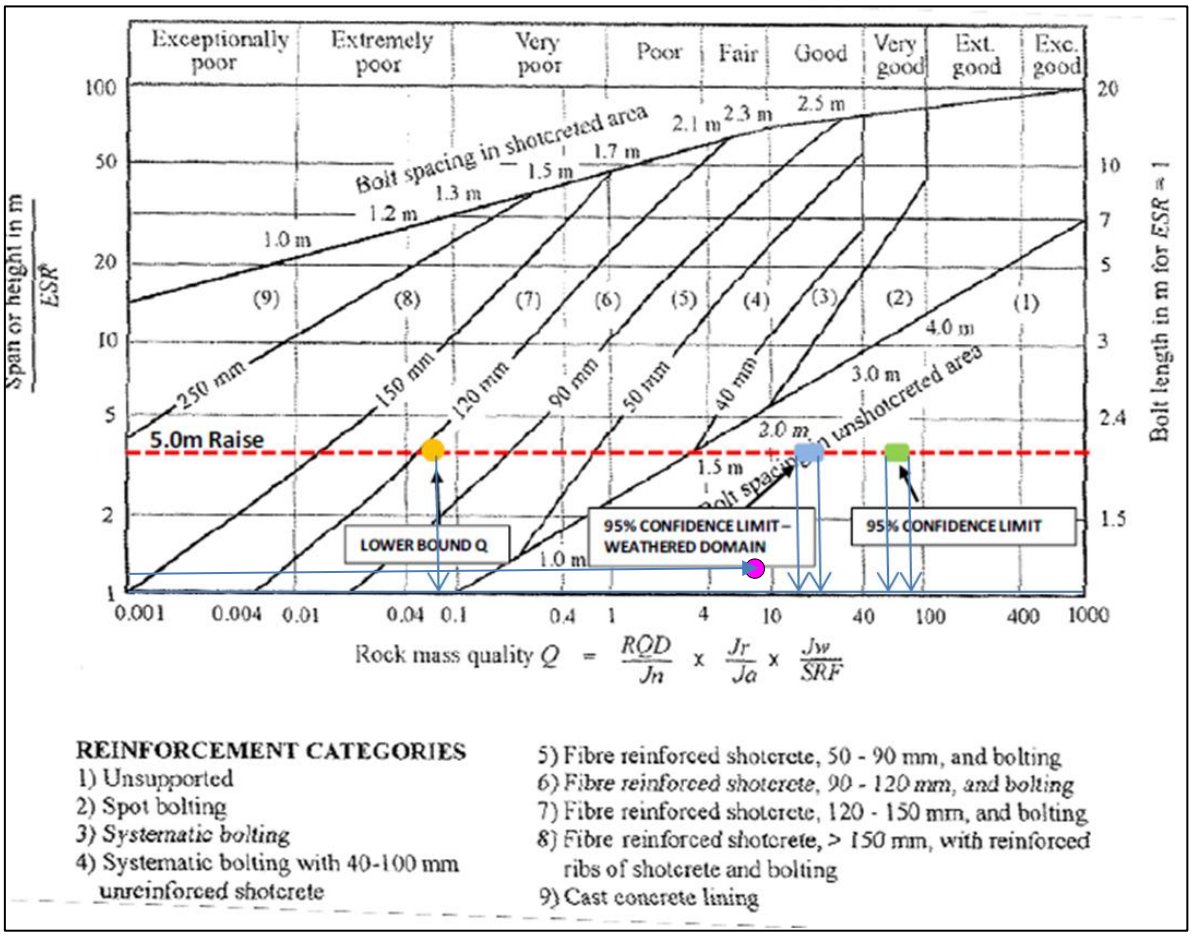

Figure 28: Support requirements for proposed ladderway.

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7. Collar

The design plans for the ladderway collar are not known at present. As detailed above the depth to natural ground should be minimal.

Any excavations required for the raisebore which will have personnel access must have an engineering design, and care must be taken to ensure that the existing fill slopes are not undercut. Support may be required such as shoring.

Drainage around the final opening will be assessed to prevent water flowing down the ladderway.

A surface enclosure will also be installed to prevent unwanted access, this will likely be a shipping container as used for the current ladderway (refer Figure 19).

Figure 39: Enclosure on current installed ladderway

8. Summary

This assessment is based on diamond drill holes in the vicinity of the proposed ladderway.

A review of stability assessment by empirical design approach shows that the raise is expected to be stable and not require support. The review further indicates that no stress or spalling issues is expected.

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Minor structures up to 2m thickness may be intersected but should not cause major issues due to the small diameter of the planned raise.

The HW metasediment domain has been used for the assessment which is back up by drillcore and logs. Minor pegmatites and amphibolites may be intersected by the raise but should not cause any issues.

Minor wedges are expected by the Kinematic analysis but should not cause major issues. Steepening the raise or orientating it perpendicular to bedding will improve stability.

No current or planned stopes are located close to the raise and no historic workings are recorded nearby.

Depth to natural ground is expected to be minimal at the raise collar but a significant excavation for the reinforced raise bore pad may still be required.

Annual inspections of the ladderway are recommended.

Reagan Kabali,
Geotechnical Engineer,
MSc Geotechnical & BEng Mining Engineering.

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Appendix H
Water Impact Assessment

EMM
creating opportunities

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9 February 2026

Joel Sulicich
Health Safety Environment and Training Manager
Broken Hill Operations Pty Ltd
130 Eyre St
Broken Hill, NSW, 2880

Re: Rasp Mine MOD13 water resources assessment of related risks and impacts

Dear Joel,

EMM Consulting Pty Limited (EMM) has been engaged by Broken Hill Operations Pty Ltd (BHO) to carry out a water resource assessment for the proposed Modification 13 (MOD13) of project approval MP 07_0018 for the Rasp Mine (the mine) in Broken Hill, New South Wales (NSW).

1 Modification description

1.1 Overview

The proposed modification (MOD 13) seeks to extend operations until 31 December 2031, supported by the following proposed activities:

- extending mining operations into the British Mine deposit
- installation of an escape ladder way from the underground workings to the surface
- changes to onsite operations to include a tailings dewatering system
- importing and processing of 100,000 tpa of ore from Pinnacles Mine

The proposed modification will not change the processing rate or other operating functions outside of those affected by the above.

1.2 Extension of mining operations

British Mine sits within exploration licence (EL) 5818 and mining lease (ML) block 16. To enable the extension of mining operations into the British Mine, BHO will apply to have the boundary of ML 16 changed to include the relevant portion of EL5818 under a separate process.

The extension of mining operations into the British Mine would be a continuation of existing underground workings and will not require surface disturbance. Ore, waste rock and tailings will be handled as per BHO's existing management procedures.

The depth of the existing British Mine is not known but for the purposes of this assessment has been considered to be no deeper than the current mine workings associated with Rasp (270 m below ground [mbgl]).

Water supply and dewatering of the underground workings will be in accordance with BHOs existing water management plan.

1.3 Emergency egress ladderway

The installation of the emergency egress ladderway will require the use of a raise boring machine (raise borer). A raise borer is generally used to excavate a circular hole between two levels of a mine without the use of explosives. The raise borer will drill a 1.1 m diameter shaft between the surface pad and the target mine level (approximately 170 m bgl). The drill cuttings and associated dust from the reamer head fall to the floor of the lower level and will remain underground.

Installing the emergency egress ladderway will require the following construction activities:

- surface site preparation and concrete pouring
- construction via raise boring
- installation of ladderway
- installation of surface structure

Due to the water quality requirements for drilling, water supply for the ladderway construction will be raw water sourced externally.

1.4 Tailings dewatering system

The tailings dewatering system will incorporate a filtration plant and a tailings slurry line and water return line between the filtration plant and Rasp Mine processing facility. The filtration plant will produce a filter cake which will be deposited in TSF3 via conveyor belt. Recovered water will be transferred via the water return line to a lined process water pond for reuse in the processing facility.

Installation of the tailings dewatering system will require the following construction activities:

- bulk earthworks
- concrete pouring
- structural steel erection
- mechanical platework, electrical and instrumentation
- construction of the tailings slurry and water return pipelines.

1.5 Importing ore from Pinnacles Mine

BHO intends to import 100,000 tpa of ore from the Pinnacles Mine to Rasp Mine for processing. Ore would be transferred in B-double trucks at fortnightly or monthly intervals to support processing requirements at Rasp Mine. Each year, Rasp Mine would receive up to 1,512 deliveries of ore.

Deliveries of ore would be unloaded at the existing Rasp Mine ROM Pad and processing using the existing processing facility. Final concentrate products would be transported via rail to Port Adelaide whilst tailings would be managed in accordance with approved Rasp Mine tailings management procedures.

2 Existing mine water management

The Rasp mine is located within the township of Broken Hill, currently operating as an underground mine. Previous operations at the site included open cut mining, with the remanent open cut voids now being used to store tailings. There is negligible upstream catchment area to the mine as it is situated on a catchment divide. The mine has been incrementally built-up over time and occupies a high point in the landscape with no external surface water catchments. The surface drainage network in the vicinity of the mine has been modified over time consisting of open channels and surface water storages for sediment laden and mine affected water.

The main uses for water on site are ore processing and for the operation of underground machinery. Minor uses of water include dust suppression, fire water, contractor facilities, and vehicle washing. Water loss from the site occurs through evaporation and water used in the processing of ore and export of concentrate.

Potable and raw water is supplied to the site from the Broken Hill town water supply. Saline groundwater is intercepted by the underground workings and pumped to the surface. This water is then used on site for ore processing and operation of underground machinery.

Mine affected water is recycled on site. Notably, water used for the operation of underground machinery is collected in sumps, pumped to the surface, stored temporarily in ponds (primarily in 'Lochness', also known as pond S22), and then pumped back underground for operation of underground machinery.

The mine site has no external surface water catchments. Rainfall runoff within the site boundaries is captured in surface water storages, or in unlined depressions. Typically, rainfall runoff evaporates, but it may be pumped into the 'Lochness'/S22 when quantities are significant.

Surface water and groundwater are managed in accordance with BHO's existing water management plan, last updated in June 2019. Previous surface water assessments have been completed as a part of each modification application from Mod 10 onwards, with brief surface water impact assessments completed as relevant in prior modifications.

3 Risk identification

The following water resource related risks have been identified for the MOD13 works:

- Mobilisation of sediment laden water in stormwater runoff from the placement of infrastructure including emergency ladderway and tailings dewatering system.
- Inundation of the emergency egress ladderway due to overland flows and flooding.
- Changes to site water balance and potential excess water from the dewatering of tailings.
- Management of stormwater water collected in TSF3.
- Aquifer interference associated with mining activities and placement of tailings.

4 Water balance

4.1 Overview

A water balance assessment was undertaken for MOD13. For this assessment, the existing water balance model was revised in GoldSim version 15. The model applied a continuous simulation methodology that assessed the performance of the water management system at Rasp over a historical period of rainfall and evaporation data. The Goldsim model was redeveloped, similar to excel, by representing the water cycle as a series of elements, each containing pre-set rules and data, that were linked together to simulate the interaction of these elements. Further information on the model is provided in Appendix A.

Figure 4.1 presents the water cycle schematic for the site water balance including MOD13 components.

The water cycle is operated as a closed water circuit with no-offsite discharges from the operations.

The primary uses of water for the site are dust suppression, the processing plant demand and underground mining demands. The losses from the water cycle are through evaporation, moisture entrained with tailings and water used to generate the concentrate product.

The assessment for MOD13 included the following changes to the model:

- Model was run on a daily timestep using updated BHO metered data where available
- Tailings were deposited in TSF3 with a modified emplaced moisture percentage to account for use of the Tailings Dewatering Plant.
- Water recycling from Tailings dewatering plant returned to the Process Water Pond.
- Changes to the water management system due to changes in TSF2. Water storages overflowing towards TSF2 are now directed into the process water management system.
- Improved assumptions around storages capacities for each component of the water management system i.e. water was allowed to reside in ‘Lochness’/S22, Pattos storage and the TSF systems rather than assuming an immediate transfer.

The model was run consider an existing and post-modification scenario using historical climate and metering data from BHO for the July 2024 to June 2025 period.

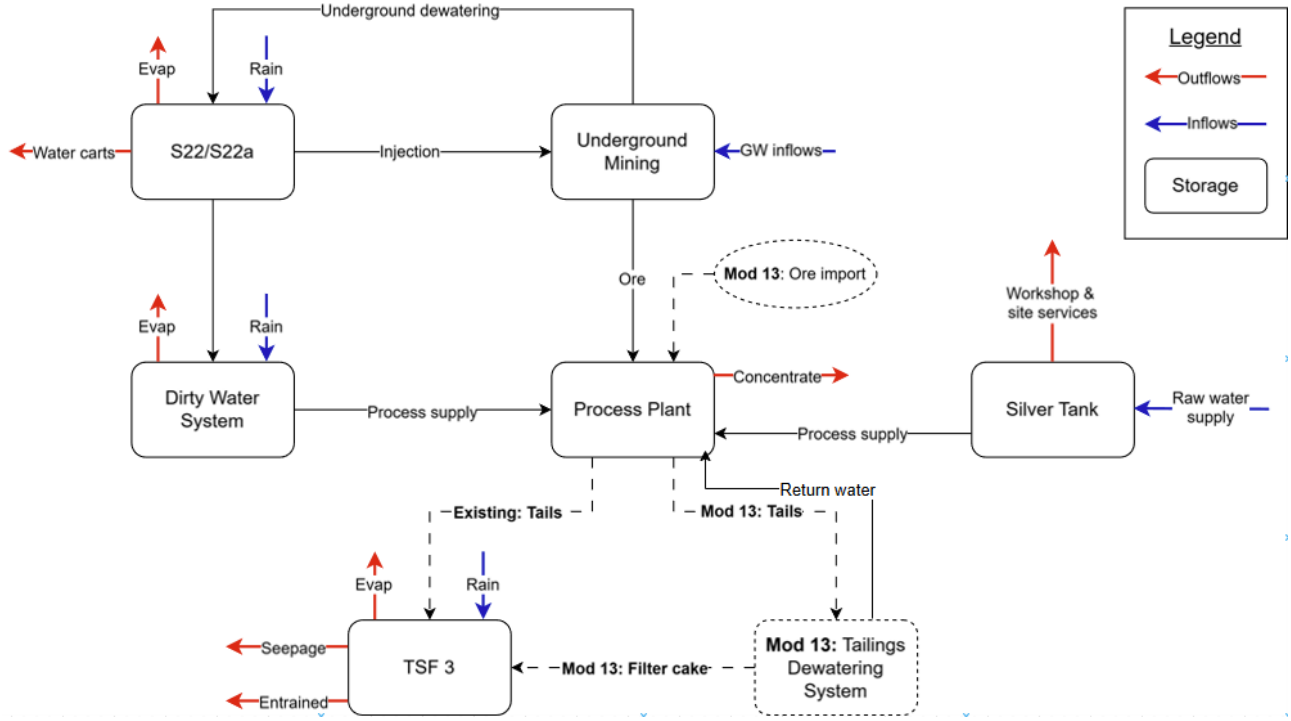

Figure 4.1 Water cycle schematic for MOD13

4.2 Water balance summary

The results of the water balance model for MOD13 are summarised in Table 4.1.

The key outcomes from the water balance model when the existing scenario is compared to the proposed MOD13 scenario are:

- MOD13 will result in a significant reduction in reliance on town water supply for processing of ore
- The model predicts a slight reduction in amount of water stored on site through less reliance on external water
- Significant reduction in evaporative losses on TSF cells
- Model assumes tailings dewatering is always operating with negligible system losses. This results in less opportunity for Pattos storage to transfer to the Processing Plant to meet its demands which results in an increase in water in the dirty water system.

Table 4.1 Existing and post-modification water balance annual results for 2024-2025

Water stream	System component	Volume (ML) – existing mine conditions	Volume (ML) – post modification conditions
Inflows			
Raw (town) water	Town water	69	91.9
Process water	Town water	158.7	9.1
	Groundwater	297.7	297.7
	Rainfall – TSF cells	18.9	18.9

Water stream	System component	Volume (ML) – existing mine conditions	Volume (ML) – post modification conditions
	Rainfall – process ponds	2.3	2.3
Total inflows		**546.6**	**419.9**
Outflows			
Raw (town) water	Vehicle workshops and vehicle wash	67.4	89.7
	Site services	1.5	2.1
Process water	Entrainment – product	2.7	2.7
	Seepage and entrainment – tails	99.0	66.6
	Evaporation – process ponds	26.9	26.9
	Evaporation – tails	140.5	10.5
	Dust suppression	77.9	77.9
	Dirty water system (storage/evaporation/ seepage)	113.8	127.4
Total outflows		**529.7**	**403.8**
Change in Storage			
Total volume in storage		**16.9**	**16.1**
Balance		***0***	***0***
Recycled			
Tailings dewatering system	Proposed infrastructure under MOD13	0	201.7

5 Groundwater

5.1 Overview

MOD13 includes access to new mining areas in the British Mine, the construction of an emergency ladderway and the emplacement of dewatered tailings into TSF3. Each of these components have the potential to interact with existing groundwater systems at Rasp Mine and require assessment against the Aquifer Interference Policy (AIP).

The AIP (DPI 2012) sets out the water licensing and assessment processes for aquifer interference activities. The WM Act defines an aquifer interference activity as an activity involving any of the following:

- penetration of an aquifer
- interference with water in an aquifer
- obstruction of the flow of water in an aquifer
- taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations, or

- disposal of water taken from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations.

The AIP defines the regime for protecting and managing the impacts of aquifer interference activities on NSW's water resources. The AIP requires consideration of the potential impacts of an aquifer interference activity in respect to the water table, water pressure and water quality. Proponents must estimate the water take (including incidental and indirect take) from each water source and connected water sources.

The project has the potential to intercept groundwater system in the extension of mining areas and construction of the emergency ladderway. This will be dependent on the presence of shallow groundwater systems being present in vicinity of the proposed works.

The project has the potential to interfere with water quality in an aquifer through the ongoing emplacement of tailings within TSF3. This risk will be considered qualitatively as part assessment.

5.2 Groundwater levels

The existing groundwater monitoring at Rasp is primarily focused on the recording of perched groundwater movement and site operational activities with respect to these movements. Due to the depth of the regional groundwater at the site there is little interaction between the perched groundwater systems (present at shallow depth) and regional groundwater (present at more than 100 mbgl).

The water management plan (BHO 2024b) outlines the objectives of the groundwater monitoring is to:

- Provide a program to monitor seepage movement within and adjacent to the tailings storage facilities
- Provide details of parameters and pollutants to be monitored and background local perched groundwater parameters.

There are 18 sampling locations for groundwater. GW01 (EPL point 37) to GW16 (EPL point 52) are piezometers installed at various locations around the mine site and are sampled quarterly. There are also two sampling locations for water pumped from underground mining, Shaft 7 (EPL point 53) and Kintore Pit (EPL point 54), which are sampled monthly. Of note for the MOD13 assessment are:

- GW01 and GW02 monitoring perched groundwater system located south of the TSF3.
- GW11, GW12, GW13, GW14, and GW15 monitoring perched groundwater system located north and east of the British Mine area.

5.2.1 Water stored within historical mine workings

Initial geotechnical investigations completed by BHO indicate there may be volumes of water held in the old workings of the British Mine. These volumes are currently not estimated nor are they described to occur at specific depths. As this water is stored within the mine workings and not expressed by the strata, it is not considered to be groundwater, rather part of a water management system. Regardless, pumping this volume will likely require accounting against BHO's existing groundwater licence (refer to Chapter 7).

5.2.2 Perched groundwater levels

Monitoring level data presented in the Annual Review 2023 from the groundwater wells indicated that GW02, GW13, GW14 and GW15 are consistently dry. This outcome is supported in quarterly 2025 public monitoring reports to the EPA, with GW12 also being dry for the last two rounds.

Depth to groundwater has been measured repeatedly for GW01 and GW11 based on data up to 2023. At this time it was considered that the groundwater monitoring locations indicated a rising groundwater level trend with GW01 approximately 5 mbgl and GW11 9 mbgl.

Historical interception within the perched groundwater system has been inconsistent and not necessarily predictable. Given that only one bore in the two focus areas for MOD13 intercept groundwater, it is considered unlikely that the components of the project will result in significant and/or sustained interception of the perched groundwater system.

5.2.3 Regional groundwater levels

Based on the assessment completed for the response to submissions on the MOD11 project (EMM 2024), BHO identified that regional groundwater levels, specifically in the north-east of the underground mining operations are expected to be at least 480 mbgl (based on observations made from the 1480 drive) which is below the current planned workings depth of 270 mbgl (i.e. mine workings are expected to be entirely above the regional groundwater table).

No interference of the regional groundwater table is expected due to MOD13.

5.3 Groundwater quality

Assessment of current groundwater quality has focused on the perched groundwater system. This system contains significantly elevated concentrations of lead, manganese and zinc, reflecting interaction with near-surface materials across the site. Manganese and zinc concentrations are commonly measured above 200 mg/L. Perched groundwater pH is typically slightly acidic to neutral, with values generally ranging between 5.5 and 7.5.

Tailings water shows elevated concentrations (compared to regional groundwater) of cadmium, manganese, magnesium, calcium, alkalinity, sodium, chloride, sulfate, and electrical conductivity. Acid rock drainage is not typical at Broken Hill, as pyrite is not present in significant quantities and carbonate-rich rocks provide substantial buffering capacity, limiting the potential for acid generation.

6 Assessment of proposed activities

6.1 Mobilisation of sediment during construction

Construction of the emergency egress ladderway and tailings dewatering system would require site preparation activities including ground disturbance and an accessway formed using a raise boring rig. Site preparation activities including concrete pad formation and pouring are estimated to span a period of up to 31 days for the tailings dewatering system. Stormwater runoff from the construction area has the potential to mobilise sediment from disturbance areas.

Stormwater runoff from the proposed infrastructure construction areas would drain to the existing dirty water management system. The disturbance areas are a small portion of the overall mine footprint and thus would form a small contribution to the water management system. Stormwater runoff from the proposed infrastructure construction areas is not expected to result in any material changes to the water quality of the mine water management system.

6.2 Inundation of the emergency egress ladderway

The emergency egress ladderway is expected to be installed at a suitable location in ML Block 16 with negligible risk of inundation due to local drainage or flooding as:

- the ladderway is sited away from mapped watercourses, drainage lines, and areas known to be subject to flooding
- the ladderway opening will be raised above the ground to prevent inundation of water from the immediate surrounding area
- the surface ladderway container will act to divert local stormwater runoff away from the emergency egress ladderway

6.3 Impacts to surface water quantity

The placement of the tailings dewatering plant and emergency egress ladderway will have localised impacts on stormwater flows. However, no significant impacts to stormwater quantity are expected due to the additional infrastructure.

The additional infrastructure will be integrated into the existing water management system. Catchment boundaries and stormwater routing for the water management system will not be impacted by the additional infrastructure. Areas used for the tailings dewatering plant and emergency egress ladderway will route stormwater in the same manner as the existing water management system.

6.4 Changes to the site water balance

The Tailings Dewatering Plant will result in a reduction in the reliance of imported water to the site. This will mean that some water storages will require additional or alternative water disposal mechanisms following rainfall events. Based on the water balance model scenario assumed, dust suppression activities were assumed to remain unchanged between existing and post-modification scenarios. It is likely that additional water disposal could occur through on-site dust suppression if site water inventory issues become problematic. Based on the results of the water balance modelling, it is expected that MOD13 will result in a net benefit to site water management.

6.5 Groundwater interference

Some MOD13 components have the potential to interfere with the groundwater environment through interception or modification of its water quality.

Groundwater levels are unlikely to be intercepted based on a review of available groundwater level data of the perched and regional groundwater systems. In the event that a perched groundwater system is intercepted through the construction of the emergency ladderway, BHO will implement the necessary procedures as documented within the current water management plan (BHO 2024b). This will include targeted investigation, collection and management within the water management system.

The placement of tailings within TSF3 is part of approved works. Dewatering these tailings will assist in mitigating the risk of inflows to underground workings and also result in a more efficient use of water resources for the site. Groundwater quality within the perched groundwater system shows similar characteristics to tailings water, with both exhibiting elevated concentrations of comparable metals and metalloids, including manganese and zinc.

The existing water management plan provides an established groundwater monitoring network and established investigation triggers for groundwater changes due to site operation. This includes planned monitoring of the underlying drainage system associated with the decline plug. The perched groundwater system is discontinuous and sporadic and TSF3 activities are unlikely to change the usage category of water from the system or detrimentally impact on receptors, as long as seepage to surface water systems does not occur. The connectivity between TSF3 and the perched groundwater system is further mitigated by the reduction in moisture content of the emplaced material.

7 Water licensing requirements

BHO have a water access licence (WAL 31065) to extract up to 370 ML/year of groundwater from the Adelaide Fold Belt MDB Groundwater Source. BHO can also receive an additional carryover allocation each year of up to 10% of the water access licence volume, resulting in a total entitlement of 407 ML/year when this allocation is applied.

Initial geotechnical investigations completed by BHO indicate there may volumes of water held in the old workings of the British Mine. Standard controls will be used when working in the vicinity of the old workings as per the Remnant mining critical control standard and Backfill and Voids Principal Hazard Management Plan.

BHO's predicted water extraction requirement from the water balance prepared is approximately 298 ML/year which is less than the allocation allowed for by WAL 31065. This additional water entitlement will provide buffer to account for potential groundwater inflows encountered during mining operations.

It is not expected that the MOD13 would result in the interception of enough groundwater volume to exceed BHOs water access licence limit of 370 ML/year (or 407 ML/year with carryover).

8 Conclusion

The assessment of water related risks and impacts for MOD13 indicates:

- Surface works associated with construction of the emergency ladderway and tailings dewatering system are expected to have a negligible impact on water quality in the water management system.
- The emergency egress ladderway is not expected to be inundated by flood waters or local overland flows.
- Surface water quality and quantity is not expected to be adversely affected by the placement of the tailings dewatering system.
- There is not expected to be interference with the groundwater environment as a result of the construction and operation of the MOD13 components.

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Appendix A
Water balance model

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A.1 Modelling information

An operational water balance was prepared to support the MOD13 assessment. This model was prepared to support an understanding of water volumes being moving through the site and to inform the balance of water management with and without the project. The model was developed using flow metering data provided by BHO and other assumptions outlined in the sections below.

Table A.1 Project data

Type	Item	Source	Description
Climate data	SILO patched point climate data (-39.15, 141.45)	SILO – Australian climate data from 1889 to present (DESTI 2025)	Daily rainfall and pan evaporation data
Hydrology sub-model	Australian Water Balance Model (AWBM)	Boughton (2004)	The AWBM was developed by Boughton (2004) and is widely used across Australia to estimate catchment runoff.
Storage data	Stage storage curves	18 May 2025 LiDAR (Metromap) and GIS tools	Relationship of water volume and surface area at various depths in storages
	Catchment areas, storage areas	Water management plans, satellite imagery, spatial elevation data	Areas of storages and contributing catchment areas
Water take	Shaft 7 and UG mining groundwater inflows, UG injection volumes	BHO site metering data	Site data for groundwater take and underground injection

A.2 Derived data

All catchments were assumed to be highly disturbed and sparsely vegetated. Areas, volumes and area-storage relationships for each storage were established using the site Water Management Plan, satellite imagery and elevation data at a 1 m resolution (NSW Government, 2022). As Pattos is a small storage and representative of several components of the dirty water management system, it was given a static surface area.

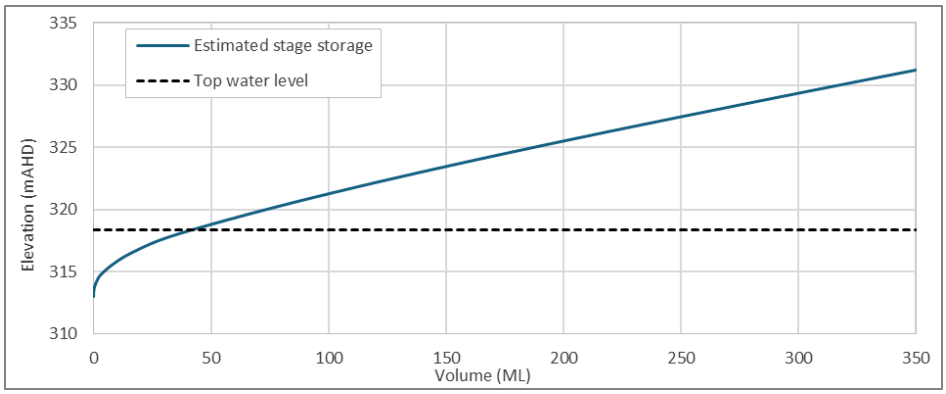
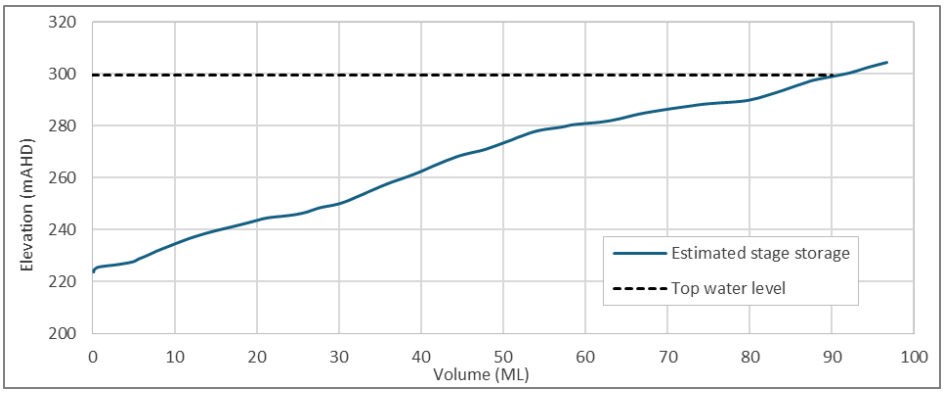
Table A.2 Storage data

Storage	Catchment area (ha)	Max surface area (ha)	Max volume (ML)[1]
S22/'Lochness'	19.52	1.1	19.5
Pattos	6.64	0.15	1.5
TSF3	14.21	1.21	N/A[2]

Notes

1. With remaining storage for a 1-in-100 year flood event
2. An area-storage curve for TSF3 was developed using the 2022 site elevation data resulting in a very high maximum value. Excessive water was never held in the TSF under pre- or post-development scenarios. Maximum storage result from modelling was approximately 2.5 ML

Table A.3 Area-storage relationship data

Storage	Area-storage relationship
S22/'Lochness'	
TSF3	

A.3 Overview

As a part of a water balance review in 2021, EMM developed an Excel based water balance model for the Rasp Mine based on pre-existing site water balance (EMM 2021). This model has since been used for reporting of water usage on site, in particular, groundwater take which was estimated as the difference between the dewatering and underground injection volumes. This methodology was endorsed by DPIE Water in November 2021 in a consultation session with BHO and EMM (BHO 2024).

To complete the MOD13 water resources assessment, the Excel water balance model was updated in Goldsim to primarily include:

- MOD13 changes (tailings dewatering system, ore imports from Pinnacles Mine)
- deposit tailings into TSF3

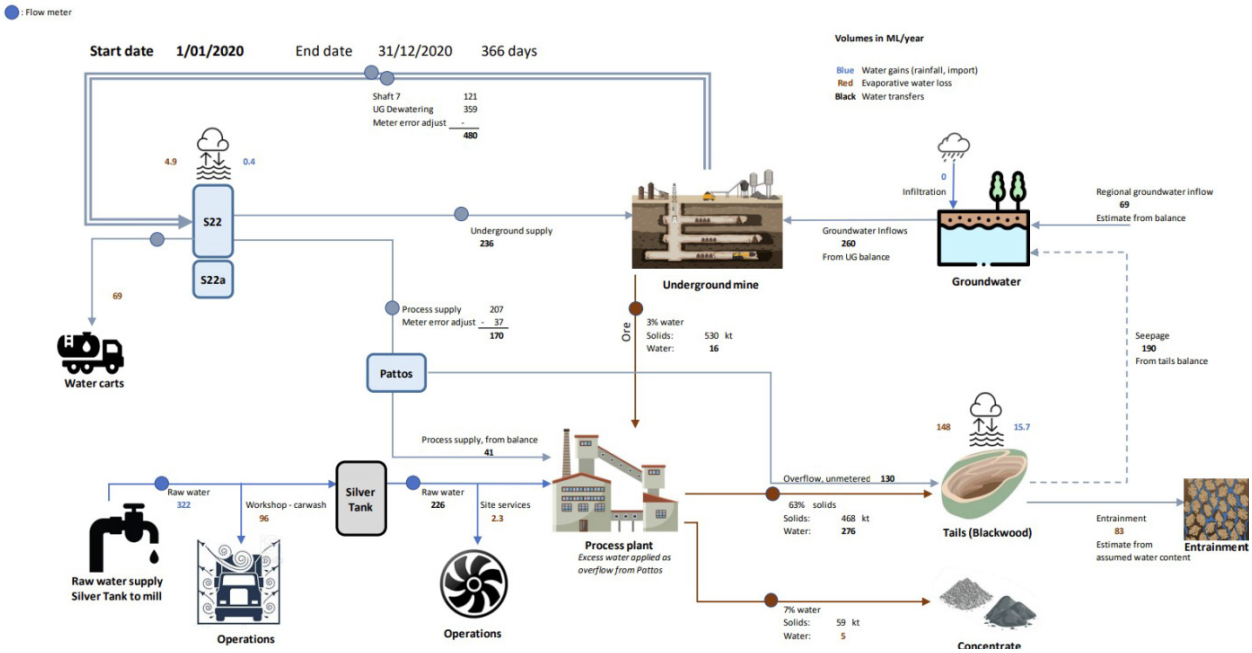
The use of GoldSim enables simpler and more transparent modelling of storage volumes and water transfers on a daily timestep, as opposed to the yearly balance with no modelled storage volumes currently used. Wherever possible, relationships between storages and the calculation of transfer volumes were kept the same as the Excel model. GoldSim version 15 was used to develop the model, which was the most recent release at the time of development.

A.4 Model changes

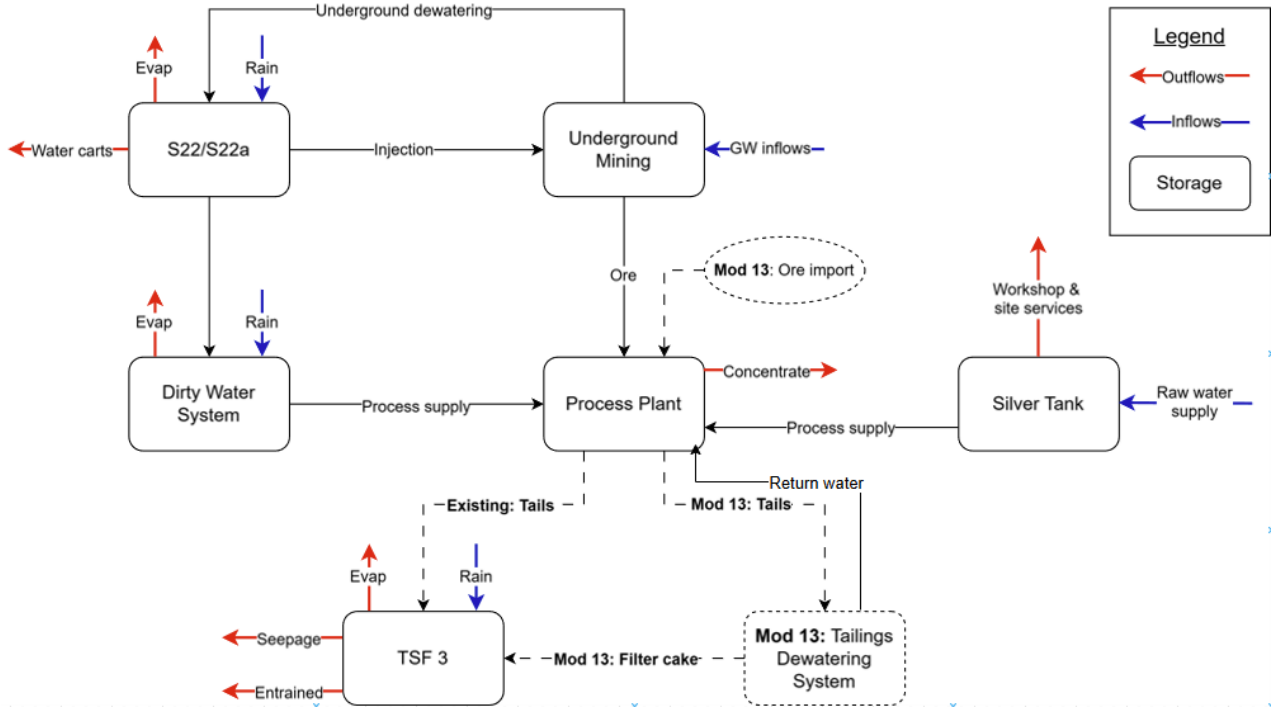
Key changes to the model are summarised below:

- Incorporated MOD13 components, with the ability to turn them off for an existing mine scenario.
- Model was run on a daily timestep as opposed to yearly in the Excel model.
- Tailings were deposited in TSF3 as opposed to TSF2.
    - Pattos no longer overflows into the TSF and instead overflows into the dirty water system.
- Storages were modelled with capacities, i.e. water was allowed to reside in S22, Pattos and the TSF rather than being immediately transferred.

The model schematics for existing conditions and post-modification conditions can be seen Figure A.1



Existing conditions - Water cycle schematic



Post modified conditions - Water cycle schematic

Figure A.1 Existing and post modified water cycle schematics

A.5 Model assumptions

Table A.4 Model assumptions

Model component	Assumption	Justification
Tailings dewatering system	Tailings exit the system with all remaining moisture fully entrained, i.e. no bleed water	Tailings will exit the dewatering system with a moisture content of approximately 12%. This is lower than the assumed 15% entrained moisture in the Excel water balance model.
	Water quality will not be a limiting factor in the use of recycled water from the dewatering system in the Processing Plant. Recycled water will be used in place of raw water from the town supply.	The quality of recycled water is presently unknown but is not expected to adversely impact operation of the Processing Plant. The post-modification model will represent an ideal re-use scenario whereby external water supply is limited.
	Water losses from the dewatering system are negligible.	Operational data will further refine estimates of water losses. It is expected the vast majority of extracted water will be collected.
S22	S22 can pump at a minimum of 7.5 L/s to the dirty water system	As outlined as the target dewatering in the WSP review of the site Water Management Plan.
Rainfall runoff	Runoff rates throughout the site were calculated using the Australian Water Balance Model (AWBM) with default parameters	AWBM is a highly regarded and commonly used package for evaluating runoff rates from catchments, however, with no calibration data, default parameters were adopted. Adopted AWBM parameters for Rasp Mine Surface type assumption: Natural catchment; A1,A2,A3: 0.134, 0.433, 0.433; C1, C2, C3: 26.25, 266.7, 533.4; BFI: 0; Ks: 1-day; Kb: 0.976
TSF	A seepage rate of 0.008 m/d was assumed.	Estimated using the excel water balance model - 271 ML seepage over 365 days and an area of 90,000 m^2 Where vegetation has been cleared and sandy soil exists, recharge can be 20-40 mm/year, though is typically less than 5 mm/year in areas where clay content of the soil exceeds 20% (Golder 2008)
	Tailings had an entrained moisture of 12% under existing and Mod 13 conditions. Under existing conditions, the excess water was routed as bleed water to the TSF, whilst under Mod 13 conditions this water was recycled in the processing plant.	The tailing dewatering system will reduce moisture content to 12%. This was kept constant across scenarios to allow for a like for like comparison.
	Assumed a surface area of 90,000 m^2	TSF2 was previously modelled with a water surface of 90,000 m^2. TSF3 is large enough that such a surface area is feasible. This will overestimate the evaporation occurring but is considered sufficient for a high level water balance prior to completion of a final TSF landform design.
Vehicle workshop / wash	A water demand of 210 L/tonne of ore mined/imported was assumed for the MOD13 model.	This is an approximate average of the demand per tonne of ore in water balances from previous years. A rate per tonne of ore was applied as the workshop requirement could no longer be worked out from a balance of the metered raw water supply when ore was imported as this would increase demand.

Pattos was modelled as representative of the dirty water system whereby it was allowed to overflow from the storage out of the model. This overflow represents movement to other storages where losses would occur due to seepage and evaporation.

A.6 Model validation

Model outputs were validated against the Excel based WBM using the same inputs under existing operational conditions for July 2024 to June 2025 metered data. Differences between the models are attributable to differences in timestep (daily vs yearly) and the inclusion of storage capacity for S22/'Lochness', Pattos, and TSF3.

Table A.5 Model validation

Water stream	System component	Source	Volume (ML) – Excel model	Volume (ML) – GoldSim model
Inflows				
Raw (town) water	Town water	Metered	69	69
Process water	Town water	Metered	158.7	158.7
	Groundwater	Calculated from water balance	298.0	297.7
	Rainfall - TSF	Calculated from rainfall data	24.9	18.9
	Rainfall – process ponds	Calculated from rainfall data	2.5	2.3
Total inflows			553.1	546.6
Outflows				
Raw (town) water	Vehicle workshops and vehicle wash	Calculated from water balance	69	67.4
	Site services	Assumed	1.6	1.5
Process water	Entrainment – product	Measured	2.7	2.7
	Seepage and entrainment – tails	Calculated from water balance	90.4	99.0
	Evaporation – process ponds	Calculated from climate data	20.0	26.9
	Evaporation – tails	Calculated from climate data	140.2	140.5
	Dust suppression	Calculated from truck movement records	76.8	77.9
	Dirty water system (storage/evaporation/ seepage)	Calculated from water balance	152.3	113.8
Total outflows			553.1	529.7
Storage				
Total volume in storage			0	16.9

A.7 Modelled results

Simulations were run under existing operational conditions and post-modification conditions using metered data from July 2024 to June 2025, with the caveat that all tailings were directed to TSF3 under both scenarios.

Table A.6 Mine water balance summary

Water stream	System component	Source	Volume (ML) – existing mine conditions	Volume (ML) – post modification conditions
Inflows				
Raw (town) water	Town water	Metered (existing) / Calculated from water balance (Mod 13)	69	91.9
Process water	Town water	Metered	158.7	9.1
	Groundwater	Calculated from water balance	297.7	297.7
	Rainfall - TSF	Calculated from rainfall data	18.9	18.9
	Rainfall – process ponds	Calculated from rainfall data	2.3	2.3
Total inflows			546.6	419.9
Outflows				
Raw (town) water	Vehicle workshops and vehicle wash	Calculated from water balance (existing) / Assumed (Mod 13)	67.4	89.7
	Site services	Assumed	1.5	2.1
Process water	Entrainment – product	Measured	2.7	2.7
	Seepage and entrainment – tails	Calculated from water balance	99.0	66.6
	Evaporation – process ponds	Calculated from climate data	26.9	26.9
	Evaporation – tails	Calculated from climate data	140.5	10.5
	Dust suppression	Assumed rate derived from historical truck movement records	77.9	77.9
	Dirty water system (storage/evaporation/ seepage)	Calculated from water balance	113.8	127.4
Total outflows			529.7	403.8
Storage				
Total volume in storage			16.9	16.1
Recycled				

Water stream	System component	Source	Volume (ML) – existing mine conditions	Volume (ML) – post modification conditions
Tailings dewatering system	Proposed infrastructure under MOD13	Calculated from water balance	0	201.7

Appendix I
Air Quality Impact Assessment

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Rasp Mine Modification 13

Air Quality Assessment

Project Number: 0370

Date: 24 February 2026

Document details

Document title	Rasp Mine Modification 13
Document subtitle	Air Quality Assessment
Project No.	0370
Date	24 February 2026
Version	Rev2
Client Name	Broken Hill Mines Pty Ltd

Document history

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Rev2	24.02.2026	Russ Francis	Jane Barnett	Rev2

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Acronyms and Abbreviations

Name	Description
AAQ-NEPM	National Environment Protection (Ambient Air Quality) Measure
AERMAP	Terrain pre-processor for AERMOD
AERMET	Meteorological data pre-processor for AERMOD
AERMOD	Air Quality Dispersion Modelling
AWS	Automatic Weather Station
BAU	Business as Usual
BoM	Bureau of Meteorology
BHM	Broken Hill Mines
CBP	Concrete Batching Plant
CML7	Consolidated Mine Lease 7
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DDG	Dust Deposition Guage
EP&A Act	Environmental Planning and Assessment Act 1979
HVAS	High Volume Air Sampler
NSW	New South Wales
NSW EPA	(NSW) Environment Protection Authority
MOD13	Modification 13
Pb	Lead
PM	(airborne) particulate matter
PM_{10}	Airborne particulate matter with an aerodynamic diameter of less than 10 µm
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of less than 2.5 µm
ROM	Run of Mine
SPCC	State Pollution Control Commission of NSW
SRTM	Shuttle Radar Topography Mission
TEOM	Tapered Element Oscillating Microbalances
TPA	Tonnes per annum
TSF	Tailings Storage Facility TSF2 tailing stored in Blackwood Pit TSF3 tailing stored in Kintore Pit
TSP	Total Suspended Particulates
UG	Underground
US EPA	United States Environmental Protection Agency
WE	Wind erosion
WHO	World Health Organisation
WR	Waste rock
WRF	Weather Research and Forecasting Model
$\mu g/m^3$	Micrograms per cubic metre

EXECUTIVE SUMMARY

Zephyr Environmental was engaged by Broken Hill Mines Pty Ltd (BHM) to conduct an Air Quality Assessment for a proposed modification (MOD13) to the Rasp Mine in Broken Hill, NSW. The purpose of this assessment was to model and evaluate the potential air quality impacts of this modification.

The assessment considers sourcing up to 500,000 tonnes per annum (tpa) of crushed ore from the nearby Pinnacles Mine for processing at the Rasp Mine facility. This represents a change in the source of the ore, but not an increase in the total annual processing volume, which remains at 500,000 tpa.

The assessment utilised the AERMOD air dispersion modelling system to predict air quality impacts on 70 sensitive receptors in the surrounding area. Two primary operational scenarios were modelled and compared:

- Scenario 1: Current approved operations, with 500,000 tpa of ore extracted from the Rasp Mine.
- Scenario 2: The proposed modification, with up to 500,000 tpa of ore transported from the Pinnacles Mine and processed at the Rasp Mine.

For modelling and comparison purposes, Scenario 2 was considered a reasonable worst-case, as it involves a longer haulage route for the ore. The modelling accounted for emissions of Total Suspended Particulates (TSP), Particulate Matter (PM_{10} and $PM_{2.5}$), and lead (Pb) from all relevant activities.

The modelling results indicate that the proposed modification (Scenario 2) results in almost no perceptible change in air quality impacts compared to the current operations (Scenario 1).

The key findings for all relevant pollutants are as follows:

- Lead (Pb): The change in annual average lead concentration and deposition between the two scenarios was found to be negligible.
- Particulate Matter (PM_{10}, $PM_{2.5}$, TSP): For both scenarios, the predicted incremental and cumulative concentrations and deposition rates for all particulate matter metrics were below the respective NSW Environment Protection Authority (EPA) ambient air quality criteria.
- Compliance: The proposed modification is not predicted to cause any new exceedances of the established air quality standards at any of the sensitive receptor locations.

1 INTRODUCTION

Zephyr Environmental (Zephyr) has been engaged by Broken Hill Mines (BHM) to complete an air quality impact assessment for a proposed modification to the Rasp Mine, Broken Hill (MOD13). BHM owns and operates the Mine under Consolidated Mine Lease 7 (CML7), within which mining has been undertaken since 1885.

The Rasp Mine (the Mine) is an underground silver/zinc/lead operation located within the city limits of Broken Hill, NSW. Existing operations include underground mining operations, a processing plant producing zinc and lead concentrates, a rail siding for concentrate dispatch and other associated infrastructure. These operations are undertaken in accordance with Project Approval PA07_0018, granted from the then Minister for Planning on 31 January 2011, under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act).

2 PROJECT DESCRIPTION

The ore extraction rate at the existing Rasp Mine is currently limited to 500,000 tonnes per annum (tpa), and no more than 8,450,000 tonnes over the life of the mine. The layout of the existing operations and selected sensitive receptors are shown in Figure 2-1. Receptors are discussed further in Section 4.

The annual extraction limit set in Schedule 2 Condition 6 of the Project Approval can be increased up to no more than 750,000 tpa of ore subject to a further air quality impact assessment being undertaken to the satisfaction of the NSW EPA and a revised limit approved in writing by the Secretary.

BHM seeks to modify the Rasp Mine approval to accept 100,000 tpa of crushed ore (lead, zinc and silver) from the Pinnacles Mine. Ore material extracted at the Pinnacles Mine will first be crushed on site using existing or mobile crushing plant and then transported to the Rasp Mine using sealed B-double trucks. The total ore processed at Rasp would still be 500,000 tpa, but MOD13 test the scenario where 100,000 tpa of ore is sourced from the Pinnacles Mine.

Crushed ore will be unloaded at the existing Rasp Mine ROM Pad, blended with ore from the Rasp Mine and processed using the existing processing facility. Final concentrate products will then be transported via rail to Port Pirie and Port Adelaide in South Australia. Tailings would be managed in accordance with the existing Rasp Mine tailings management procedures.

Impacts associated with ore extraction and crushing activities at the Pinnacles would not need to be considered providing they are undertaken within existing activity limits and consistent with existing operations at each mine site.

To understand the impact of importing ore from Pinnacles compared to the current approved operations, two scenarios have been modelled, as follows:

- Scenario 1: Current operations with extraction rate of 500,000 tpa from Rasp Mine
- Scenario 2: Current operations but receiving up to 500,000 tpa from Pinnacles

The haulage route for the Pinnacles ore to the ROM pad is slightly longer than for internal haulage from the Rasp portal to the ROM pad, and so Scenario 2 is potentially a worst-case scenario.

Rasp as also considering the introduction of a dewatering facility at some time in the future, which would mean the conclusion of tailings harvesting activities at TSF2. This would further reduce total emissions from the site.

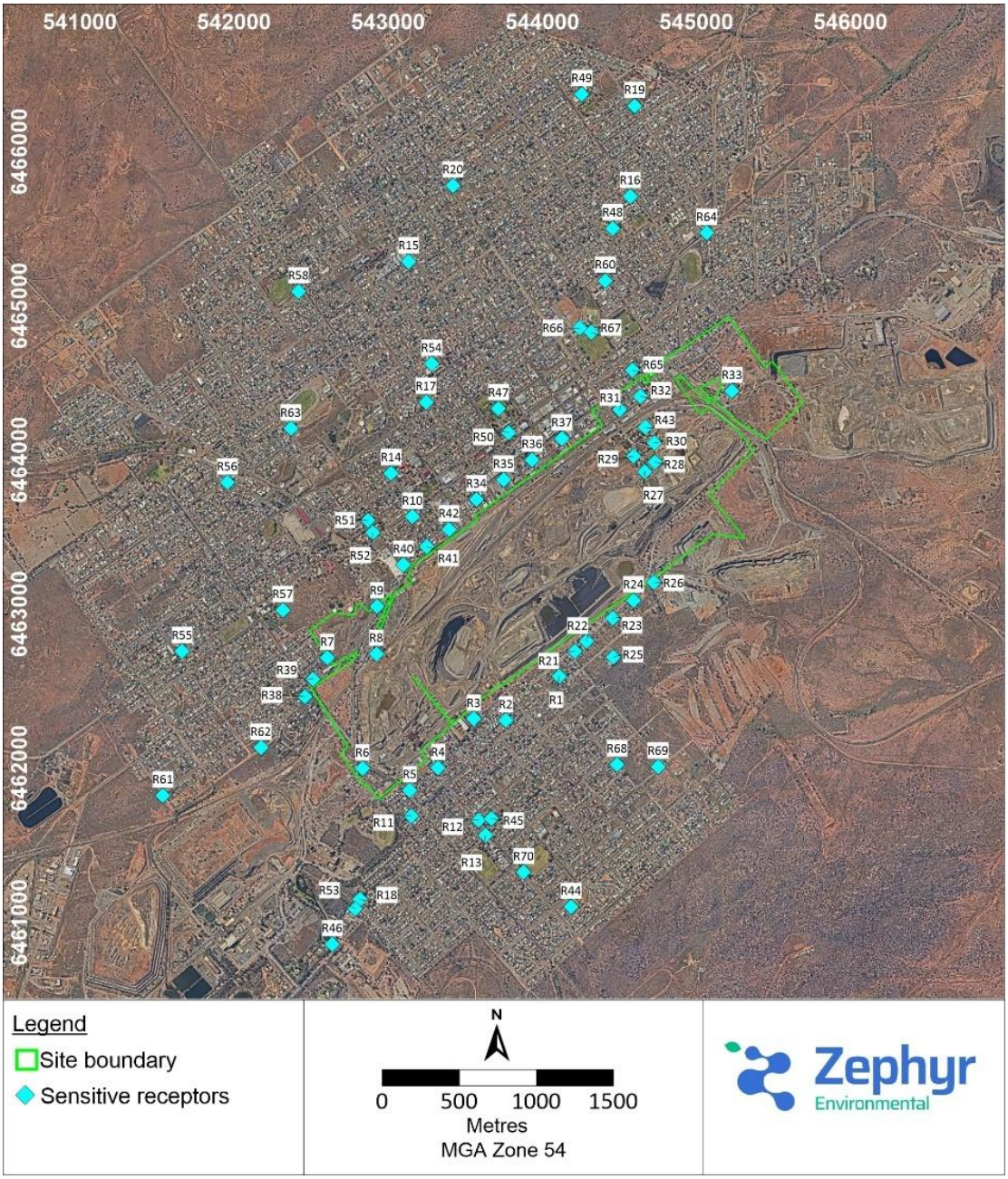

Figure 2-1: Site location and sensitive receptors

3 AMBIENT AIR QUALITY CRITERIA

The NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (Approved Methods) (NSW EPA, 2022) specifies air quality assessment criteria relevant for assessing impacts from air pollution. The air quality goals relate to the total particulate matter (PM) burden in the air and not just the PM from the Mine. Background PM therefore needs to be considered when using these goals to assess potential impacts. In this case, the current approved operations for 500,000 tpa represent the existing, or background, conditions for Modification 13. These impacts are measured using the current monitoring network and are discussed in detail in Section 5.1.

Table 3-1 provides a summary of the air quality goals for pollutants that are relevant to this study. It is important to note that, except for deposited dust, the criteria are applied to the cumulative impacts due to the proposed modification and other existing sources.

Table 3-1: NSW EPA air quality assessment criteria

Pollutant	Standard	Averaging Period
TSP	90 µg/m^3	Annual
PM_{10}	25 µg/m^3	Annual
	50 µg/m^3	24-hour
$PM_{2.5}$	8 µg/m^3	Annual
	25 µg/m^3	24-hour
Lead (Pb) (TSP fraction)	0.5 µg/m^3	Annual
Deposited Dust	2 g/m^2/month*	Annual
	4 g/m^2/month	Annual

Notes: *Increment from the site.

4 ASSESSMENT APPROACH

4.1 Modelling approach

For consistency with all previous assessment work, the current assessment has used the US-EPA regulatory model, AERMOD. The air dispersion modelling conducted for this assessment represents an advanced modelling system using the AERMET/AERMOD model. AERMOD was selected as a suitable dispersion model due to the source types, location of nearest receptors and nature of local topography. AERMOD is the United States Environmental Protection Agency's (US EPA) recommended steady-state plume dispersion model for regulatory purposes. The AERMOD model was developed and is supported by the US EPA and is now the model of choice for nearfield (less than 50 km from an emission source) applications in the US.

A significant feature of AERMOD is that the Pasquill-Gifford stability-based dispersion has been replaced with a turbulence-based approach that uses the Monin-Obukhov length scale to account for the effects of atmospheric turbulence-based dispersion.

The modelling domain set up for the project was 10 km x 10 km. Two receptor grids were set up as follows:

- 9 km x 9 km grid at 500 m spacing
- 5 km x 5 km grid at 100 m spacing.

In addition, sensitive receptors have been assessed as mentioned below.

4.2 Sensitive receptors

In addition to the gridded receptors described above, predictions have also been made at specific discrete receptor locations. In total, 70 sensitive receptors have been included. There are 42 from the original study (Environ, 2010a), seven receptors including the old bowling green and six playgrounds which were added as part of the MOD4 air quality assessment (Pacific Environment, 2017a). An additional 21 receptors were included in previous assessments following a request from the Health Risk Assessment team for MOD6. Their locations are shown in Figure 2-1. Summary tables that describe each receptor are provided in Appendix A.

5 EXISTING ENVIRONMENT

5.1 Local meteorology

Air pollutant concentrations are strongly influenced by meteorological conditions, primarily in the form of prevailing wind directions and interactions with diurnal flow regimes. Wind speed, wind direction, temperature and relative humidity all affect the dispersion and transport of pollution and are basic input requirements for dispersion modelling. Figure 5-1 presents a summary of some of the meteorological parameters measured at Broken Hill Airport between 2019 – 2024 (inclusive). This shows reasonable consistency in parameters across the six years.

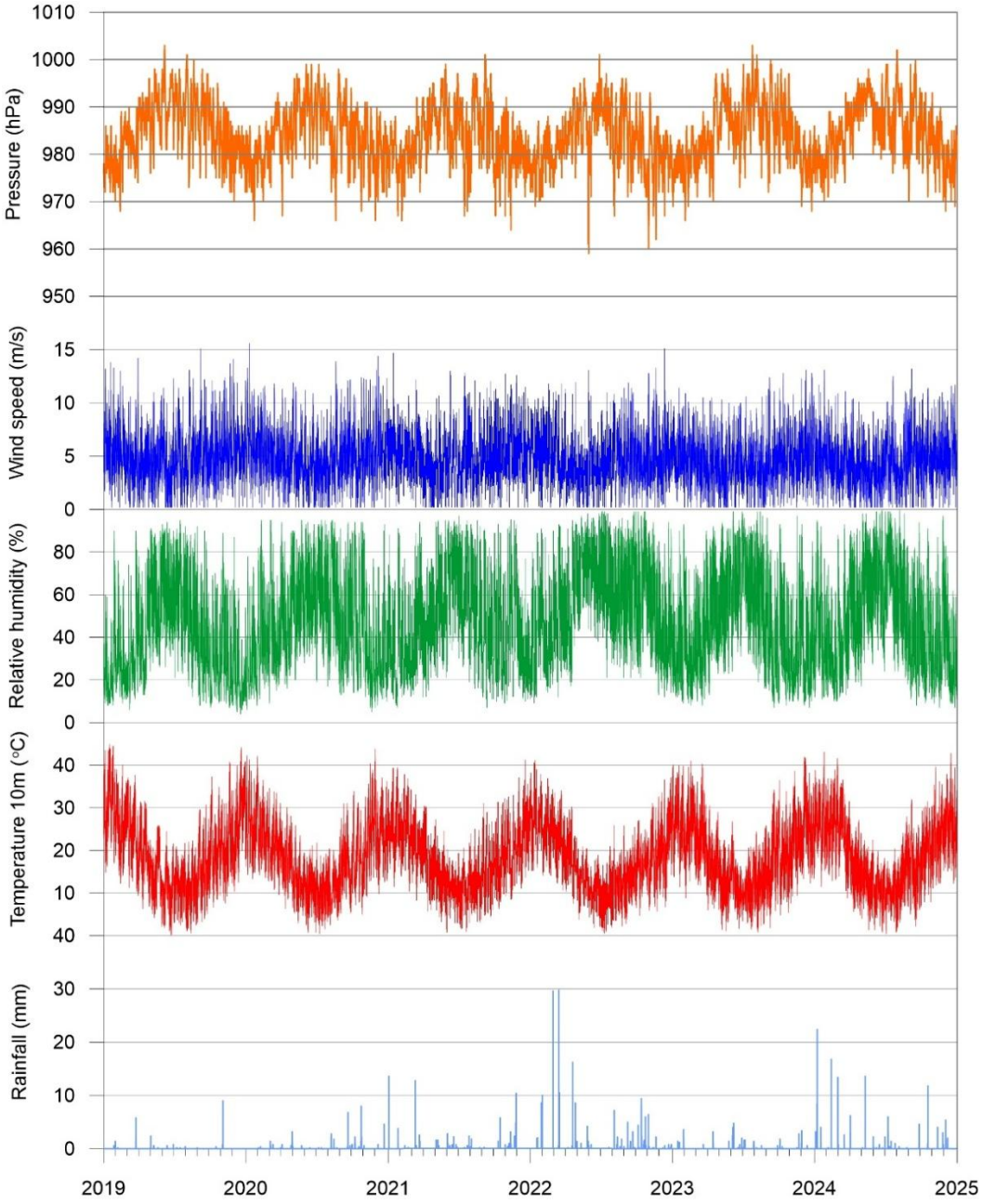

Figure 5-1: Meteorological data summary from 2019 – 2024 at Broken Hill Airport

5.1.1 Wind speed and direction

Figure 5-2 presents the annual wind roses from 2019 to 2024 from Broken Hill Airport. This analysis shows that conditions are reasonably consistent from year to year. Based on the wind roses and the preference to focus on the most recent year as possible, 2024 has been chosen for this assessment. Figure 5-3 presents the seasonal variations for 2024.

On an annual basis, there is a strong dominance by winds from the southern quadrant. This is the most frequent wind direction in all seasons except winter, with the winds in winter generally from the norther quadrant. The annual average wind speed is 4.6 m/s in 2024, with 2.7% of winds below 0.5 m/s (calms).

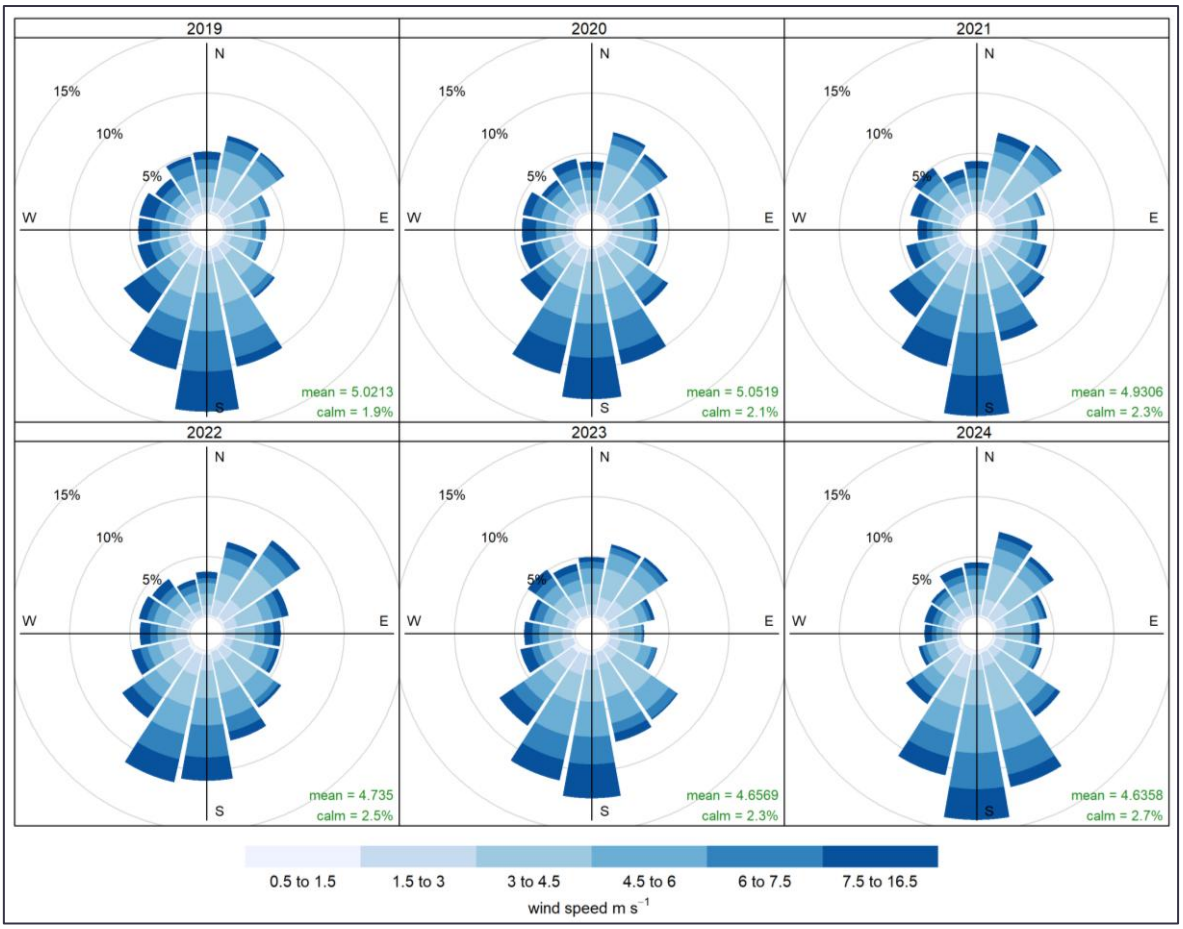

Figure 5-2: Annual wind roses for Broken Hill Airport (2019 – 2024)

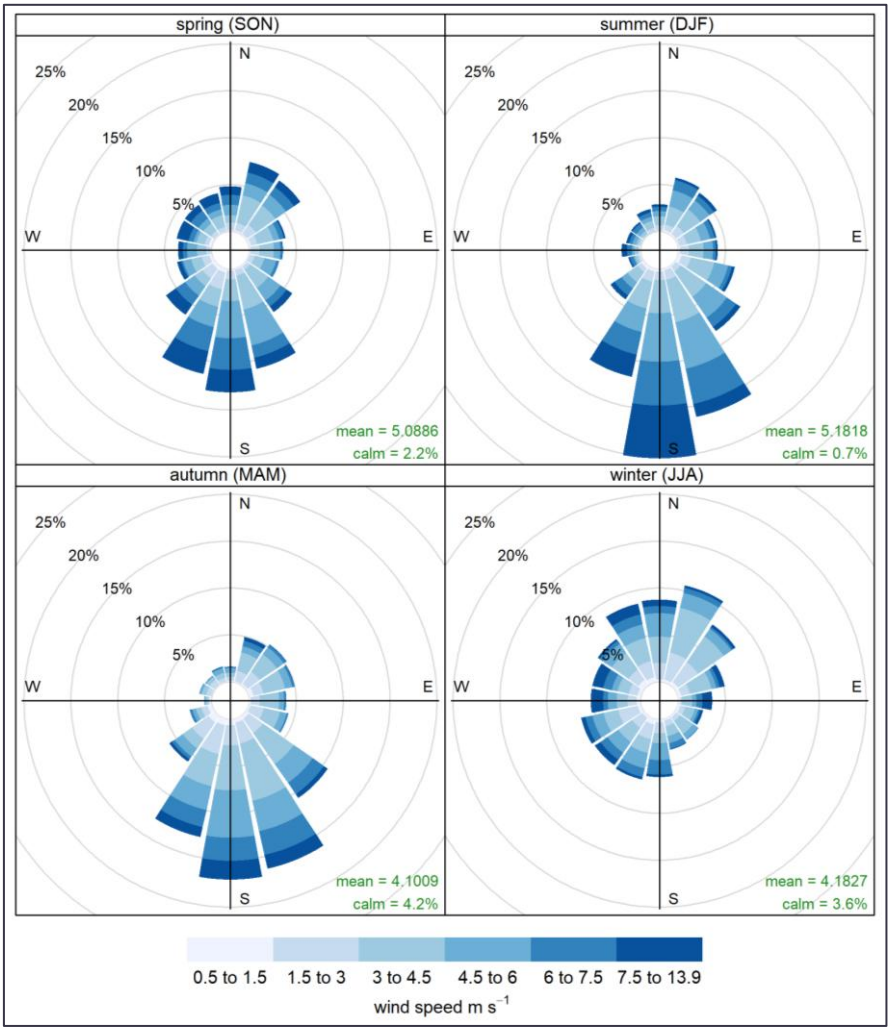

Figure 5-3: Seasonal wind roses for Broken Hill Airport (2024)

5.1.2 Atmospheric stability

Atmospheric stability refers to the degree of turbulence or mixing that occurs within the atmosphere and is an important factor in the rate of atmospheric dispersion. Highly stable conditions lead to poor dispersion while unstable conditions enable more effective dispersion of odour.

Figure 5-4 presents the diurnal variation in atmospheric stability at the mining operations from the prognostic modelling data. High percentages of stable and very stable conditions at night indicate the presence of temperature inversions at these times, which can result in less effective dispersion.

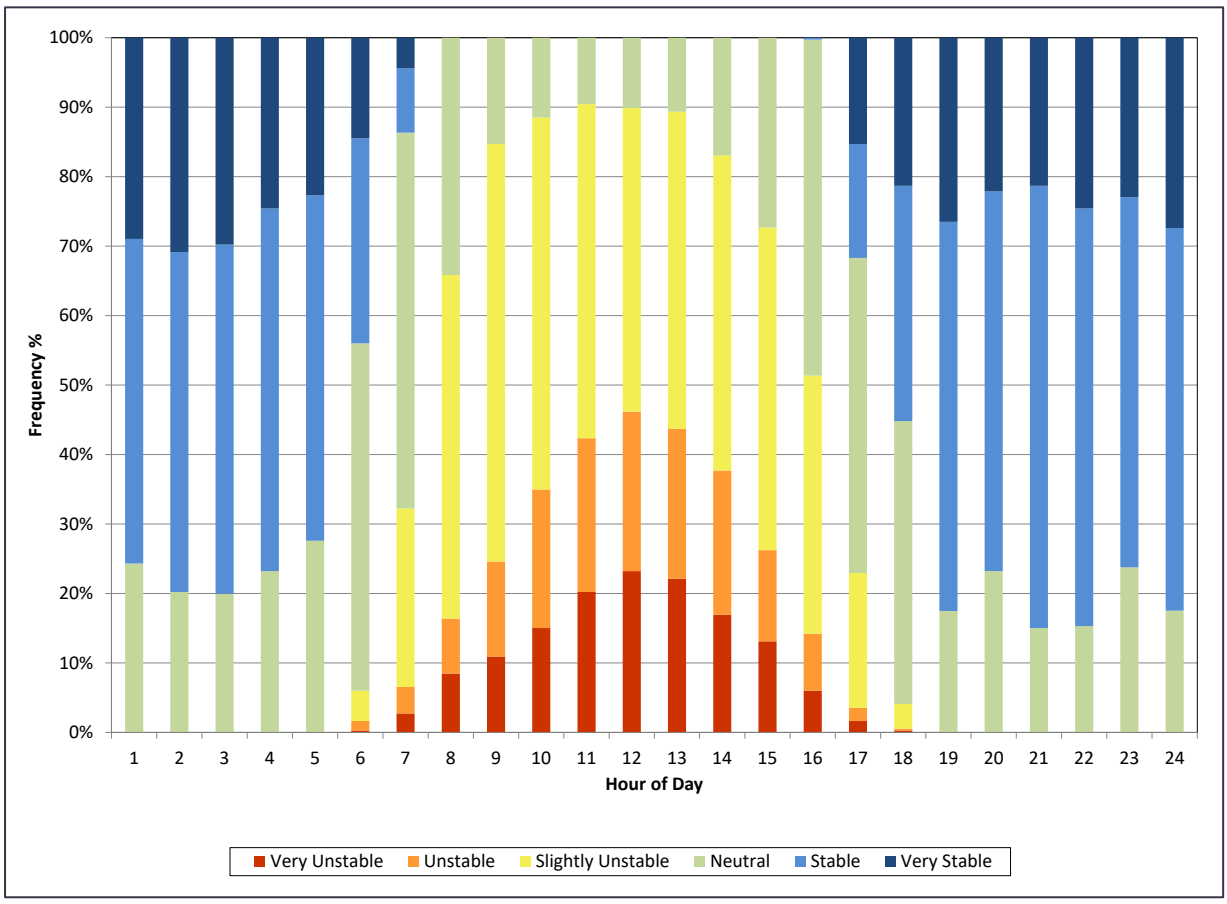

Figure 5-4: Diurnal variation in stability at Broken Hill in 2024

5.2 Local air quality

Ambient air quality measurements are made across the BHM monitoring network shown in Figure 5-5. The network includes the following:

- Three High volume Air Samplers (HVAS) measuring Total Suspended Particulate (TSP) / particulate matter less than 10 µm in aerodynamic diameter (PM_{10}) and lead (Pb) concentrations at two locations on site, and one location offsite
- Two Tapered Element Oscillating Microbalances (TEOMs) measuring PM_{10} at one location on site, and one offsite
- Seven Dust Deposition Gauges (DDGs) measuring dust deposition and percentage deposited Pb at three on site, two on surface exclusion areas within the mining lease, and two offsite

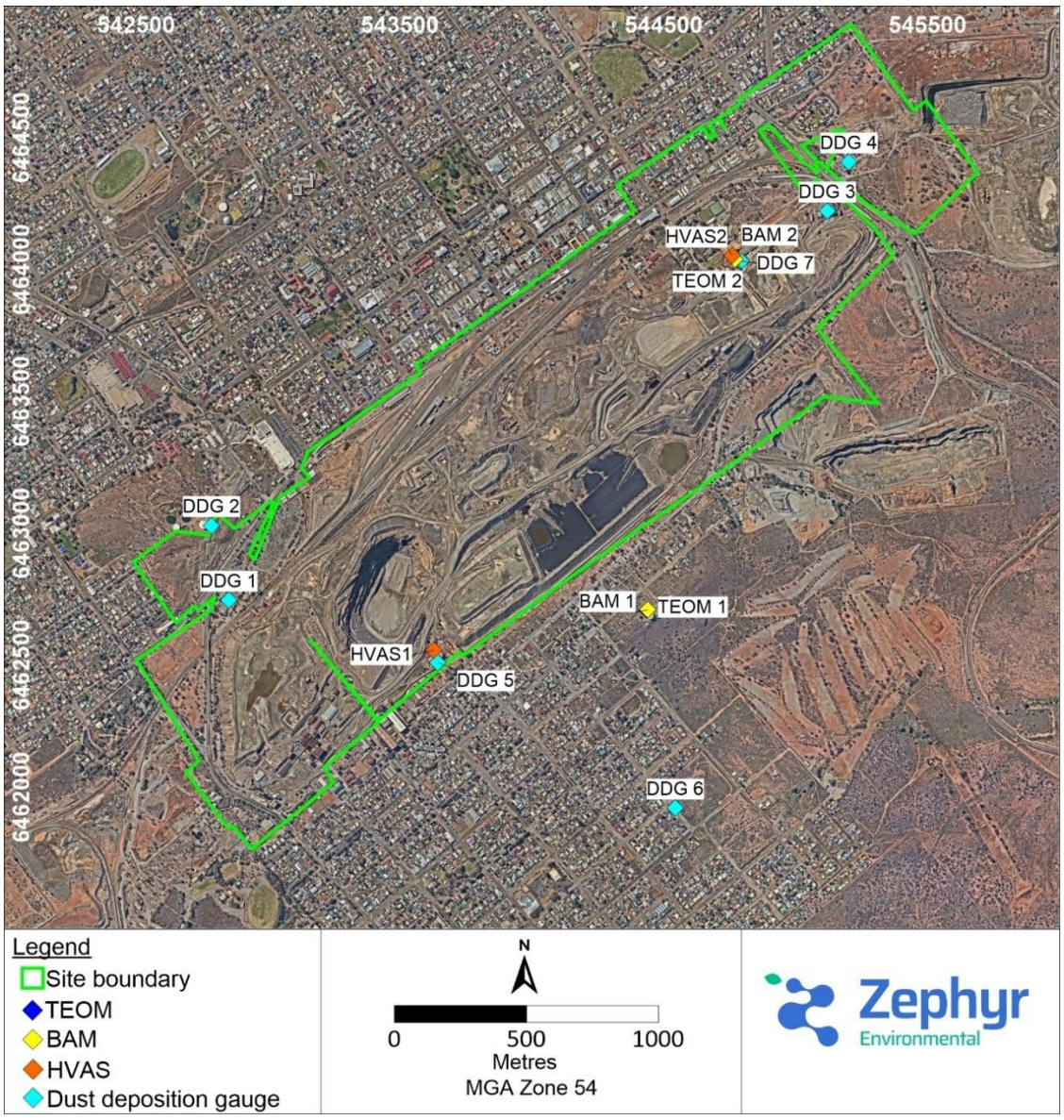

Figure 5-5: Rasp Mine ambient air quality monitoring network

5.2.1 TSP and PM_{10}

As noted above, total suspended particulates (TSP) is measured on a six-day cycle at two High Volume Air Sampler (HVAS) locations. Table 5-1 presents the annual averages for each site. In addition, continuous PM_{10} is measured using a Tapered Element Oscillating Microbalance (TEOM) at two sites. These continuous measurements for 2024 are shown in Figure 5-6. There is clearly significant variability in these daily averages, which is expected for PM_{10}. Measurements are more variable and often higher at TEOM2, but the annual averages are very similar, as shown in Table 5-1.

Table 5-1: Annual average TSP concentrations in 2024

Monitor	Annual average concentrations (µg/m³)	
	PM10	TSP
HVAS	-	34.5
HVAS3	-	32.3
TEOM1	12.5	-
TEOM2	13.2	-

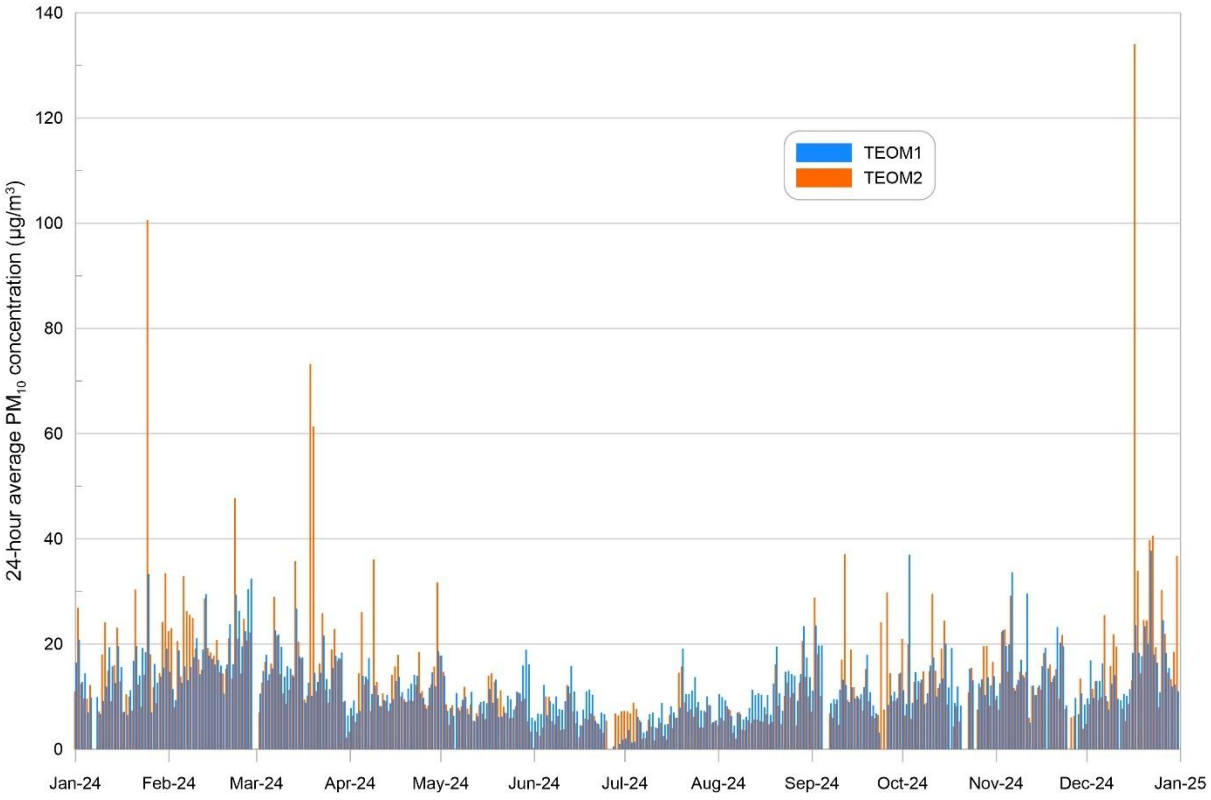

Figure 5-6: 24-hour average TEOM PM_{10} concentrations in 2024

5.2.2 Dust deposition and lead

Dust deposition samples are collected on a monthly basis (approximately 30 days) and then analysed in a laboratory. For the purposes of this report, the relevant indicator for dust is total insoluble solids. These samples are also analysed for lead. The results are presented as annual averages in Table 5-2.

Table 5-2: Annual average dust deposition rates (insoluble solids) for 2024

Gauge ID	Dust deposition	
	Insoluble solids	Lead
DDG1 – St Johns	0.7	0.002
DDG2 – Block 10	0.8	0.001
DDG3 – Thompsons Shaft	0.9	0.005
DDG4 – Junction Mine	2.3	0.007
DDG5 – Silver Tank	1.6	0.003
DDG6 – Casuarina Ave	1.4	0.001
DDG7 – Backwoods	0.7	0.003

5.2.3 Background values for the assessment

The following provides a summary of the adopted background values used for this assessment:

- PM_{10} annual average concentration = (TEOM 1 = 12.5 µg/m^3 ; TEOM 2 = 13.2 µg/m^3)
- PM_{10} 24-hour concentration = daily varying from either TEOM 1 or TEOM 2
- $PM_{2.5}$ annual average concentration = ratio of TEOM1 and TEOM2 (TEOM 1 = 5.1 µg/m^3; TEOM 2 = 5.4 µg/m^3)
- $PM_{2.5}$ 24-hour concentration = daily varying as ratio from either TEOM 1 or TEOM 2
- TSP annual average concentration = 34.5 µg/m^3
- Annual monthly average deposited dust = 0.7 g/m^2/month to 2.3 g/m^2/month
- Annual average lead (TSP) concentration = 0.13 µg/m^3 (2024 annual average Pb at Silver Tank)
- Annual lead deposition (TSP fraction) = 0.001 g/m^2/annum to 0.007 g/m^2/annum

6 EMISSIONS TO AIR

6.1 Modelling scenarios

Emissions have been calculated for the two modelling scenarios noted in Section 2, namely:

- 500,000 tpa from Rasp (as approved)
- 500,000 tpa from Pinnacles (MOD13)

It is anticipated that ore transportation from the Pinnacles Mine to the Rasp Mine would be undertaken on a campaign basis at fortnightly or monthly intervals to align with processing requirements at the Rasp Mine.

6.2 Emission estimates

Estimates of PM emissions have been made for the key dust generating activities. Emission factors developed within NSW, and by the United States Environmental Protection Agency (US EPA, 1985), have been applied to estimate the amount of dust produced by each proposed activity.

Emissions inventories have been developed for both scenarios. The full emission estimates for TSP, PM_{10}, $PM_{2.5}$ and Pb (as TSP), have been provided in Appendix B, Table B-1 and B-2.

Estimates of emissions for each source were developed on an hourly time step taking into account the activities that would take place at that location. Dust generating activities are represented by a series of volume sources situated according to the location of activities for the modelled scenarios.

The activities and associated source locations are provided in Table 6-1.

Table 6-1: Activities and associated source locations

Activity	Associated Scenario	Allocated source locations
Ore - Hauling ore from boxcut to ROM pad by truck (sealed roads)	Scenario 1 only	1,2,3,4,5
Ore - Hauling ore from Pinnacles Mine to ROM pad by truck (sealed roads)	Scenario 2 only	3,4,5,15,16,17, 24,34,35,36,37, 38,39,40
Ore - Unloading ore at ROM pad	Scenario 1 + Scenario 2	5
Ore - Front end loaders at ROM pad		5
Ore - Crushed ore storage bin transfer		6
Ore - Crushing		6
Ore - Hauling concentrate by trucks within processing plant (unsealed roads)		7
Ore - Hauling concentrate by trucks to rail siding (sealed roads)		9,10,11,13,14
CBP - Truck movement - cement (unsealed roads)	Scenario 1 + Scenario 2	7,8,41,42,43,44
CBP - Truck movement - cement (sealed roads)		2,3,9,10,11,13, 14,15,16,17,24,45, 46,47,48,49,50,51, 52,53
CBP - Truck movement - aggregate (unsealed roads)		41,42,43,44
CBP - Truck movement - aggregate (sealed roads)		34,35,36,37,38,39,

Activity	Associated Scenario	Allocated source locations
		40,45,46,47,48,49, 50,51,52,53
CBP - Truck movement - sand (unsealed roads)		41,42,43,44
CBP - Truck movement - sand (sealed roads)		34,35,36,37,38,39, 40,45,46,47,48,49, 50,51,52,53
CBP - Truck movement - shotcrete (unsealed roads)		7,8,27,28,29,30, 31,41,42,43,44
CBP - Truck movement - shotcrete (sealed roads)		2,3,9,10,11,13, 14,15,16,17,24,40, 45,46,47,48,49,50, 51,52,53
CBP - Loading cement at rail siding		13
CBP - Aggregate transfer		43
CBP - Sand transfer		43
CBP - Cement transfer		43
CBP - Weigh hopper loading		44
CBP - Truck loading		44
CBP - Residual from de-dusted air loading cement and fly-ash		44
CBP - Wind erosion (aggregate stockpiles)		42
CBP - Wind erosion (whole CBP)		42,43,44
WR - Hauling from boxcut to BHP Pit (sealed roads)		1,2,15,16,17
WR - Hauling from boxcut to BHP Pit (unsealed roads)		23,25,26
WR - Unloading at BHP Pit		26
WR - Dozers/front end loaders at BHP Pit		26
WR - Loading at BHP Pit		26
WR - Hauling from BHP Pit to boxcut (unsealed roads)		23,25,26
WR - Hauling from BHP Pit to boxcut (sealed roads)		1,2,15,16,17
WE - ROM Pad stockpile		5
WE - Free areas		3,4,5,12,18,19, 20,21,22,32,33
WE - Disturbed areas		8,10,13,14,15,17, 24,25,27,28,29,30, 31
TSF - Grader/Excavator shaving top layer of TSF2		46,47,48,49,50
TSF - Two dozers pushing shaved tailings into stockpile		51
TSF - WE from TSF area		46,47,48,49,50
TSF - WE from tailings stockpile		51
TSF - Excavator loading tailings stockpile to truck		51
TSF - Hauling within TSF2 (unsealed roads)		10,28,29,30,31,52,

Activity	Associated Scenario	Allocated source locations
		54,55,56,57,58
TSF - Hauling outside TSF2 (sealed roads)		15,16,17,24,27,40
TSF - Hauling into Kintore pit (unsealed roads)		28,29,30,31
TSF - Unloading at Kintore Pit		31

6.3 Control measures

The control measures listed in Table 6-2 have been applied in the assessment. These control measures are consistent with previous assessments.

Table 6-2: Control measures and allocated percentage

Activity / control measure	Allocated percentage
Sealed road	99%
Water sprays on feeder hopper for front end loaders at ROM pad	50%
Water sprays and chemical suppressant on unsealed roads	80%
Weigh hopper loading undertaken inside a building	75%
Water spray for truck loading	75%
Enclosure for aggregate stockpiles	70%
Chemical suppressant to control wind erosion for whole CBP	95%
Water sprays for unloading / loading / dozers / front end loaders	50%
Control on ROM pad stockpile / TSF area / tailings stockpile	65%
Control for crushing	95%
Control on free areas based on confined air burst chamber tests	97%
Control on disturbed areas based on confined air burst chamber tests	90%

6.4 Percentage lead composition

The percentage lead composition for the materials at the site are provided in Table 6-3 and have been used in the assessment.

Table 6-3: Percentage lead composition

Material	% Pb	Assumption
Concentrate	73.3%	Per Table 22 of Environ (2010)
Tailings	0.3%	Per Table 22 of Environ (2010)
Free areas	1.4%	Per Table 22 of Environ (2010)
Unpaved Road A	0.5%	Pb analysis by BHM (August 2019)
Unpaved Road B	0.8%	Pb analysis by BHM (August 2019)
Unpaved Road C	0.5%	Pb analysis by BHM (August 2019)
Unpaved Road D	1.3%	Pb analysis by BHM (August 2019)
Unpaved Road F	1.9%	Pb analysis by BHM (August 2019)
Unpaved Road G	1.1%	Pb analysis by BHM (August 2019)
Unpaved Road H	1.4%	Pb analysis by BHM (August 2019)
ROM ore	3.0%	Per Table 22 of Environ (2010)
Waste rock	0.5%	Per comms with client 24/10/2016

7 MODELLING RESULTS

Modelling was undertaken to determine the incremental mine-related concentrations and deposition rates occurring due to the operation of the Mine and then cumulatively with background concentrations included.

The incremental results, in both tabular and figure format, for each pollutant have been presented for all 70 receptors in the main body of the report. The change plots have been provided in the main body of the report.

The cumulative results tables for each pollutant are provided in Appendix C. Cumulative figures are provided in each section below.

Criteria are not relevant for incremental changes and so have not been provided on the incremental charts, but are provided for cumulative.

7.1 Annual average lead concentration

Table 7-1 and Figure 7-1 present the predicted incremental annual average lead concentration (as TSP) for Scenario 1 and Scenario 2 in tabular and figure format, respectively.

Figure 7-2 presents the change in annual average lead concentration (as TSP) (µg/m³) – Scenario 2 minus Scenario 1.

Figure 7-3 presents the cumulative annual average lead concentration (as TSP) (µg/m³) for Scenario 1 and Scenario 2.

These results show almost no change in impacts at receptors between Scenario 1 and 2.

Table 7-1: Predicted incremental annual average lead concentration (as TSP) (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1	Scenario 2	Receptor ID	Scenario 1	Scenario 2
R1	0.0051	0.0050	R36	0.0088	0.0088
R2	0.0039	0.0038	R37	0.0100	0.0100
R3	0.0048	0.0048	R38	0.0014	0.0014
R4	0.0022	0.0022	R39	0.0015	0.0015
R5	0.0015	0.0015	R40	0.0069	0.0068
R6	0.0016	0.0016	R41	0.0082	0.0081
R7	0.0018	0.0017	R42	0.0110	0.0109
R8	0.0033	0.0032	R43	0.0130	0.0130
R9	0.0033	0.0033	R44	0.0009	0.0009
R10	0.0072	0.0071	R45	0.0015	0.0015
R11	0.0013	0.0013	R46	0.0005	0.0005
R12	0.0016	0.0015	R47	0.0060	0.0060
R13	0.0014	0.0014	R48	0.0023	0.0023
R14	0.0049	0.0049	R49	0.0012	0.0012
R15	0.0020	0.0020	R50	0.0070	0.0070
R16	0.0019	0.0019	R51	0.0042	0.0042
R17	0.0043	0.0042	R52	0.0046	0.0046
R18	0.0007	0.0007	R53	0.0007	0.0007
R19	0.0012	0.0012	R54	0.0035	0.0035
R20	0.0016	0.0016	R55	0.0006	0.0006
R21	0.0062	0.0061	R56	0.0013	0.0013
R22	0.0068	0.0068	R57	0.0013	0.0013
R23	0.0092	0.0092	R58	0.0013	0.0013
R24	0.0129	0.0130	R59	0.0003	0.0003
R25	0.0052	0.0052	R60	0.0031	0.0031
R26	0.0177	0.0177	R61	0.0005	0.0005
R27	0.0321	0.0321	R62	0.0009	0.0009
R28	0.0226	0.0226	R63	0.0018	0.0018
R29	0.0238	0.0238	R64	0.0017	0.0017
R30	0.0157	0.0156	R65	0.0065	0.0065
R31	0.0101	0.0101	R66	0.0044	0.0044
R32	0.0086	0.0086	R67	0.0045	0.0045
R33	0.0047	0.0047	R68	0.0021	0.0021
R34	0.0109	0.0107	R69	0.0016	0.0016
R35	0.0099	0.0098	R70	0.0011	0.0011

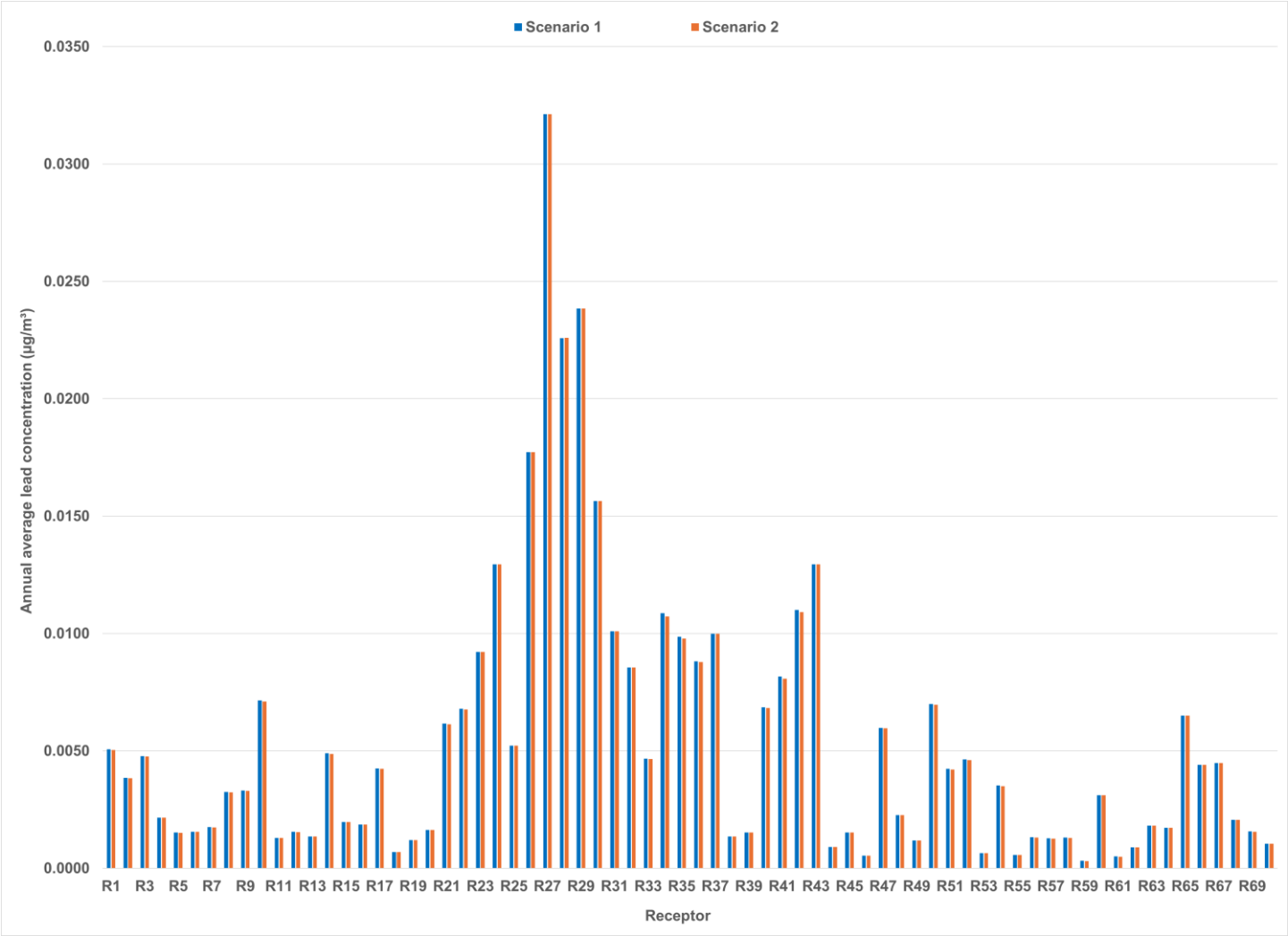

Figure 7-1: Predicted incremental annual average lead concentration (as TSP) (µg/m³) for Scenario 1 and Scenario 2

Figure 7-2: Change in annual average lead concentration (as TSP) (µg/m³) – Scenario 2 minus Scenario 1

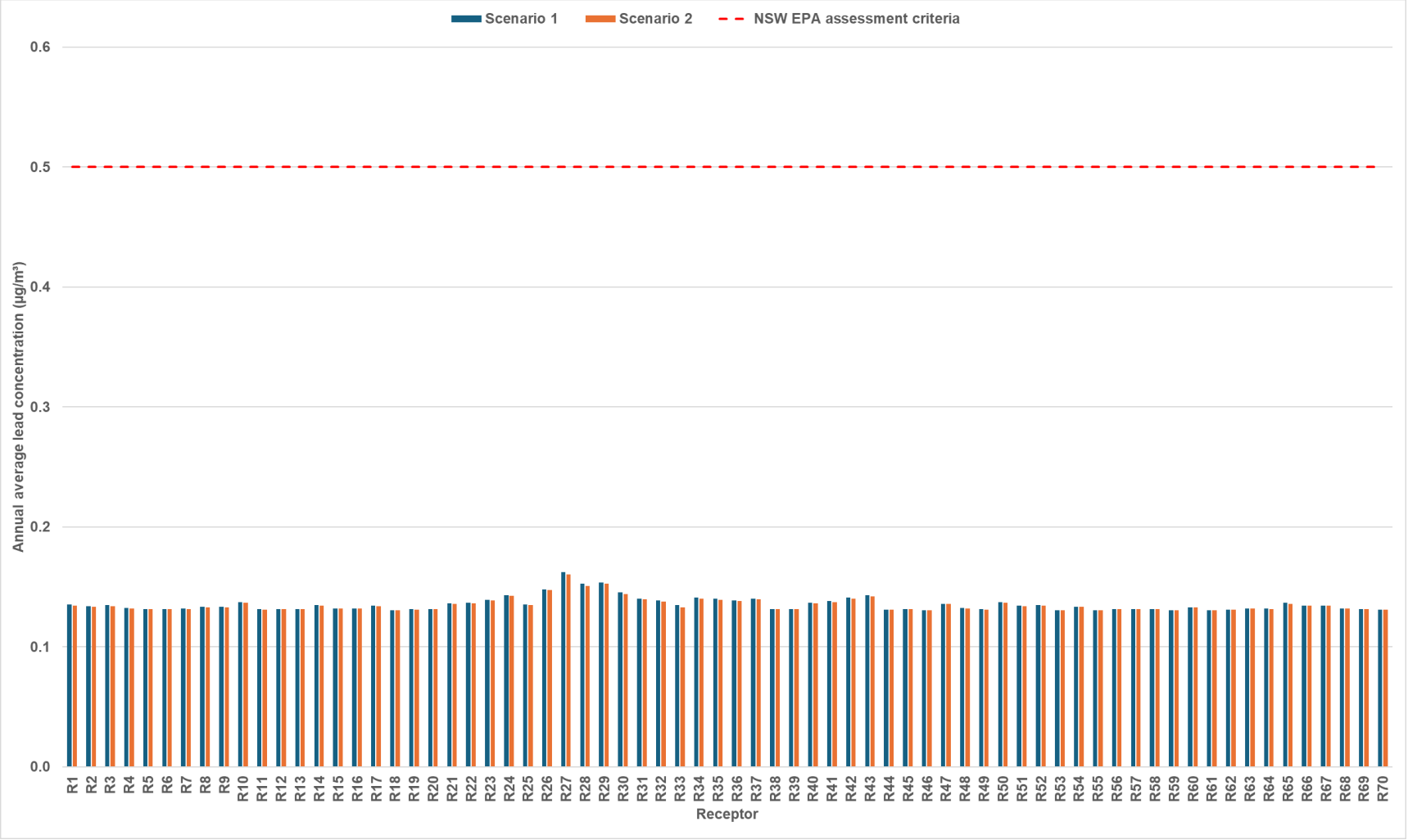

Figure 7-3: Cumulative annual average lead concentration (as TSP) (µg/m³) for Scenario 1 and Scenario 2

7.2 Annual average lead deposition

Table 7-2 and Figure 7-4 present the predicted incremental annual average lead deposition (as TSP) for Scenario 1 and Scenario 2 in tabular and figure format, respectively. Figure 7-5 presents the almost imperceptible change in annual average lead deposition (as TSP) (g/m^2/annum).

Figure 7-6 presents the cumulative annual average lead deposition (as TSP) (g/m^2/annum) for Scenario 1 and Scenario 2.

Table 7-2: Predicted incremental annual average lead deposition (as TSP) (g/m^2/annum) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1	Scenario 2	Receptor ID	Scenario 1	Scenario 2
R1	0.0100	0.0100	R36	0.0158	0.0157
R2	0.0085	0.0085	R37	0.0179	0.0180
R3	0.0114	0.0114	R38	0.0020	0.0019
R4	0.0041	0.0041	R39	0.0022	0.0022
R5	0.0027	0.0027	R40	0.0117	0.0116
R6	0.0023	0.0023	R41	0.0150	0.0150
R7	0.0026	0.0026	R42	0.0200	0.0199
R8	0.0055	0.0055	R43	0.0262	0.0262
R9	0.0062	0.0062	R44	0.0017	0.0017
R10	0.0120	0.0119	R45	0.0029	0.0029
R11	0.0023	0.0023	R46	0.0009	0.0009
R12	0.0029	0.0029	R47	0.0108	0.0108
R13	0.0025	0.0025	R48	0.0045	0.0045
R14	0.0080	0.0080	R49	0.0024	0.0024
R15	0.0035	0.0035	R50	0.0128	0.0127
R16	0.0037	0.0037	R51	0.0067	0.0067
R17	0.0074	0.0074	R52	0.0073	0.0073
R18	0.0011	0.0011	R53	0.0011	0.0011
R19	0.0024	0.0024	R54	0.0062	0.0062
R20	0.0031	0.0030	R55	0.0009	0.0009
R21	0.0117	0.0117	R56	0.0019	0.0019
R22	0.0126	0.0126	R57	0.0019	0.0019
R23	0.0167	0.0168	R58	0.0022	0.0022
R24	0.0233	0.0233	R59	0.0006	0.0006
R25	0.0097	0.0097	R60	0.0062	0.0062
R26	0.0327	0.0327	R61	0.0007	0.0007
R27	0.0665	0.0665	R62	0.0012	0.0012
R28	0.0467	0.0467	R63	0.0028	0.0028
R29	0.0478	0.0478	R64	0.0035	0.0035
R30	0.0319	0.0319	R65	0.0130	0.0130
R31	0.0203	0.0203	R66	0.0085	0.0085
R32	0.0173	0.0173	R67	0.0088	0.0088
R33	0.0106	0.0106	R68	0.0039	0.0039
R34	0.0202	0.0200	R69	0.0031	0.0031
R35	0.0179	0.0178	R70	0.0020	0.0020

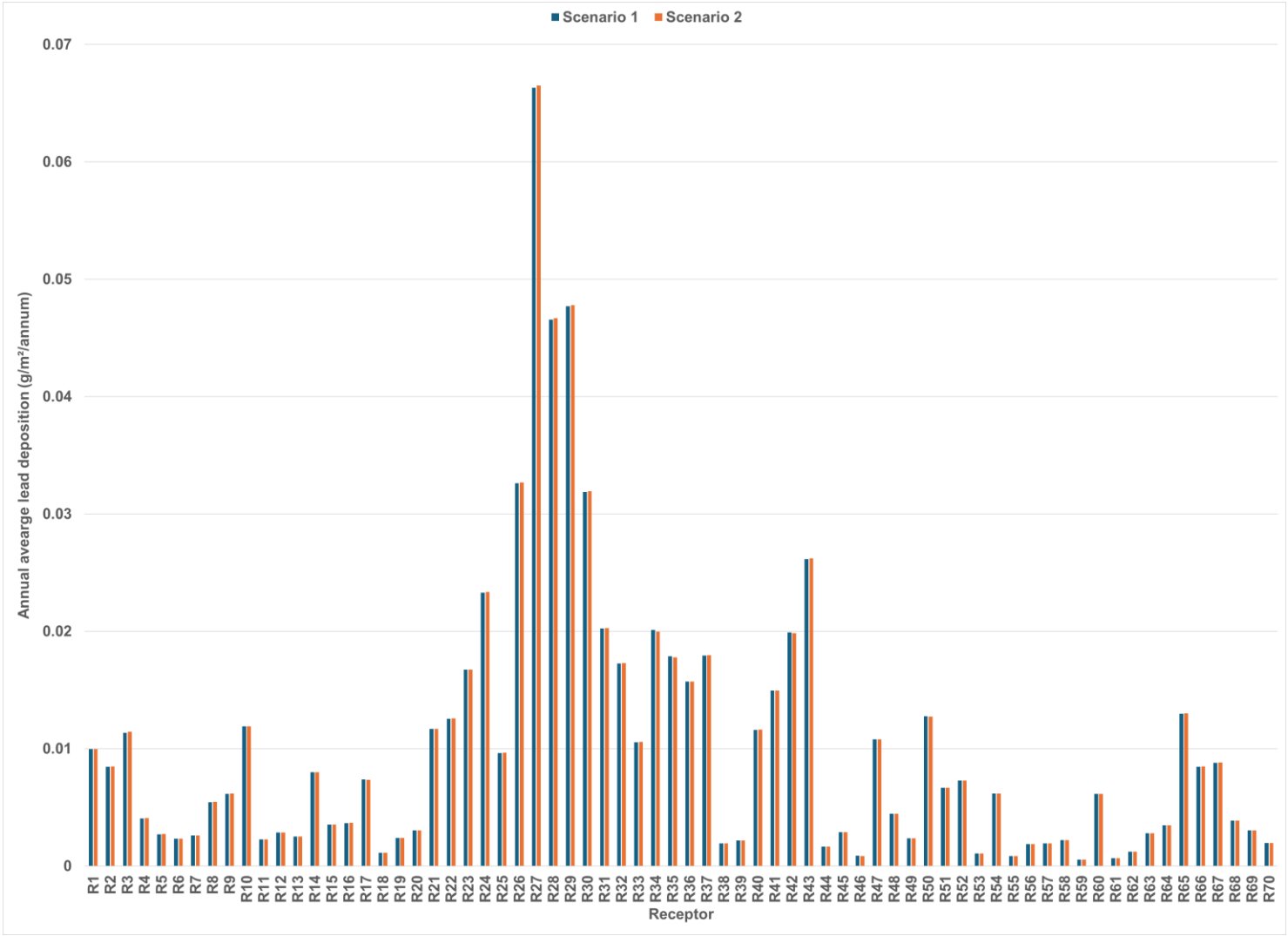

Figure 7-4: Predicted incremental annual average lead deposition (as TSP) (g/m^2/annum) for Scenario 1 and Scenario 2

Figure 7-5: Change in annual average lead deposition (as TSP) (g/m^2/annum) – Scenario 2 minus Scenario 1

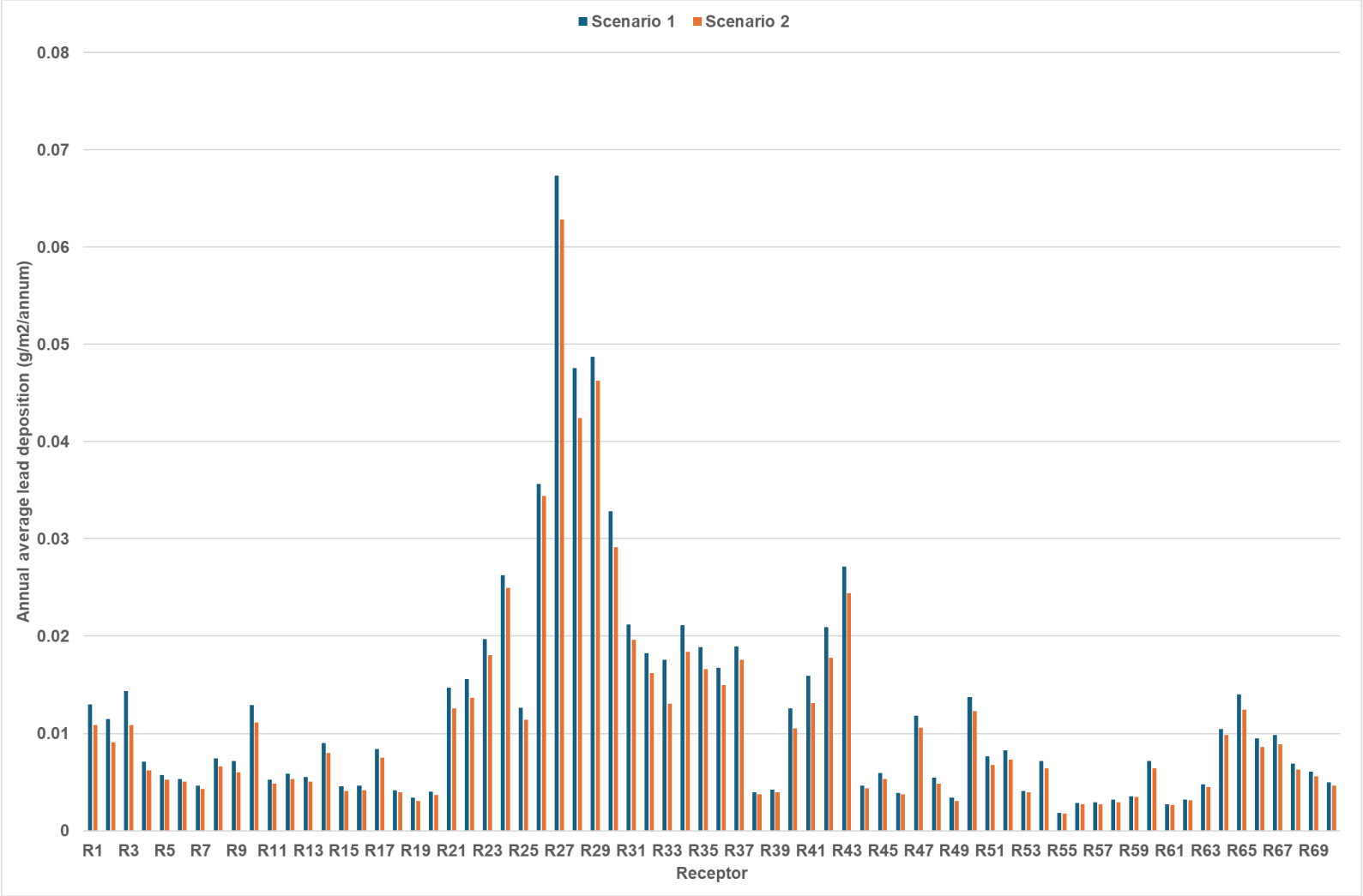

Figure 7-6: Cumulative annual average lead deposition (as TSP) (g/m^2/annum) – for Scenario 1 and Scenario 2

7.3 Maximum 24-hour average $PM_{2.5}$

Table 7-5 and Figure 7-7 presents the predicted incremental maximum 24-hour average $PM_{2.5}$ concentrations for Scenario 1 and Scenario 2 in tabular and figure format, respectively. There are no additional exceedances.

Figure 7-8 presents the change in maximum 24-hour average $PM_{2.5}$ concentrations for Scenario 2 minus Scenario 1.

Table 7-3: Predicted incremental maximum 24-hour average $PM_{2.5}$ concentrations (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1	Scenario 2	Receptor ID	Scenario 1	Scenario 2
R1	0.4678	0.4717	R36	0.8167	0.8158
R2	0.2258	0.2275	R37	0.5634	0.5625
R3	0.2265	0.2396	R38	0.1954	0.1964
R4	0.1535	0.1921	R39	0.1908	0.1910
R5	0.1301	0.1696	R40	0.6141	0.6189
R6	0.2271	0.2297	R41	0.5198	0.5209
R7	0.1888	0.1896	R42	0.4051	0.4068
R8	0.2779	0.2800	R43	0.5474	0.5511
R9	0.4133	0.4141	R44	0.1314	0.1320
R10	0.3256	0.3280	R45	0.1900	0.1929
R11	0.1317	0.1453	R46	0.1082	0.1129
R12	0.1636	0.1668	R47	0.5149	0.5155
R13	0.1787	0.1815	R48	0.1609	0.1610
R14	0.3099	0.3122	R49	0.0902	0.0901
R15	0.1198	0.1204	R50	0.6654	0.6653
R16	0.1149	0.1154	R51	0.3600	0.3614
R17	0.2466	0.2463	R52	0.2760	0.2786
R18	0.1180	0.1256	R53	0.1170	0.1241
R19	0.0876	0.0882	R54	0.3775	0.3766
R20	0.1289	0.1292	R55	0.1120	0.1125
R21	0.5829	0.5869	R56	0.1175	0.1186
R22	0.6767	0.6790	R57	0.1740	0.1772
R23	1.1170	1.1171	R58	0.1269	0.1271
R24	1.1299	1.1331	R59	0.0463	0.0467
R25	0.7130	0.7151	R60	0.2013	0.2013
R26	2.0239	2.0254	R61	0.1132	0.1156
R27	1.1953	1.1965	R62	0.1801	0.1826
R28	1.0094	1.0125	R63	0.1686	0.1704
R29	0.9787	0.9821	R64	0.1167	0.1172
R30	0.7923	0.7947	R65	0.3017	0.3025
R31	0.5895	0.5908	R66	0.2272	0.2271
R32	0.4634	0.4658	R67	0.2164	0.2159
R33	0.3315	0.3331	R68	0.2023	0.2033
R34	0.5914	0.5929	R69	0.2005	0.2008
R35	0.5609	0.5580	R70	0.1222	0.1233

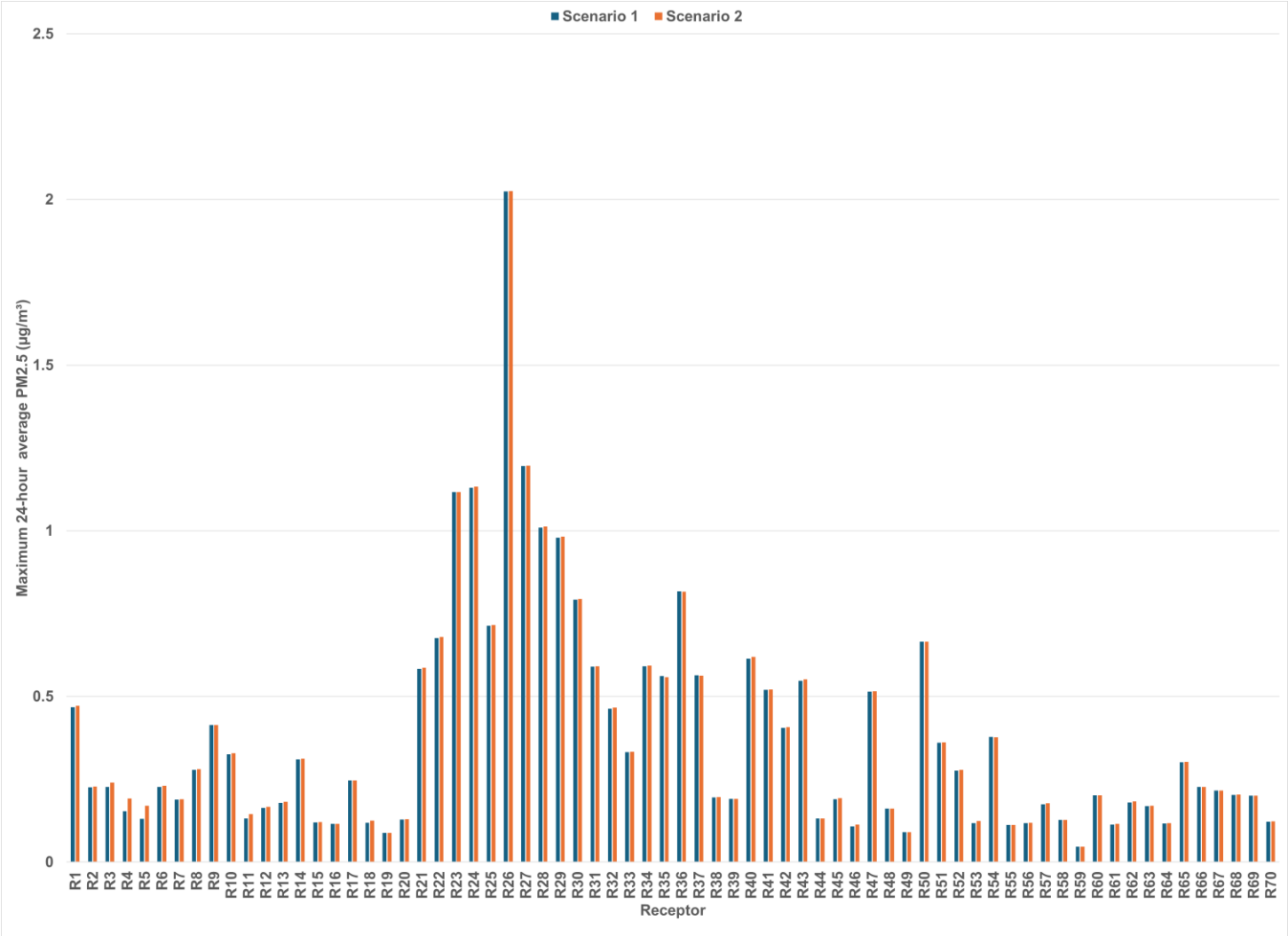

Figure 7-7: Predicted incremental maximum 24-hour average $PM_{2.5}$ concentrations (µg/m³) for Scenario 1 and Scenario 2

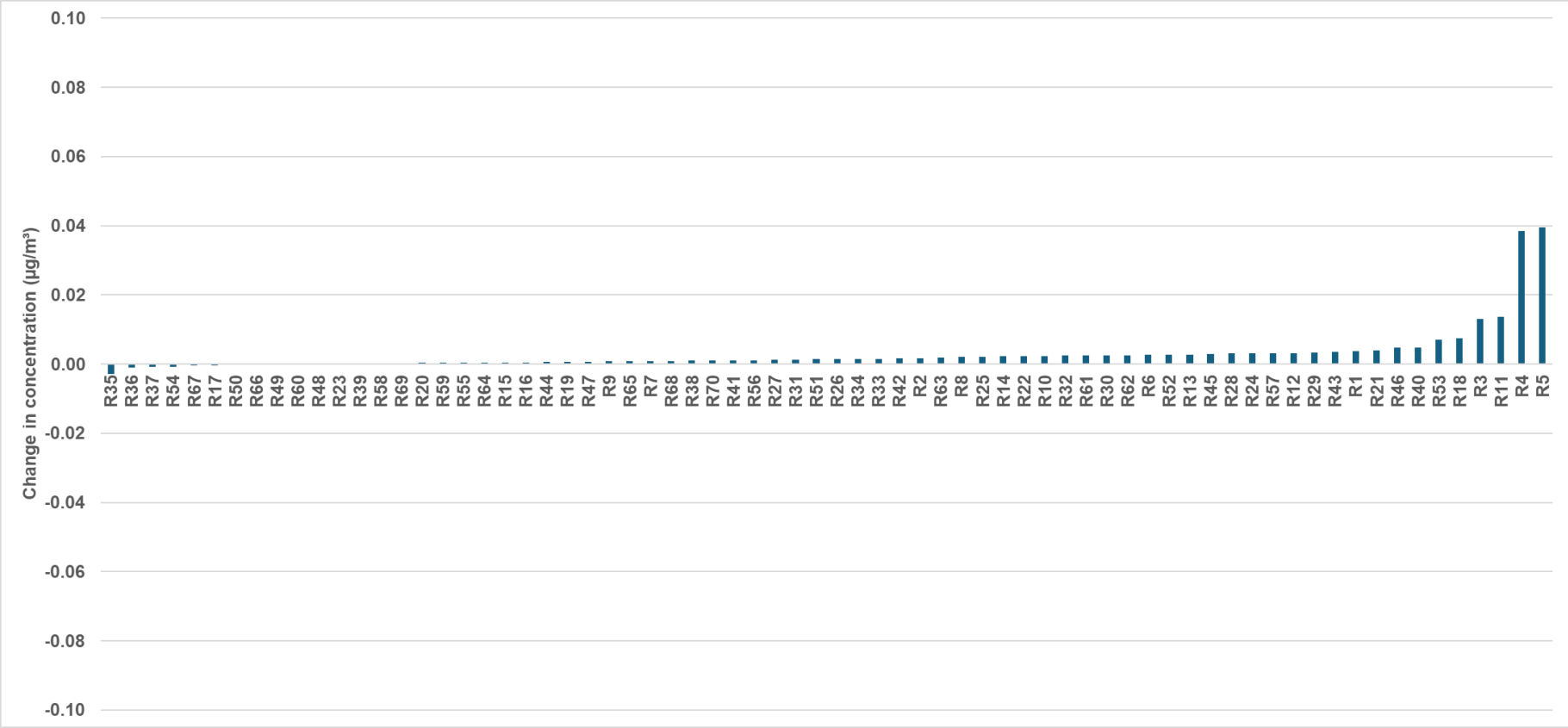

Figure 7-8: Change in maximum 24-hour average $PM_{2.5}$ (µg/m³) – Scenario 2 minus Scenario 1

7.4 Maximum 24-hour average PM_{10}

Table 7-4 and Figure 7-9 presents the predicted incremental maximum 24-hour average PM_{10} concentrations for Scenario 1 and Scenario 2 in tabular and figure format, respectively. None of these result in any additional exceedances.

Figure 7-10 presents the change in maximum 24-hour average PM_{10} concentrations for Scenario 2 minus Scenario 1.

Figure 7-11 presents the predicted incremental maximum 24-hour average PM_{10} concentrations.

Table 7-4: Predicted incremental maximum 24-hour average PM_{10} concentrations (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1	Scenario 2	Receptor ID	Scenario 1	Scenario 2
R1	1.2773	1.3065	R36	1.9231	1.9312
R2	1.1994	1.2739	R37	1.5620	1.5675
R3	1.7145	2.0465	R38	0.8079	0.8208
R4	0.9022	1.1869	R39	0.7066	0.7180
R5	0.4690	0.7196	R40	1.8511	1.8882
R6	0.7448	0.7632	R41	1.5121	1.5222
R7	0.6065	0.6258	R42	1.2196	1.2594
R8	1.5408	1.5706	R43	1.7845	1.8083
R9	1.2989	1.3086	R44	0.3890	0.3987
R10	0.9209	0.9396	R45	0.5642	0.6383
R11	0.5247	0.6803	R46	0.4052	0.4397
R12	0.6781	0.6882	R47	1.3761	1.3830
R13	0.5563	0.5648	R48	0.5225	0.5263
R14	0.8498	0.8744	R49	0.2823	0.2846
R15	0.3716	0.3788	R50	1.5269	1.5343
R16	0.3724	0.3791	R51	1.0452	1.0552
R17	0.7337	0.7394	R52	0.7947	0.8164
R18	0.4375	0.4913	R53	0.4298	0.4800
R19	0.2516	0.2575	R54	0.8944	0.8959
R20	0.3821	0.3883	R55	0.3453	0.3496
R21	1.5967	1.6270	R56	0.4352	0.4595
R22	1.9040	1.9326	R57	0.6524	0.6768
R23	3.0640	3.0869	R58	0.3931	0.3976
R24	3.2350	3.2605	R59	0.2067	0.2224
R25	1.8408	1.8588	R60	0.6298	0.6348
R26	5.5837	5.6074	R61	0.4716	0.4863
R27	3.9811	3.9977	R62	0.8581	0.8788
R28	3.9002	3.9126	R63	0.5253	0.5436
R29	3.4879	3.5216	R64	0.3831	0.3872
R30	2.6794	2.6911	R65	1.1441	1.1534
R31	1.7558	1.7737	R66	0.7449	0.7491
R32	1.2262	1.2450	R67	0.6966	0.7139
R33	1.4155	1.4314	R68	0.6395	0.6512
R34	1.4310	1.4585	R69	0.5637	0.5767
R35	1.4546	1.4540	R70	0.4673	0.5112

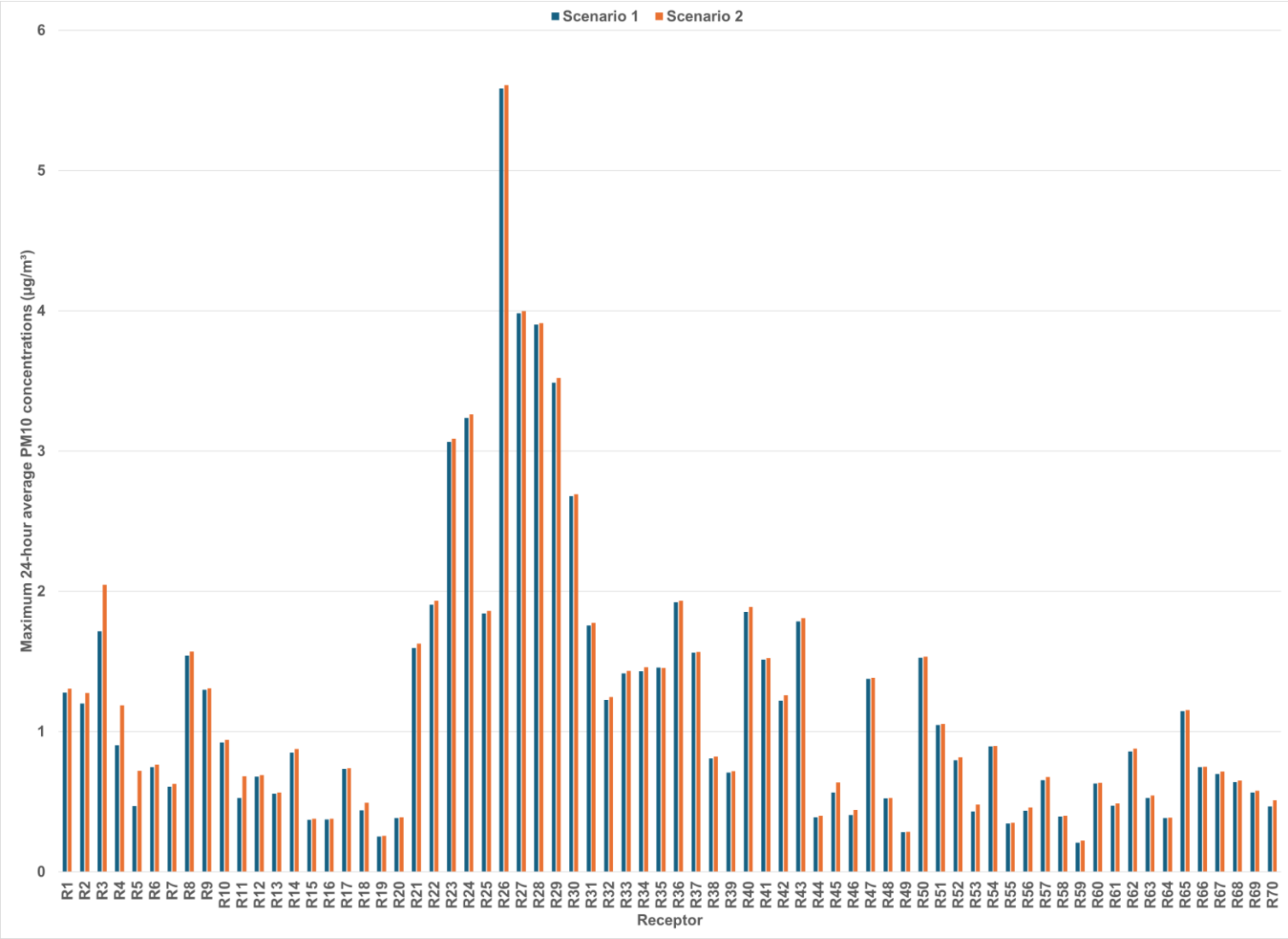

Figure 7-9: Predicted incremental maximum 24-hour average PM_{10} concentrations (µg/m³) for Scenario 1 and Scenario 2

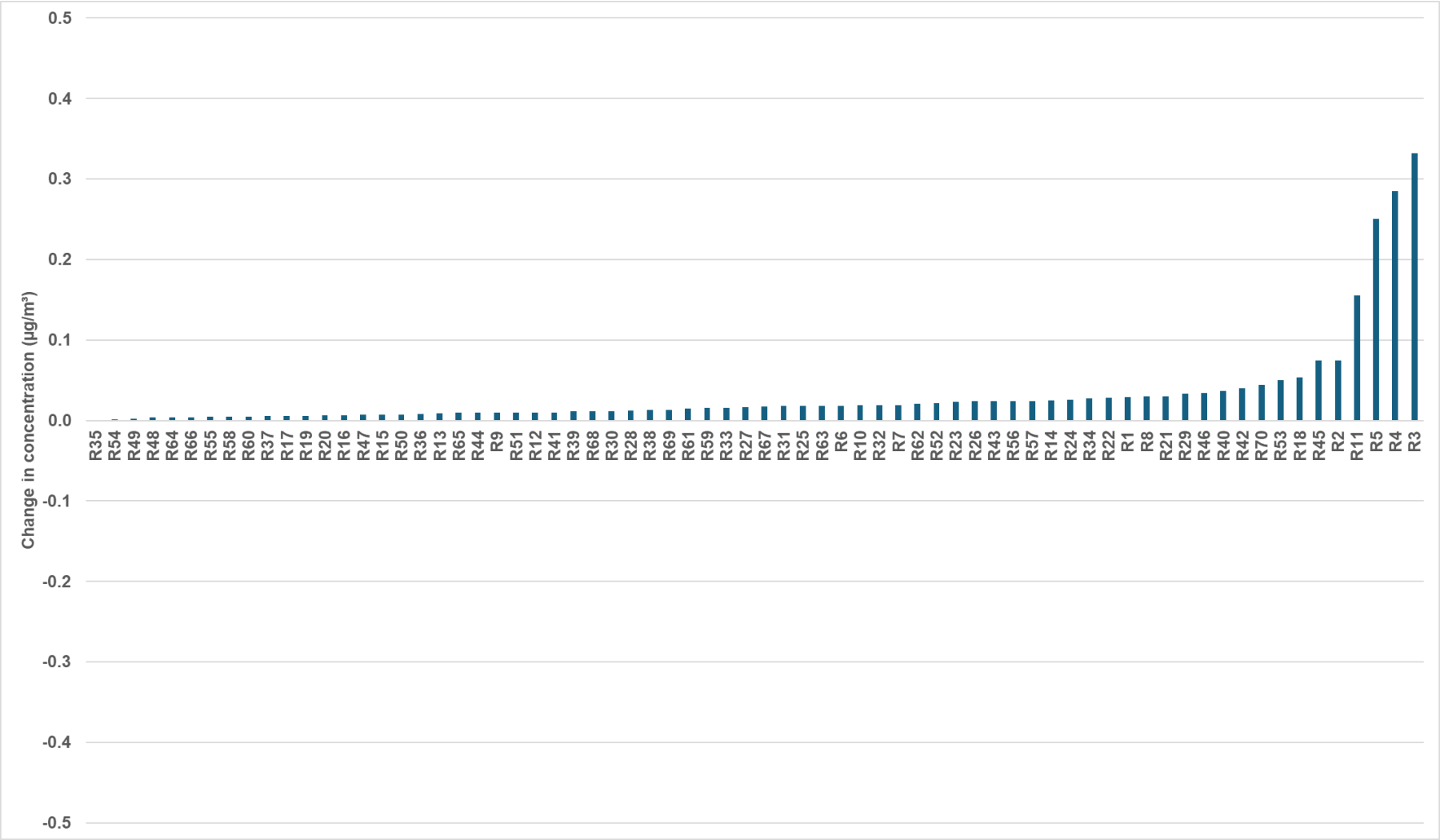

Figure 7-10: Change in maximum 24-hour average PM_{10} (µg/m³) – Scenario 2 minus Scenario 1

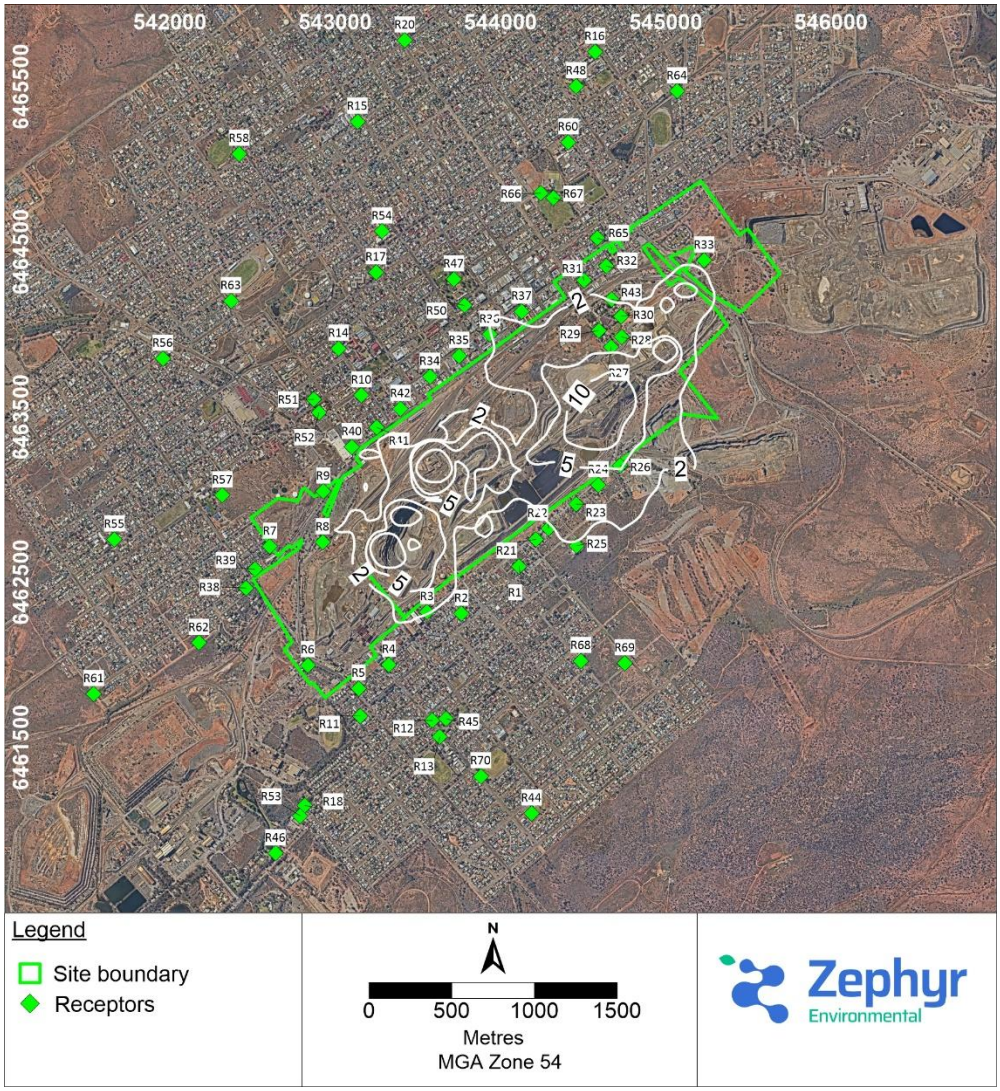

Figure 7-11: Maximum 24-hour average PM_{10} incremental concentrations Annual average $PM_{2.5}$

Table 7-5 and Figure 7-12 presents the predicted incremental annual average $PM_{2.5}$ concentrations for Scenario 1 and Scenario 2 in tabular and figure format, respectively. There are no predicted exceedances of the ambient air quality criterion.

Figure 7-13 presents the cumulative annual average $PM_{2.5}$ concentrations for Scenario 1 and 2.

Figure 7-14 presents the change in annual average $PM_{2.5}$ concentrations for Scenario 2 minus Scenario 1.

Table 7-5: Predicted incremental annual average $PM_{2.5}$ (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1	Scenario 2	Receptor ID	Scenario 1	Scenario 2
R1	0.0394	0.0405	R36	0.0676	0.0682
R2	0.0291	0.0313	R37	0.0732	0.0735
R3	0.0337	0.0403	R38	0.0108	0.0117
R4	0.0162	0.0237	R39	0.0117	0.0126
R5	0.0125	0.0151	R40	0.0402	0.0418
R6	0.0112	0.0126	R41	0.0535	0.0552
R7	0.0135	0.0146	R42	0.0656	0.0672
R8	0.0233	0.0253	R43	0.0864	0.0866
R9	0.0244	0.0260	R44	0.0075	0.0077
R10	0.0437	0.0449	R45	0.0128	0.0137
R11	0.0108	0.0121	R46	0.0052	0.0055
R12	0.0126	0.0135	R47	0.0431	0.0436
R13	0.0114	0.0121	R48	0.0178	0.0179
R14	0.0313	0.0320	R49	0.0104	0.0105
R15	0.0170	0.0172	R50	0.0498	0.0504
R16	0.0151	0.0152	R51	0.0277	0.0286
R17	0.0293	0.0298	R52	0.0277	0.0287
R18	0.0064	0.0068	R53	0.0062	0.0066
R19	0.0105	0.0106	R54	0.0278	0.0282
R20	0.0152	0.0154	R55	0.0051	0.0054
R21	0.0478	0.0488	R56	0.0105	0.0108
R22	0.0524	0.0533	R57	0.0099	0.0105
R23	0.0650	0.0657	R58	0.0123	0.0125
R24	0.0853	0.0857	R59	0.0032	0.0033
R25	0.0443	0.0449	R60	0.0230	0.0232
R26	0.1126	0.1129	R61	0.0049	0.0051
R27	0.2015	0.2018	R62	0.0078	0.0082
R28	0.1499	0.1501	R63	0.0147	0.0151
R29	0.1537	0.1539	R64	0.0130	0.0131
R30	0.1056	0.1058	R65	0.0459	0.0461
R31	0.0683	0.0685	R66	0.0323	0.0325
R32	0.0588	0.0589	R67	0.0325	0.0327
R33	0.0331	0.0332	R68	0.0157	0.0161
R34	0.0721	0.0733	R69	0.0123	0.0126
R35	0.0739	0.0749	R70	0.0086	0.0090

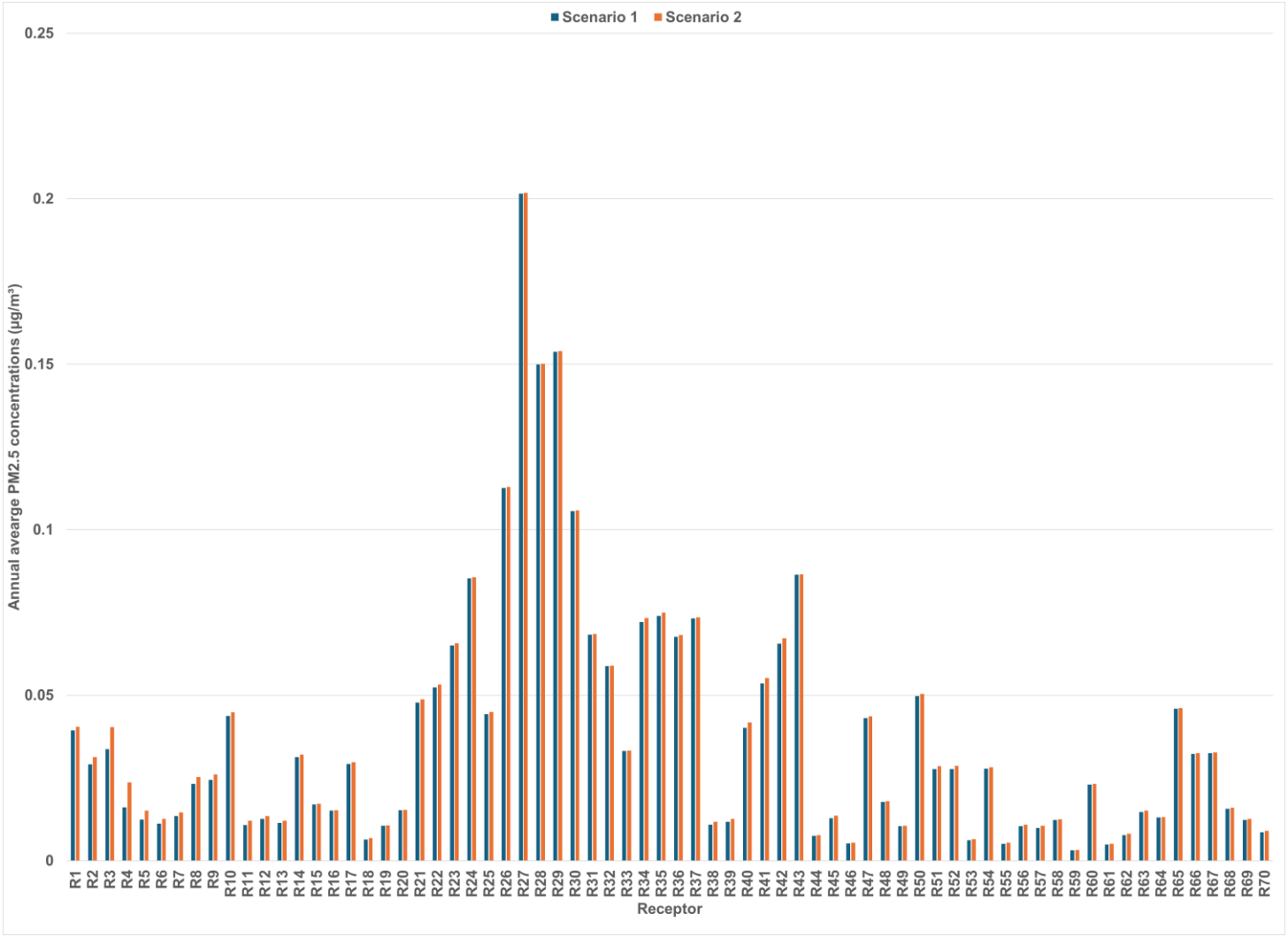

Figure 7-12: Predicted incremental annual average $PM_{2.5}$ concentration (µg/m³) for Scenario 1 and Scenario 2

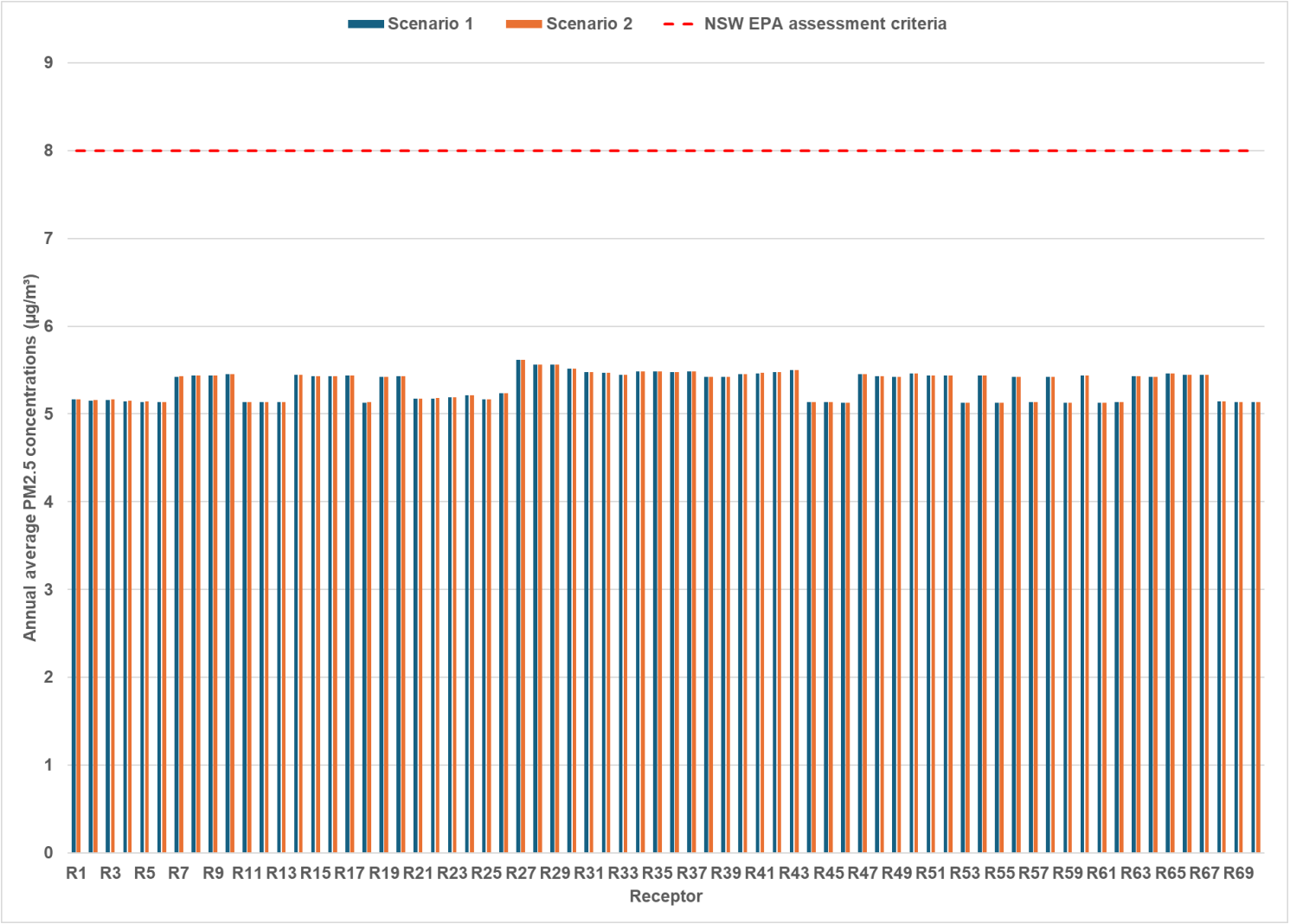

Figure 7-13: Cumulative annual average $PM_{2.5}$ concentration (µg/m³) for Scenario 1 and Scenario 2

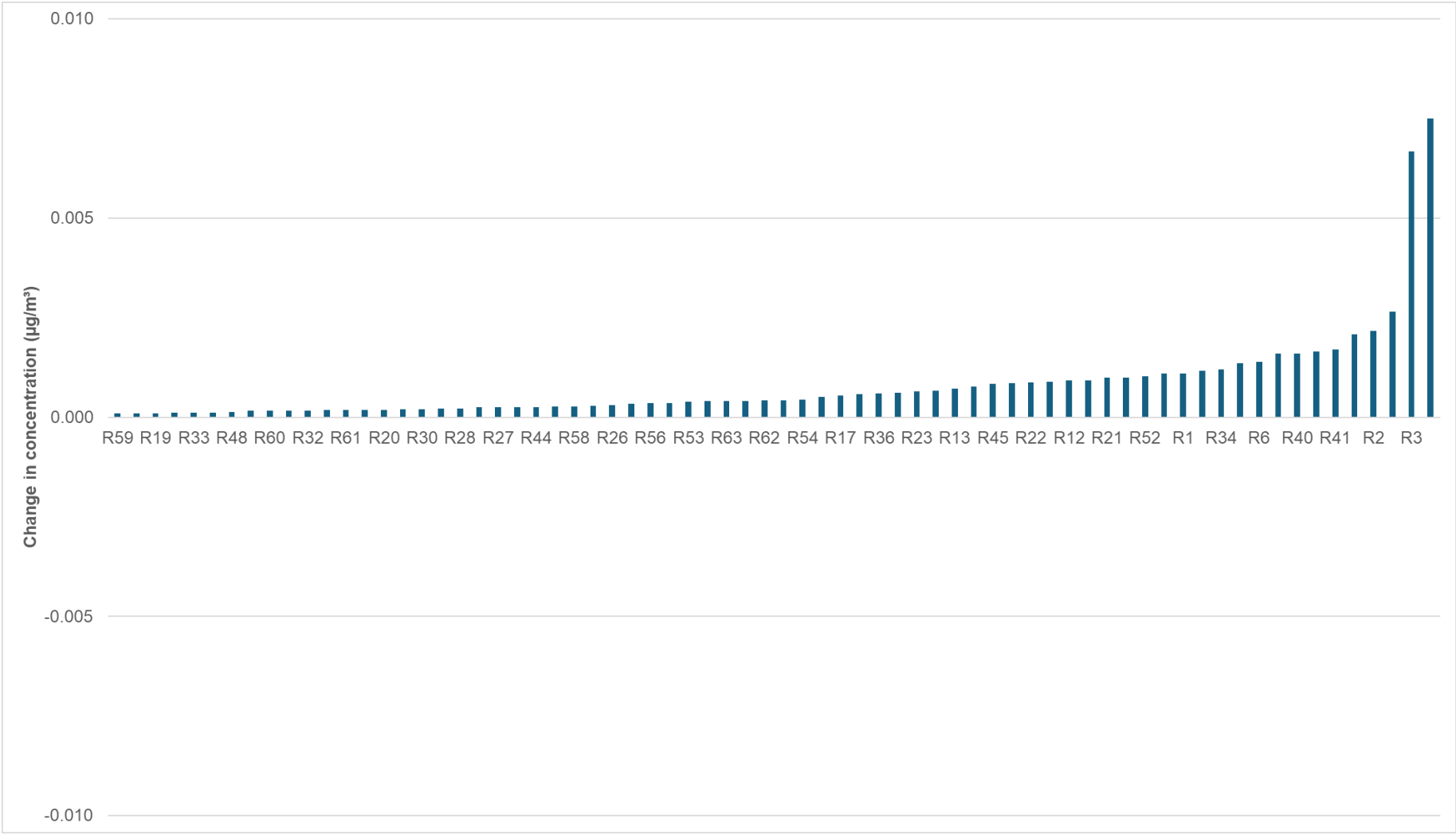

Figure 7-14: Change in annual average $PM_{2.5}$ (µg/m³) – Scenario 2 minus Scenario 1

7.5 Annual average PM_{10}

Table 7-6 and Figure 7-15 presents the predicted incremental annual average PM_{10} concentration for Scenario 1 and Scenario 2 in tabular and figure format, respectively. There are no predicted exceedance of the ambient air quality criterion.

Figure 7-16 presents the cumulative annual average PM_{10} concentrations for Scenario 1 and 2.

Figure 7-17 presents the change in annual average PM_{10} concentrations for Scenario 2 minus Scenario 1.

Figure 7-23 and Figure 7-24 present the incremental and cumulative annual average PM_{10} contours for Scenario 2.

Table 7-6: Predicted incremental annual average PM_{10} (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1	Scenario 2	Receptor ID	Scenario 1	Scenario 2
R1	0.1477	0.1562	R36	0.2310	0.2377
R2	0.1311	0.1455	R37	0.2537	0.2580
R3	0.1777	0.2203	R38	0.0426	0.0483
R4	0.0742	0.1223	R39	0.0466	0.0526
R5	0.0514	0.0688	R40	0.1827	0.1938
R6	0.0442	0.0533	R41	0.2323	0.2445
R7	0.0551	0.0623	R42	0.2706	0.2826
R8	0.1103	0.1239	R43	0.3586	0.3610
R9	0.1228	0.1337	R44	0.0283	0.0301
R10	0.1752	0.1838	R45	0.0512	0.0569
R11	0.0439	0.0530	R46	0.0193	0.0213
R12	0.0511	0.0573	R47	0.1497	0.1545
R13	0.0452	0.0501	R48	0.0667	0.0680
R14	0.1216	0.1273	R49	0.0390	0.0399
R15	0.0627	0.0648	R50	0.1730	0.1786
R16	0.0565	0.0576	R51	0.1079	0.1146
R17	0.1118	0.1161	R52	0.1121	0.1194
R18	0.0241	0.0270	R53	0.0231	0.0258
R19	0.0390	0.0399	R54	0.0998	0.1035
R20	0.0550	0.0567	R55	0.0196	0.0218
R21	0.1674	0.1759	R56	0.0396	0.0422
R22	0.1778	0.1856	R57	0.0400	0.0444
R23	0.2074	0.2140	R58	0.0474	0.0494
R24	0.2602	0.2650	R59	0.0125	0.0131
R25	0.1433	0.1486	R60	0.0871	0.0887
R26	0.3280	0.3320	R61	0.0184	0.0197
R27	0.9046	0.9081	R62	0.0297	0.0327
R28	0.6937	0.6966	R63	0.0551	0.0581
R29	0.6101	0.6136	R64	0.0510	0.0518
R30	0.4620	0.4645	R65	0.1781	0.1800
R31	0.2649	0.2674	R66	0.1196	0.1218
R32	0.2346	0.2366	R67	0.1231	0.1251
R33	0.1561	0.1572	R68	0.0576	0.0604
R34	0.2691	0.2792	R69	0.0462	0.0482
R35	0.2518	0.2609	R70	0.0338	0.0366

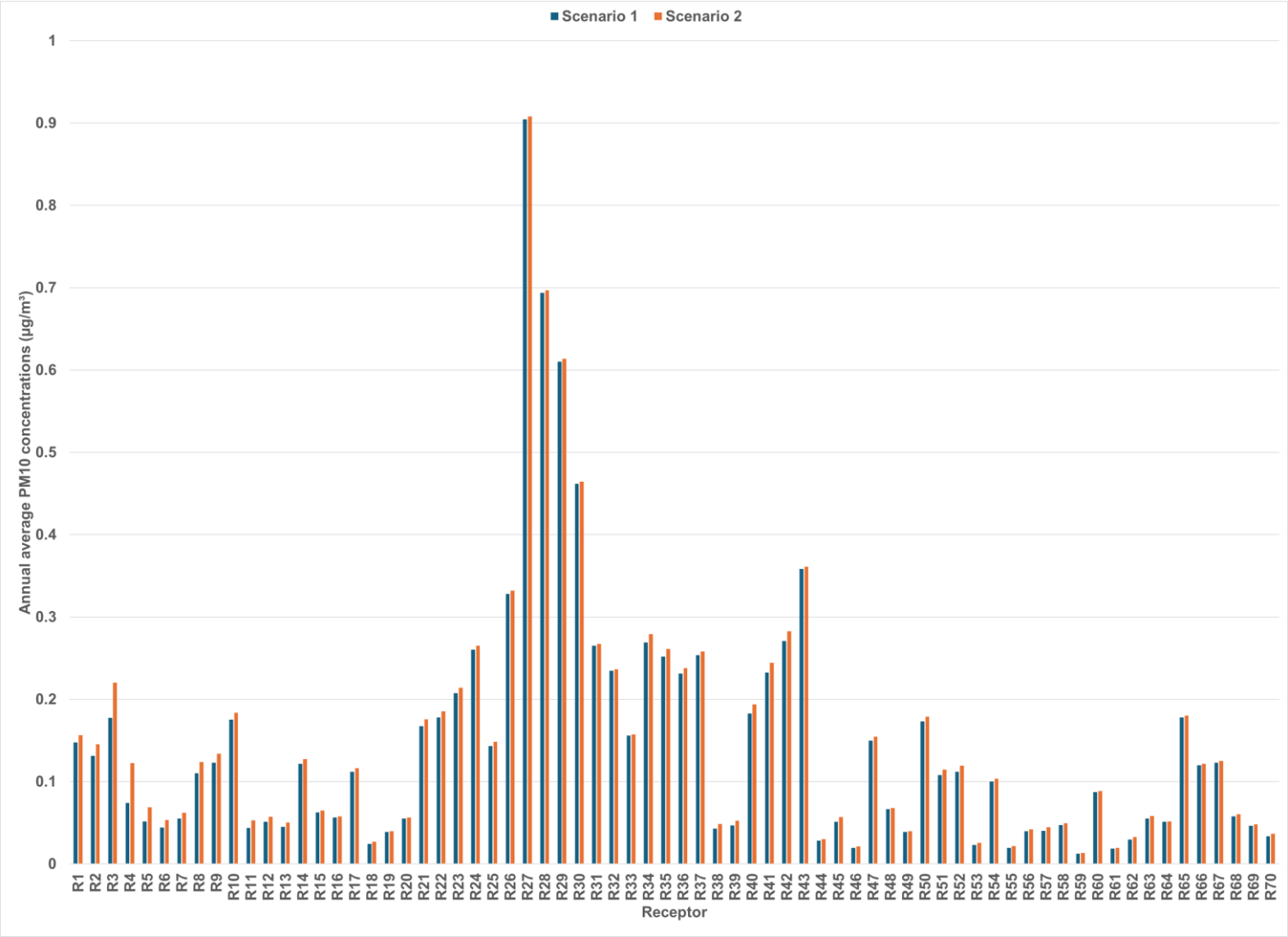

Figure 7-15: Predicted incremental annual average PM_{10} concentration (µg/m³) for Scenario 1 and Scenario 2

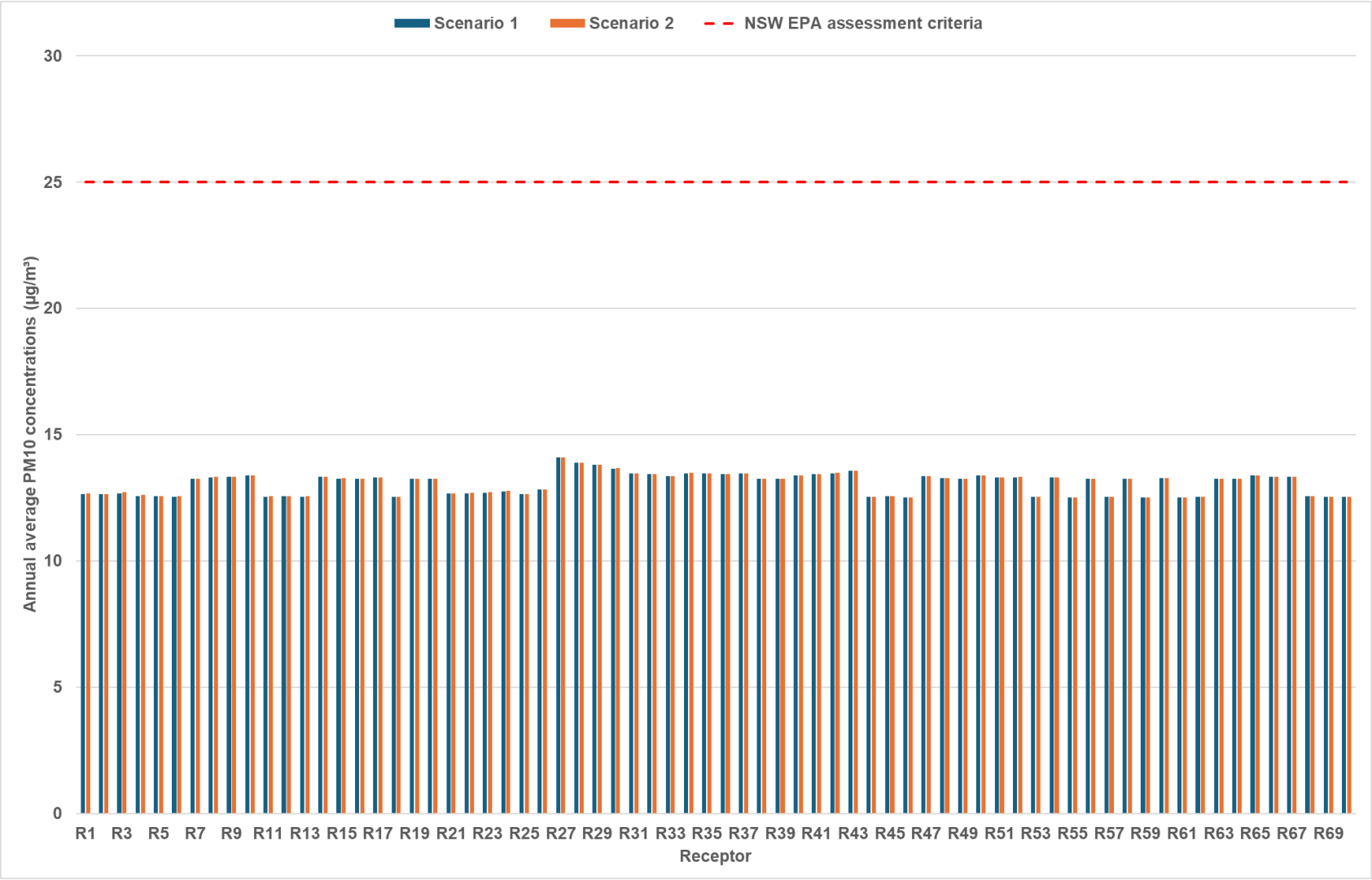

Figure 7-16: Cumulative annual average PM_{10} concentration (µg/m³) for Scenario 1 and Scenario 2

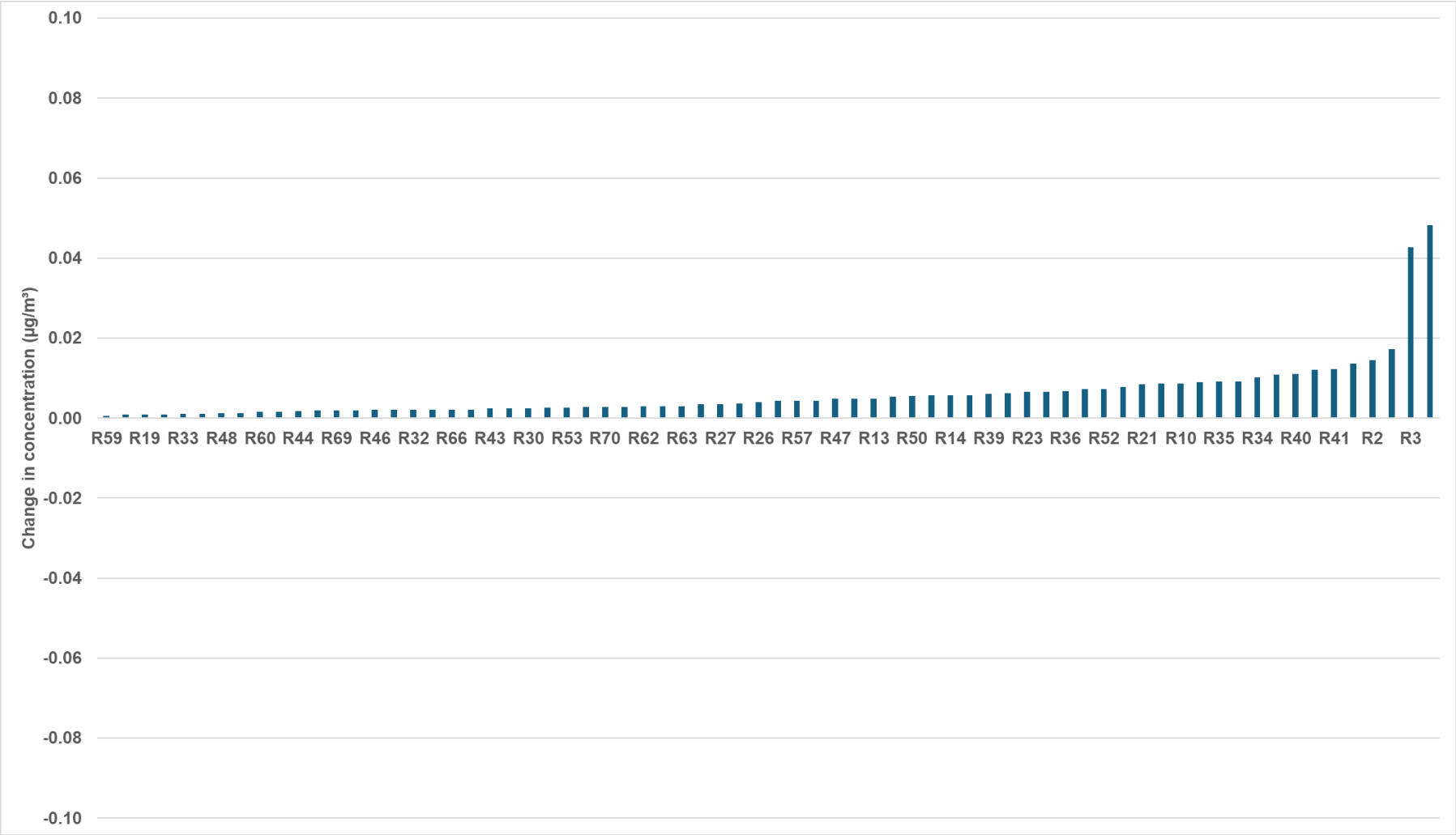

Figure 7-17: Change in annual average PM_{10} (µg/m³) – Scenario 2 minus Scenario 12

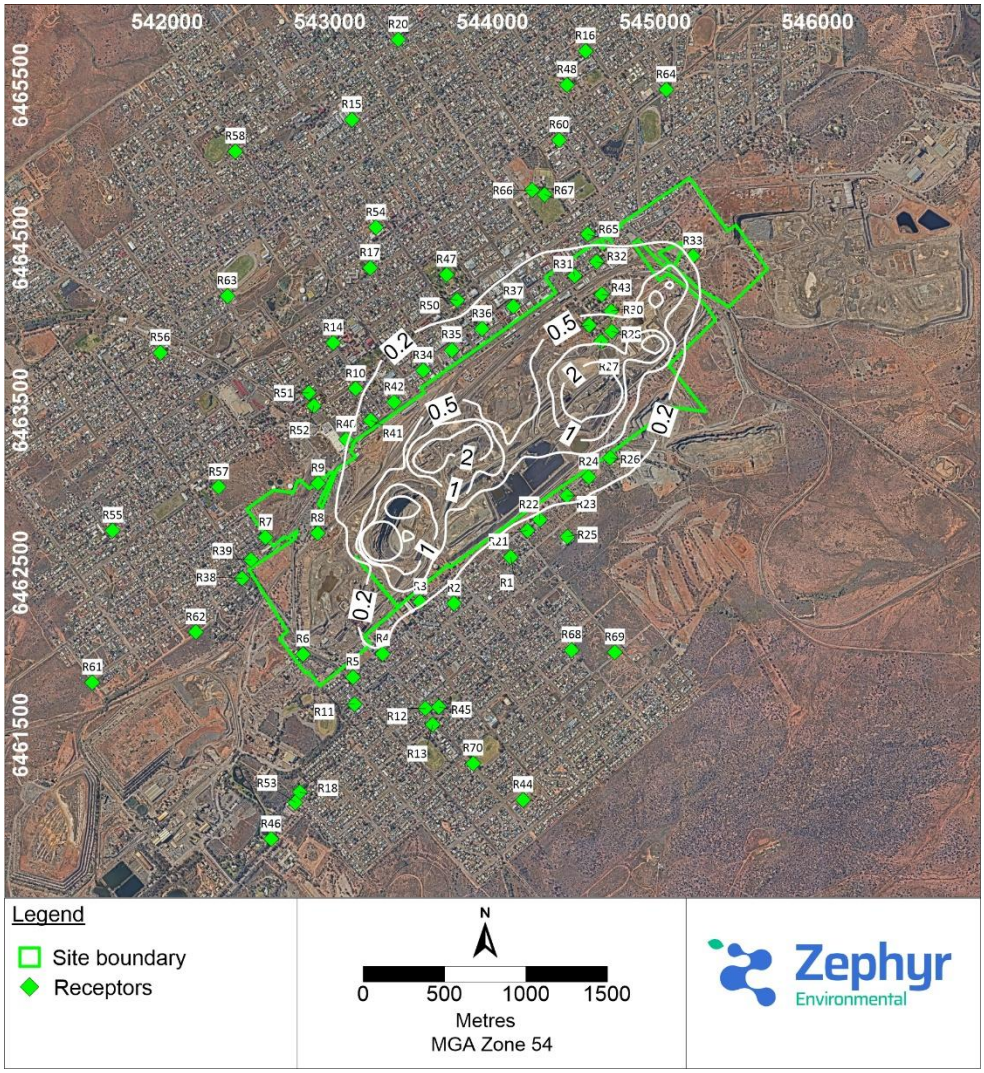

Figure 7-18: Incremental annual average PM_{10} concentrations (µg/m³) – Scenario 2 minus Scenario 1

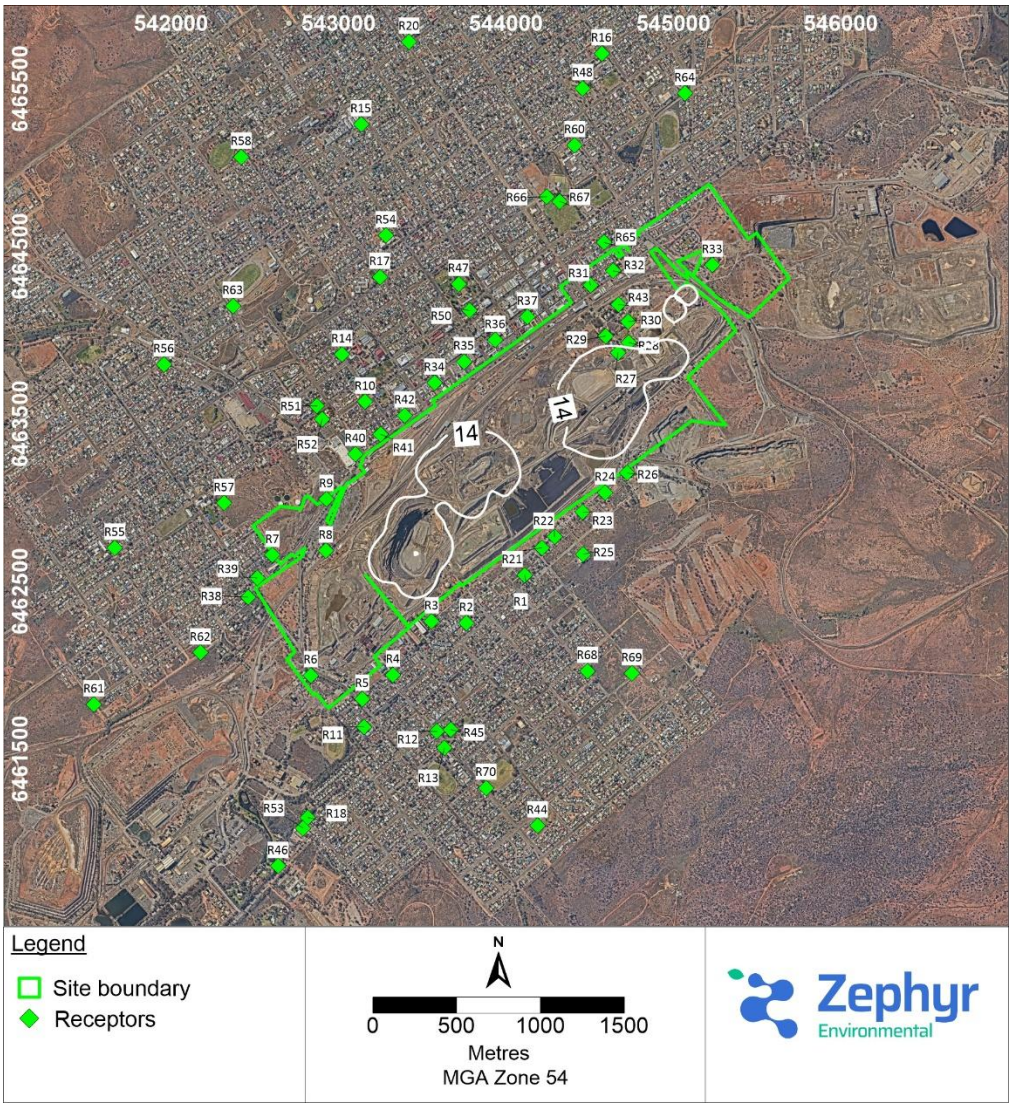

Figure 7-19: Cumulative annual average PM_{10} concentrations (µg/m³) – Scenario 2 minus Scenario 1

7.6 Annual average TSP

Table 7-7 and Figure 7-20 presents the predicted incremental annual average TSP concentrations for Scenario 1 and Scenario 2 in tabular and figure format, respectively. There are no predicted exceedance of the ambient air quality criterion.

Figure 7-21 presents the cumulative annual average TSP concentrations for Scenario 1 and 2.

Figure 7-22 presents the change in annual average TSP concentrations for Scenario 2 minus Scenario 1.

Figure 7-23 and Figure 7-24 present the incremental and cumulative annual average TSP contours for Scenario 2.

Table 7-7: Predicted incremental annual average TSP (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1	Scenario 2	Receptor ID	Scenario 1	Scenario 2
R1	0.3143	0.3306	R36	0.5175	0.5307
R2	0.2904	0.3206	R37	0.5592	0.5675
R3	0.4132	0.5110	R38	0.0815	0.0901
R4	0.1534	0.2773	R39	0.0921	0.1015
R5	0.0982	0.1324	R40	0.4449	0.4640
R6	0.0912	0.1065	R41	0.5429	0.5644
R7	0.1106	0.1218	R42	0.6547	0.6775
R8	0.2525	0.2758	R43	0.8073	0.8117
R9	0.2756	0.2937	R44	0.0523	0.0553
R10	0.4110	0.4259	R45	0.0989	0.1097
R11	0.0812	0.0985	R46	0.0299	0.0328
R12	0.0985	0.1106	R47	0.3192	0.3278
R13	0.0856	0.0949	R48	0.1242	0.1263
R14	0.2616	0.2707	R49	0.0642	0.0656
R15	0.1059	0.1090	R50	0.3853	0.3960
R16	0.1020	0.1036	R51	0.2396	0.2500
R17	0.2259	0.2329	R52	0.2645	0.2760
R18	0.0393	0.0438	R53	0.0371	0.0411
R19	0.0651	0.0664	R54	0.1853	0.1908
R20	0.0867	0.0890	R55	0.0328	0.0357
R21	0.3649	0.3816	R56	0.0688	0.0721
R22	0.3859	0.4013	R57	0.0781	0.0842
R23	0.4720	0.4854	R58	0.0709	0.0735
R24	0.6209	0.6309	R59	0.0183	0.0191
R25	0.2812	0.2905	R60	0.1735	0.1761
R26	0.8080	0.8162	R61	0.0275	0.0292
R27	2.2657	2.2727	R62	0.0509	0.0551
R28	1.6885	1.6937	R63	0.0963	0.1003
R29	1.4616	1.4681	R64	0.0957	0.0970
R30	1.0609	1.0654	R65	0.3746	0.3778
R31	0.5893	0.5938	R66	0.2455	0.2493
R32	0.5093	0.5129	R67	0.2541	0.2576
R33	0.2879	0.2895	R68	0.1173	0.1223
R34	0.6412	0.6609	R69	0.0925	0.0960
R35	0.5821	0.6001	R70	0.0642	0.0692

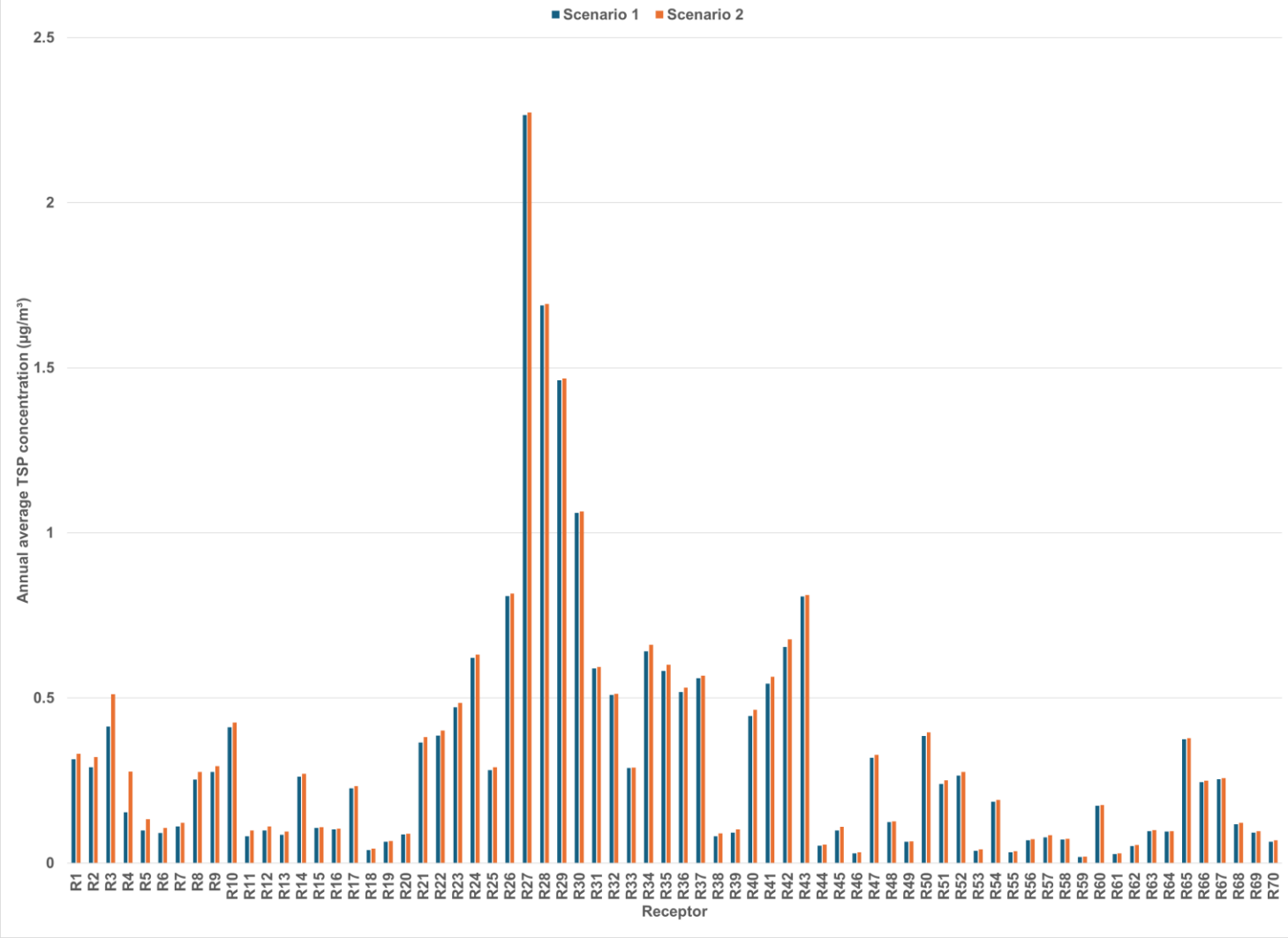

Figure 7-20: Predicted incremental annual average TSP concentration (µg/m³) for Scenario 1 and Scenario 2

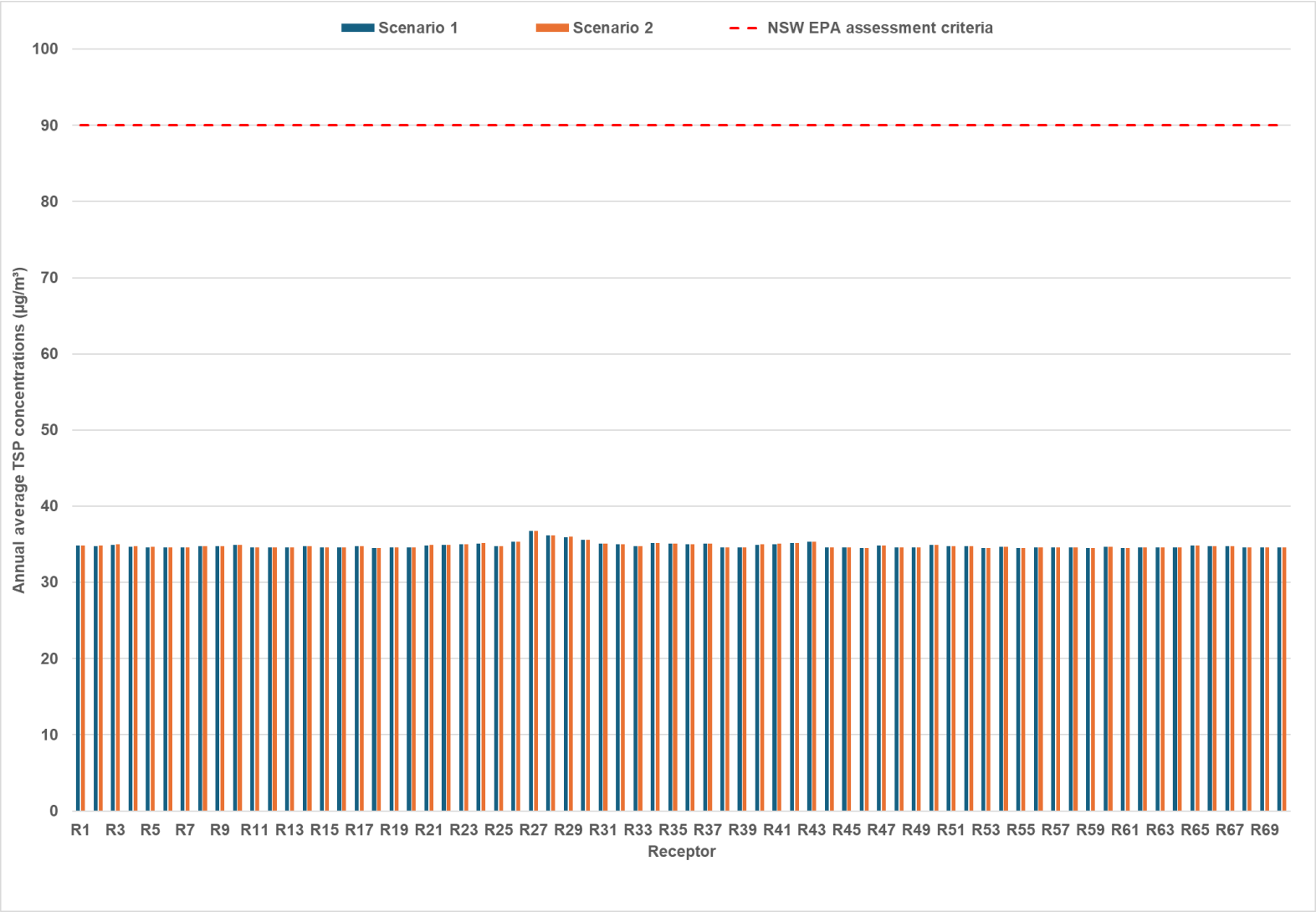

Figure 7-21: Cumulative annual average TSP concentration (µg/m³) for Scenario 1 and Scenario 2

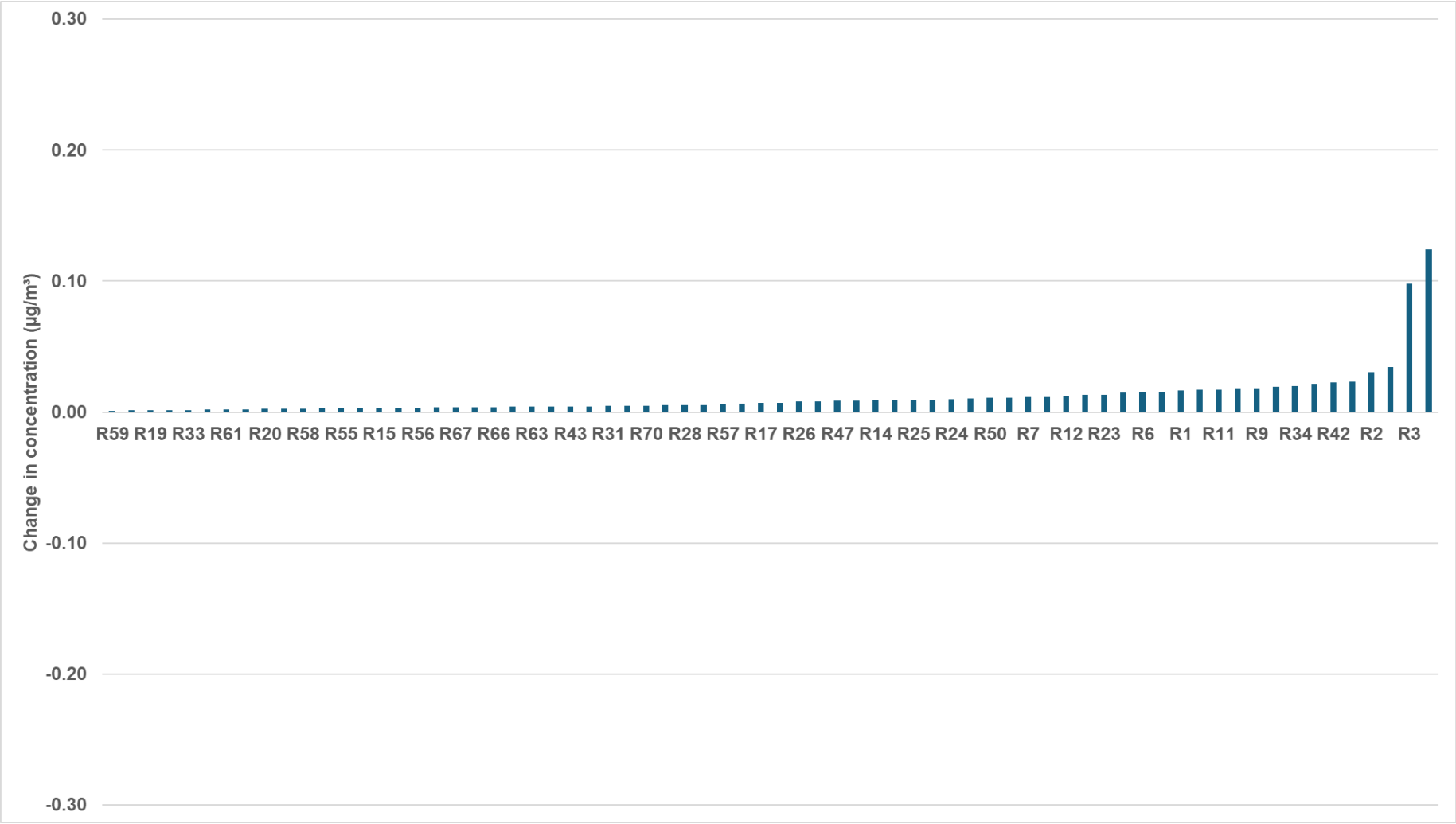

Figure 7-22: Change in annual average TSP (µg/m³) – Scenario 2 minus Scenario 12

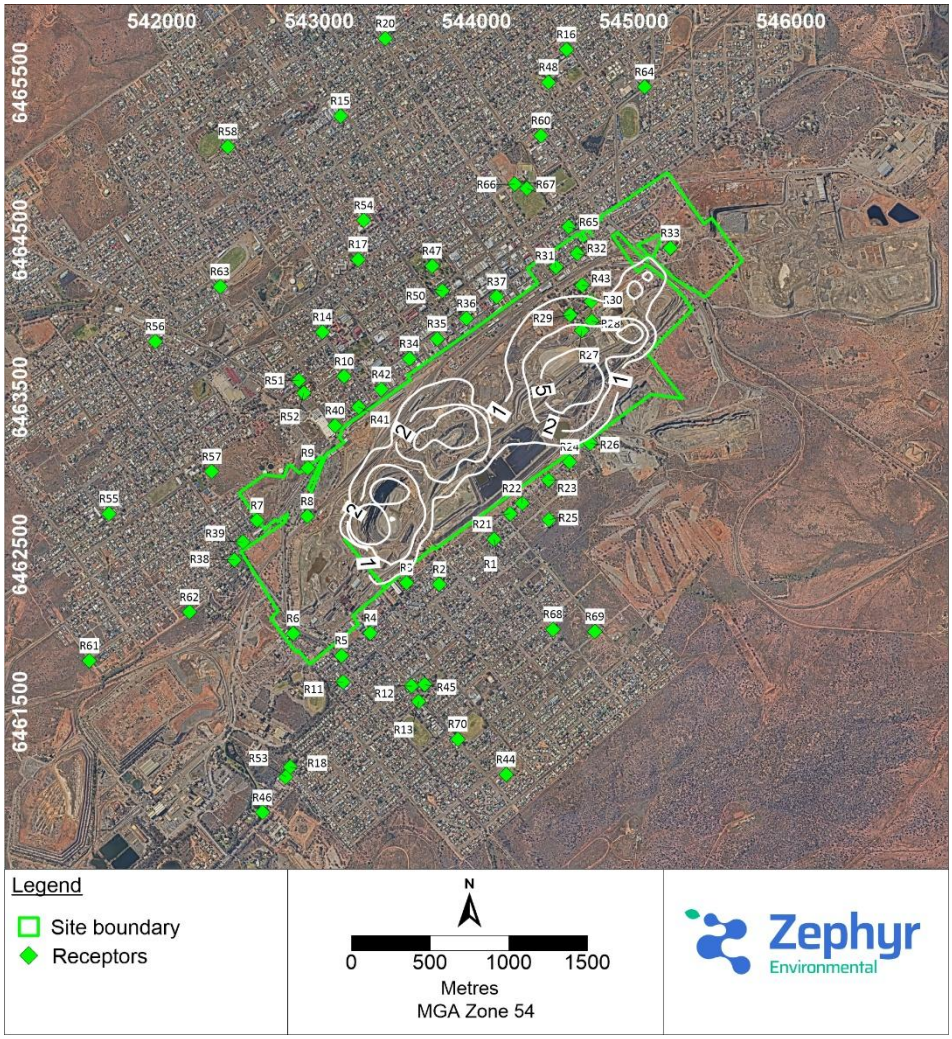

Figure 7-23: Incremental annual average TSP concentrations (µg/m³) for Scenario 2

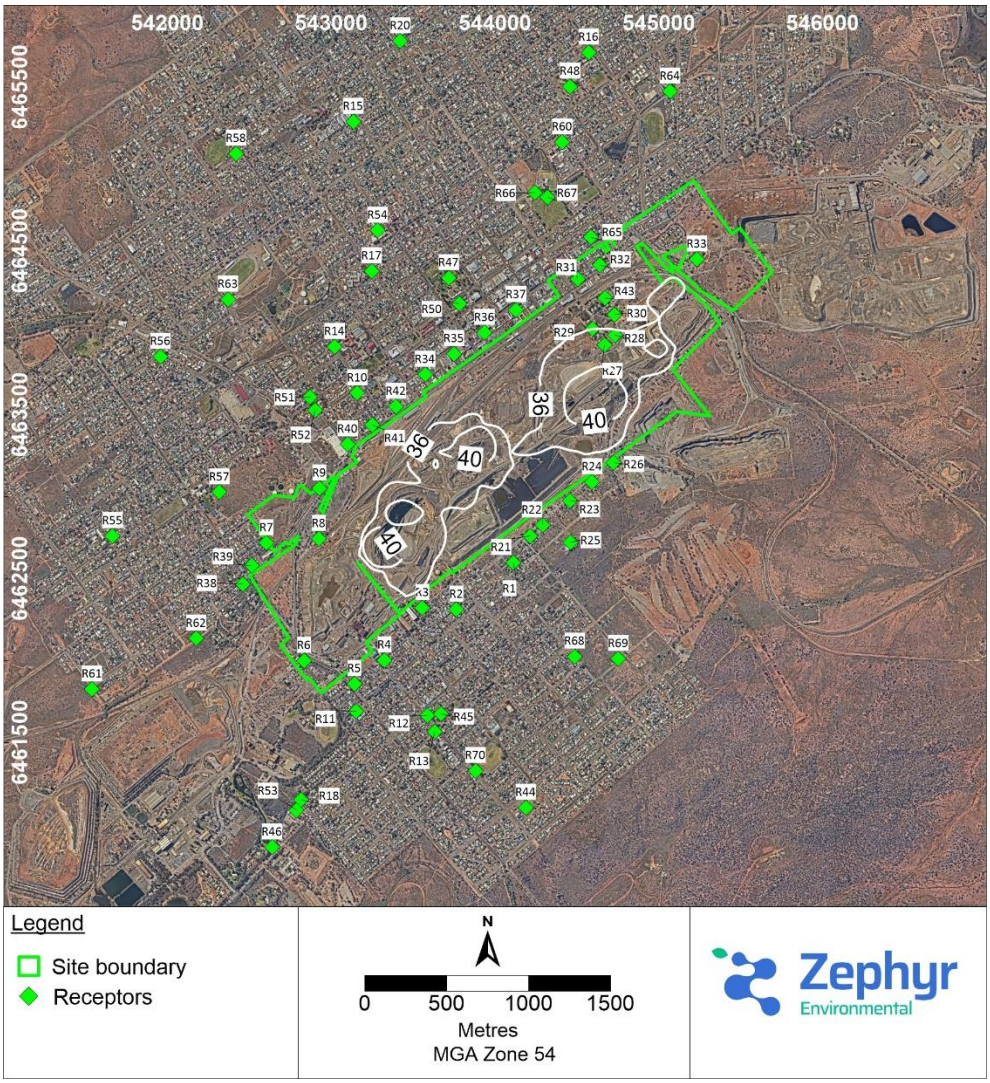

Figure 7-24: Cumulative annual average TSP concentrations (µg/m³) for Scenario 2

7.7 Annual average dust deposition

Table 7-8 and Figure 7-25 presents the predicted incremental annual average dust deposition (g/m^2/month) for Scenario 1 and Scenario 2. There are no predicted exceedances of the ambient air quality criterion.

Figure 7-26 presents the cumulative annual average dust deposition for Scenario 1 and 2.

Figure 7-27 presents the change in annual average dust deposition concentrations for Scenario 2 minus Scenario 1.

Table 7-8: Predicted incremental annual average dust deposition (g/m^2/month) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1	Scenario 2	Receptor ID	Scenario 1	Scenario 2
R1	0.0581	0.0603	R36	0.0831	0.0850
R2	0.0601	0.0642	R37	0.0905	0.0917
R3	0.0903	0.1040	R38	0.0117	0.0127
R4	0.0280	0.0457	R39	0.0136	0.0147
R5	0.0173	0.0214	R40	0.0807	0.0832
R6	0.0139	0.0156	R41	0.1008	0.1036
R7	0.0172	0.0185	R42	0.1154	0.1185
R8	0.0439	0.0468	R43	0.1468	0.1474
R9	0.0508	0.0531	R44	0.0090	0.0094
R10	0.0695	0.0715	R45	0.0174	0.0188
R11	0.0138	0.0160	R46	0.0047	0.0051
R12	0.0169	0.0185	R47	0.0523	0.0535
R13	0.0147	0.0159	R48	0.0217	0.0220
R14	0.0426	0.0439	R49	0.0114	0.0116
R15	0.0175	0.0180	R50	0.0634	0.0650
R16	0.0178	0.0180	R51	0.0388	0.0402
R17	0.0369	0.0379	R52	0.0433	0.0448
R18	0.0063	0.0068	R53	0.0059	0.0064
R19	0.0114	0.0116	R54	0.0303	0.0312
R20	0.0147	0.0151	R55	0.0049	0.0052
R21	0.0638	0.0660	R56	0.0097	0.0101
R22	0.0650	0.0671	R57	0.0121	0.0128
R23	0.0764	0.0782	R58	0.0115	0.0119
R24	0.0979	0.0993	R59	0.0030	0.0031
R25	0.0471	0.0484	R60	0.0305	0.0308
R26	0.1296	0.1307	R61	0.0036	0.0038
R27	0.4266	0.4276	R62	0.0069	0.0073
R28	0.3214	0.3221	R63	0.0146	0.0152
R29	0.2634	0.2644	R64	0.0169	0.0171
R30	0.1971	0.1977	R65	0.0668	0.0672
R31	0.1049	0.1056	R66	0.0420	0.0426
R32	0.0918	0.0923	R67	0.0441	0.0446
R33	0.0557	0.0559	R68	0.0204	0.0211
R34	0.1102	0.1130	R69	0.0163	0.0168
R35	0.0952	0.0978	R70	0.0111	0.0118

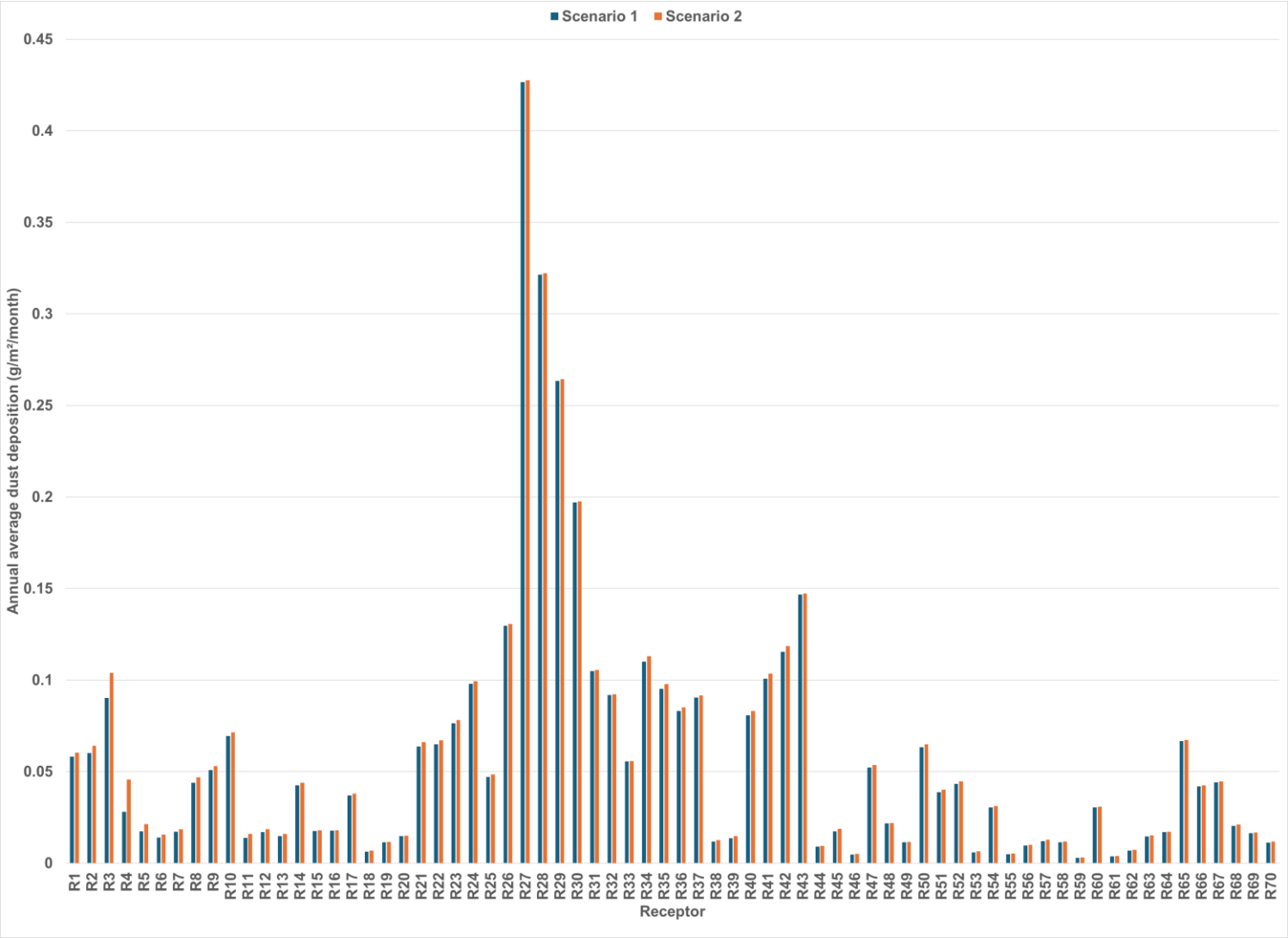

Figure 7-25: Predicted incremental annual average dust deposition (g/m²/month) for Scenario 1 and Scenario 2

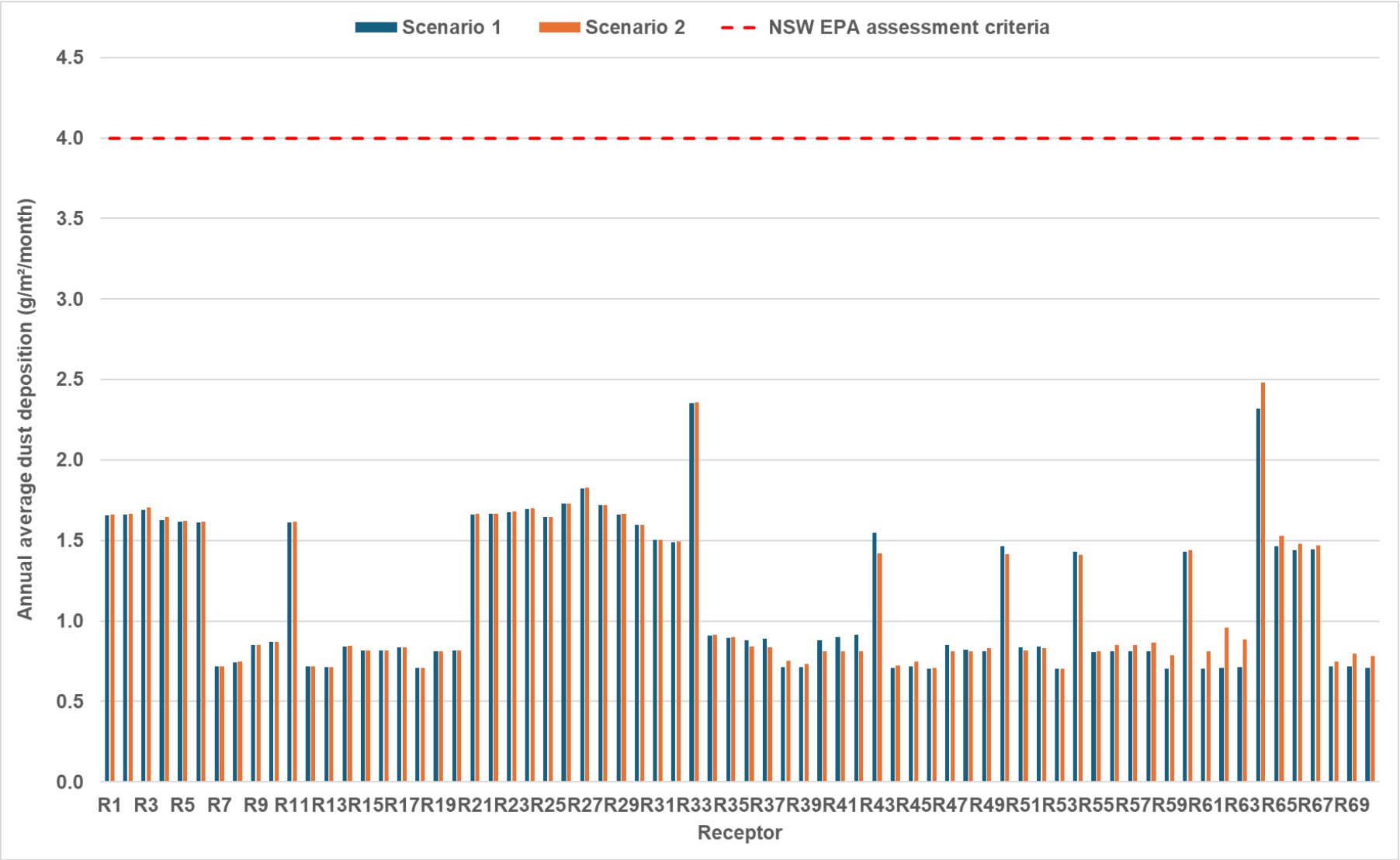

Figure 7-26: Cumulative annual average dust deposition (g/m²/month) for Scenario 1 and Scenario 2

Figure 7-27: Change in annual average dust deposition (g/m^2/month) – Scenario 2 minus Scenario 12

8 CONCLUSIONS

This report has assessed particulate matter and lead impacts associated with the proposed modification 13 (MOD13) activities at Rasp Mine. Local land use, terrain, air quality and meteorology were considered in the assessment and dispersion modelling was completed using the AERMOD modelling system.

The assessment considered two scenarios:

- Scenario 1: Current operations with extraction rate of 500,000 tpa from Rasp Mine
- Scenario 2: Current operations but receiving 500,000 tpa from Pinnacles

Emissions to air were estimated for both scenarios and these emissions were then evaluated in terms of their predicted off-site impacts using the AERMOD atmospheric dispersion model. Predictions were made at gridded receptors across the model domain, as well as at individual sensitive receptors.

All air quality metrics are predicted to be below their respective NSW EPA ambient air quality criteria for both scenarios.

Scenario 2 is considered to be a reasonable worst-case future scenario, as it includes longer haulage of ore (from the Pinnacles mine) and also still includes tailings harvesting from TSF2. Any future introduction of a dewatering facility would remove the need for this tailings harvesting and therefore likely result in lower impacts at receptors.

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Appendix A

Description of sensitive receptors and allocated background monitoring location

Table A-1: Sensitive receptor locations and adopted monitoring location used for background

Receptor ID	Receptor Name	Description	x	y	Adopted monitoring location used for background		
					PM_{10}, $PM_{2.5}$	TSP	Dust and % lead deposition
R1	Piper Street North	Residence	544110	6462598	TEOM1	TSP-HVAS	DG5
R2	Piper Street Central	Southern Cross Care (St Anne's)	543763	6462312	TEOM1	TSP-HVAS	DG5
R3	Eyre Street North	Residence	543555	6462322	TEOM1	TSP-HVAS	DG5
R4	Eyre Street Central	Residence	543324	6462003	TEOM1	TSP-HVAS	DG5
R5	Eyre Street South	Residence	543140	6461859	TEOM1	TSP-HVAS	DG5
R6	South Road	Residence	542833	6462000	TEOM1	TSP-HVAS	DG5
R7	Carbon Lane	Residence	542604	6462718	TEOM2	TSP-HVAS	DG1
R8	Old South Road	Residence	542923	6462744	TEOM2	TSP-HVAS	DG1
R9	South Rd	RSPCA	542926	6463052	TEOM2	TSP-HVAS	DG2
R10	Cnr Garnet & Blende Streets	Duke of Cornwall Park	543158	6463633	TEOM2	TSP-HVAS	DG2
R11	29 Comstock Street	Alma Bugdil Preschool	543150	6461692	TEOM1	TSP-HVAS	DG5
R12	Cnr Patton & Comstock Streets	Playtime School	543587	6461665	TEOM1	TSP-HVAS	DG7
R13	Comstock Street	Alma Primary School	543631	6461566	TEOM1	TSP-HVAS	DG7
R14	76 Garnet Street	Broken Hill High School	543019	6463916	TEOM2	TSP-HVAS	DG2
R15	176 Thomas St	Broken Hill Base Hospital	543133	6465290	TEOM2	TSP-HVAS	DG2
R16	Chapple Street	N. Broken Hill Primary School	544570	6465713	TEOM2	TSP-HVAS	DG2
R17	Mica Street	Broken Hill Public School	543245	6464378	TEOM2	TSP-HVAS	DG2
R18	2 Patton Street	Rainbow Pre-school	542815	6461151	TEOM1	TSP-HVAS	DG7
R19	Murton Street	Willyama High School	544599	6466299	TEOM2	TSP-HVAS	DG2
R20	470 Morgan Street	Morgan Street Primary School	543420	6465782	TEOM2	TSP-HVAS	DG2
R21	Eyre Street North	Residence	544212	6462762	TEOM1	TSP-HVAS	DG5
R22	Eyre Street North	Residence	544288	6462828	TEOM1	TSP-HVAS	DG5
R23	Eyre Street North	Residence	544456	6462974	TEOM1	TSP-HVAS	DG5
R24	Eyre Street North	Residence	544591	6463090	TEOM1	TSP-HVAS	DG5

Receptor ID	Receptor Name	Description	x	y	Adopted monitoring location used for background		
					PM_{10}, $PM_{2.5}$	TSP	Dust and % lead deposition
R25	Lawton Street	Essential Water Tank	544460	6462723	TEOM1	TSP-HVAS	DG5
R26	Holten Drive	Quarry offices	544723	6463208	TEOM1	TSP-HVAS	DG5
R27	Proprietary Square	Residence	544666	6463926	TEOM2	TSP-HVAS	DG6
R28	Proprietary Square	British Flats Playground	544731	6463988	TEOM2	TSP-HVAS	DG6
R29	Iodide Street	Residence	544592	6464026	TEOM2	TSP-HVAS	DG6
R30	Iodide Street	Perilya Social Club	544728	6464112	TEOM2	TSP-HVAS	DG6
R31	Crystal Street	Residence	544503	6464328	TEOM2	TSP-HVAS	DG6
R32	Crystal Street	Residence	544637	6464415	TEOM2	TSP-HVAS	DG6
R33	Brownes Shaft	Brownes Shaft Residence	545231	6464450	TEOM2	TSP-HVAS	DG4
R34	Crystal Street	Residence	543572	6463746	TEOM2	TSP-HVAS	DG2
R35	Crystal Street	Residence	543748	6463873	TEOM2	TSP-HVAS	DG2
R36	Crystal Street	Nachiapan Surgery	543934	6464002	TEOM2	TSP-HVAS	DG2
R37	Crystal Street	Residence	544127	6464141	TEOM2	TSP-HVAS	DG2
R38	Gypsum Street	Residence	542459	6462467	TEOM2	TSP-HVAS	DG1
R39	Gypsum Street	Residence	542512	6462581	TEOM2	TSP-HVAS	DG1
R40	Silver City Hwy	Coles Supermarket	543099	6463321	TEOM2	TSP-HVAS	DG2
R41	Silver City Hwy	Residence	543249	6463439	TEOM2	TSP-HVAS	DG2
R42	Silver City Hwy	Residence	543394	6463551	TEOM2	TSP-HVAS	DG2
R43	Proprietary Square	Playground	544670	6464213	TEOM2	TSP-HVAS	DG6
R44	Cnr Duff and South Streets	Duff Street Park Playground	544186	6461103	TEOM1	TSP-HVAS	DG7
R45	141 Patton Street	Patton Park	543670	6461675	TEOM1	TSP-HVAS	DG7
R46	Wentworth Street	Zinc Lakes	542637	6460861	TEOM1	TSP-HVAS	DG7
R47	Cnr Beryl and Sulphide Streets	Sturt Park Playground	543716	6464336	TEOM2	TSP-HVAS	DG2
R48	Queen Elizabeth Park	Playground	544457	6465505	TEOM2	TSP-HVAS	DG2
R49	Aquatic Centre	Playground	544257	6466375	TEOM2	TSP-HVAS	DG2

Receptor ID	Receptor Name	Description	x	y	Adopted monitoring location used for background		
					PM_{10}, $PM_{2.5}$	TSP	Dust and % lead deposition
R50	229 Beryl Street	Aruma Lodge	543782	6464178	TEOM2	TSP-HVAS	DG6
R51	1 Braceman St	Eureka Shorty O'Neill	542870	6463609	TEOM2	TSP-HVAS	DG2
R52	1 - 40 Blende St	Con Crowley Village	542900	6463529	TEOM2	TSP-HVAS	DG2
R53	168 Thomas St	War Vets Retirement Living	542787	6461088	TEOM1	TSP-HVAS	DG7
R54	192 Lane St	Sacred Heart Parish Primary School	543282	6464626	TEOM2	TSP-HVAS	DG6
R55	106 Wills Street	Railwaytown Public School	541663	6462761	TEOM1	TSP-HVAS	DG2
R56	185 Rakow Street	Burke Ward Public School	541956	6463856	TEOM2	TSP-HVAS	DG2
R57	Gypsum Street	AJ Keast Park	542316	6463028	TEOM1	TSP-HVAS	DG2
R58	367 Kaolin Street	Picton Oval	542418	6465095	TEOM2	TSP-HVAS	DG2
R59	Broken Hill Airport	Flying Doctors Medical Centre	544243	6459543	TEOM1	TSP-HVAS	DG7
R60	121 Bagot Street	Busy Kids Child Care Centre	544409	6465165	TEOM2	TSP-HVAS	DG6
R61	Cnr Slag and Gaffney Streets	Residence	541538	6461826	TEOM1	TSP-HVAS	DG1
R62	Slag Street	Residence	542174	6462135	TEOM1	TSP-HVAS	DG1
R63	Williams Street	Memorial Oval	542368	6464205	TEOM2	TSP-HVAS	DG1
R64	Silver Street	Jubilee Oval	545067	6465474	TEOM2	TSP-HVAS	DG4
R65	Argent Lane	Residence	544584	6464584	TEOM2	TSP-HVAS	DG6
R66	Blende Street	O'Neill Park Soccer Grounds	544241	6464857	TEOM2	TSP-HVAS	DG6
R67	Blende Street	Cricket Grounds	544319	6464830	TEOM2	TSP-HVAS	DG6
R68	Whitaker Street	Residence	544485	6462026	TEOM1	TSP-HVAS	DG7
R69	King Street	Residence	544751	6462012	TEOM1	TSP-HVAS	DG7
R70	Talbot Street	Lamb Oval	543879	6461328	TEOM1	TSP-HVAS	DG7

Appendix B

Emissions estimation

Table B-1: Annual emission estimates for Scenario 1 BAU 2024

Activity	Adopted monitoring location used for background			
	TSP	PM_{10}	$PM_{2.5}$	Pb (TSP)
Ore - Hauling ore from boxcut to ROM pad by truck (sealed roads)	296	74	7	2
Ore - Unloading ore at ROM pad	779	368	56	23
Ore - Front end loaders at ROM pad	4,869	883	511	146
Ore - Crushed ore storage bin transfer	779	368	56	23
Ore - Crushing	68	30	30	2
Ore - Hauling concentrate by trucks within processing plant (unsealed roads)	2,963	743	74	33
Ore - Hauling concentrate by trucks to rail siding (sealed roads)	533	134	13	6
CBP - Truck movement - cement (unsealed roads)	125	31	3	1
CBP - Truck movement - cement (sealed roads)	6	2	0	0.03
CBP - Truck movement - aggregate (unsealed roads)	111	28	3	1
CBP - Truck movement - aggregate (sealed roads)	16	4	0	0.1
CBP - Truck movement - sand (unsealed roads)	426	107	11	2
CBP - Truck movement - sand (sealed roads)	61	15	2	0.3
CBP - Truck movement - shotcrete (unsealed roads)	479	120	12	3
CBP - Truck movement - shotcrete (sealed roads)	24	6	1	0.1
CBP - Loading cement at rail siding	10	5	1	-
CBP - Aggregate transfer	33	16	1	-
CBP - Sand transfer	16	8	0	-
CBP - Cement transfer	3	1	0	-
CBP - Weigh hopper loading	20	10	1	-
CBP - Truck loading	379	101	6	-
CBP - Residual from de-dusted air loading cement and fly-ash	0	53	3	-
CBP - Wind erosion (aggregate stockpiles)	26	13	2	0.4
CBP - Wind erosion (whole CBP)	15	8	1	0.2
WR - Hauling from boxcut to BHP Pit (sealed roads)	5	1	0	0.1
WR - Hauling from boxcut to BHP Pit (unsealed roads)	67	17	2	1
WR - Unloading at BHP Pit	6	3	0	0.03
WR - Dozers/front end loaders at BHP Pit	1,623	294	170	8
WR - Loading at BHP Pit	67	32	5	0.3
WR - Hauling from BHP Pit to boxcut (unsealed roads)	724	182	18	14
WR - Hauling from BHP Pit to boxcut (sealed roads)	54	14	1	1
WE - ROM Pad stockpile	92	46	7	3
WE - Free areas	727	363	55	10
WE - Disturbed areas	5,939	2,970	445	112
TSF - Grader/Excavator shaving top layer of TSF2	69	33	5	0.2
TSF - Two dozers pushing shaved tailings into stockpile	216	35	23	1
TSF - WE from TSF area	221	110	17	1
TSF - WE from tailings stockpile	71	35	5	0.2
TSF - Excavator loading tailings stockpile to truck	69	33	5	0.2

Activity	Adopted monitoring location used for background			
	TSP	PM_{10}	$PM_{2.5}$	Pb (TSP)
TSF - Hauling within TSF2 (unsealed roads)	7,002	1,755	176	22
TSF - Hauling outside TSF2 (sealed roads)	438	110	11	2
TSF - Hauling into Kintore pit (unsealed roads)	6,126	1,536	154	33
TSF - Unloading at Kintore Pit	69	33	5	0.2
Total	**35,622**	**10,728**	**1,897**	**451**

Table B-2: Annual emission estimates for Scenario 2 500,000 tpa from Pinnacles

Activity	Adopted monitoring location used for background			
	TSP	PM_{10}	$PM_{2.5}$	Pb (TSP)
Ore - Hauling ore from boxcut to ROM pad by truck (sealed roads)	1,185	297	30	6
Ore - Unloading ore at ROM pad	779	368	56	23
Ore - Front end loaders at ROM pad	4,869	883	511	146
Ore - Crushed ore storage bin transfer	779	368	56	23
Ore - Crushing	68	30	30	2
Ore - Hauling concentrate by trucks within processing plant (unsealed roads)	2,963	743	74	33
Ore - Hauling concentrate by trucks to rail siding (sealed roads)	533	134	13	6
CBP - Truck movement - cement (unsealed roads)	125	31	3	1
CBP - Truck movement - cement (sealed roads)	6	2	0	0.03
CBP - Truck movement - aggregate (unsealed roads)	111	28	3	1
CBP - Truck movement - aggregate (sealed roads)	16	4	0	0.1
CBP - Truck movement - sand (unsealed roads)	426	107	11	2
CBP - Truck movement - sand (sealed roads)	61	15	2	0.3
CBP - Truck movement - shotcrete (unsealed roads)	479	120	12	3
CBP - Truck movement - shotcrete (sealed roads)	24	6	1	0
CBP - Loading cement at rail siding	10	5	1	-
CBP - Aggregate transfer	33	16	1	-
CBP - Sand transfer	16	8	0	-
CBP - Cement transfer	3	1	0	-
CBP - Weigh hopper loading	20	10	1	-
CBP - Truck loading	379	101	6	-
CBP - Residual from de-dusted air loading cement and fly-ash	0	53	3	-
CBP - Wind erosion (aggregate stockpiles)	26	13	2	0.4
CBP - Wind erosion (whole CBP)	15	8	1	0.2
WR - Hauling from boxcut to BHP Pit (sealed roads)	5	1	0	0.03
WR - Hauling from boxcut to BHP Pit (unsealed roads)	67	17	2	0.4
WR - Unloading at BHP Pit	6	3	0	0.03
WR - Dozers/front end loaders at BHP Pit	1,623	294	170	8
WR - Loading at BHP Pit	67	32	5	1

Activity	Adopted monitoring location used for background			
	TSP	PM_{10}	$PM_{2.5}$	Pb (TSP)
WR - Hauling from BHP Pit to boxcut (unsealed roads)	724	182	18	14
WR - Hauling from BHP Pit to boxcut (sealed roads)	54	14	1	0.3
WE - ROM Pad stockpile	92	46	7	3
WE - Free areas	727	363	55	10
WE - Disturbed areas	5,939	2,970	445	112
TSF - Grader/Excavator shaving top layer of TSF2	69	33	5	0.2
TSF - Two dozers pushing shaved tailings into stockpile	216	35	23	1
TSF - WE from TSF area	221	110	17	1
TSF - WE from tailings stockpile	71	35	5	0.2
TSF - Excavator loading tailings stockpile to truck	69	33	5	0.2
TSF - Hauling within TSF2 (unsealed roads)	7,002	1,755	176	22
TSF - Hauling outside TSF2 (sealed roads)	438	110	11	2
TSF - Hauling into Kintore pit (unsealed roads)	6,126	1,536	154	33
TSF - Unloading at Kintore Pit	69	33	5	0.2
Total	**36,511**	**10,951**	**1,919**	**456**

Appendix C

Incremental and cumulative results

Table C-1: Predicted incremental and cumulative annual average lead concentration (as TSP) (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1		Scenario 2		Receptor ID	Scenario 1		Scenario 2	
	Mine Inc	Cml	Mine Inc	Cml		Mine Inc	Cml	Mine Inc	Cml
R1	0.0051	0.1351	0.0050	0.1350	R36	0.0088	0.1388	0.0088	0.1388
R2	0.0039	0.1339	0.0038	0.1338	R37	0.0100	0.1400	0.0100	0.1400
R3	0.0048	0.1348	0.0048	0.1348	R38	0.0014	0.1314	0.0014	0.1314
R4	0.0022	0.1322	0.0022	0.1322	R39	0.0015	0.1315	0.0015	0.1315
R5	0.0015	0.1315	0.0015	0.1315	R40	0.0069	0.1369	0.0068	0.1368
R6	0.0016	0.1316	0.0016	0.1316	R41	0.0082	0.1382	0.0081	0.1381
R7	0.0018	0.1318	0.0017	0.1317	R42	0.0110	0.1410	0.0109	0.1409
R8	0.0033	0.1333	0.0032	0.1332	R43	0.0130	0.1430	0.0130	0.1430
R9	0.0033	0.1333	0.0033	0.1333	R44	0.0009	0.1309	0.0009	0.1309
R10	0.0072	0.1372	0.0071	0.1371	R45	0.0015	0.1315	0.0015	0.1315
R11	0.0013	0.1313	0.0013	0.1313	R46	0.0005	0.1305	0.0005	0.1305
R12	0.0016	0.1316	0.0015	0.1315	R47	0.0060	0.1360	0.0060	0.1360
R13	0.0014	0.1314	0.0014	0.1314	R48	0.0023	0.1323	0.0023	0.1323
R14	0.0049	0.1349	0.0049	0.1349	R49	0.0012	0.1312	0.0012	0.1312
R15	0.0020	0.1320	0.0020	0.1320	R50	0.0070	0.1370	0.0070	0.1370
R16	0.0019	0.1319	0.0019	0.1319	R51	0.0042	0.1342	0.0042	0.1342
R17	0.0043	0.1343	0.0042	0.1342	R52	0.0046	0.1346	0.0046	0.1346
R18	0.0007	0.1307	0.0007	0.1307	R53	0.0007	0.1307	0.0007	0.1307
R19	0.0012	0.1312	0.0012	0.1312	R54	0.0035	0.1335	0.0035	0.1335
R20	0.0016	0.1316	0.0016	0.1316	R55	0.0006	0.1306	0.0006	0.1306
R21	0.0062	0.1362	0.0061	0.1361	R56	0.0013	0.1313	0.0013	0.1313
R22	0.0068	0.1368	0.0068	0.1368	R57	0.0013	0.1313	0.0013	0.1313
R23	0.0092	0.1392	0.0092	0.1392	R58	0.0013	0.1313	0.0013	0.1313
R24	0.0129	0.1429	0.0130	0.1430	R59	0.0003	0.1303	0.0003	0.1303
R25	0.0052	0.1352	0.0052	0.1352	R60	0.0031	0.1331	0.0031	0.1331
R26	0.0177	0.1477	0.0177	0.1477	R61	0.0005	0.1305	0.0005	0.1305
R27	0.0321	0.1621	0.0321	0.1621	R62	0.0009	0.1309	0.0009	0.1309
R28	0.0226	0.1526	0.0226	0.1526	R63	0.0018	0.1318	0.0018	0.1318
R29	0.0238	0.1538	0.0238	0.1538	R64	0.0017	0.1317	0.0017	0.1317
R30	0.0157	0.1457	0.0156	0.1456	R65	0.0065	0.1365	0.0065	0.1365
R31	0.0101	0.1401	0.0101	0.1401	R66	0.0044	0.1344	0.0044	0.1344
R32	0.0086	0.1386	0.0086	0.1386	R67	0.0045	0.1345	0.0045	0.1345
R33	0.0047	0.1347	0.0047	0.1347	R68	0.0021	0.1321	0.0021	0.1321
R34	0.0109	0.1409	0.0107	0.1407	R69	0.0016	0.1316	0.0016	0.1316
R35	0.0099	0.1399	0.0098	0.1398	R70	0.0011	0.1311	0.0011	0.1311

Note: *Mine Inc = Mine increment, Cml = Cumulative

Table C-2: Predicted incremental and cumulative annual average lead deposition (as TSP) (g/m^2/month) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1		Scenario 2		Receptor ID	Scenario 1		Scenario 2	
	Mine Inc	Cml	Mine Inc	Cml		Mine Inc	Cml	Mine Inc	Cml
R1	0.0100	0.0130	0.0100	0.0130	R36	0.0157	0.0167	0.0157	0.0167
R2	0.0085	0.0115	0.0085	0.0115	R37	0.0179	0.0189	0.0180	0.0190
R3	0.0114	0.0144	0.0114	0.0144	R38	0.0019	0.0039	0.0019	0.0039
R4	0.0041	0.0071	0.0041	0.0071	R39	0.0022	0.0042	0.0022	0.0042
R5	0.0027	0.0057	0.0027	0.0057	R40	0.0116	0.0126	0.0116	0.0126
R6	0.0023	0.0053	0.0023	0.0053	R41	0.0150	0.0160	0.0150	0.0160
R7	0.0026	0.0046	0.0026	0.0046	R42	0.0199	0.0209	0.0199	0.0209
R8	0.0055	0.0075	0.0055	0.0075	R43	0.0262	0.0272	0.0262	0.0272
R9	0.0061	0.0071	0.0062	0.0072	R44	0.0017	0.0047	0.0017	0.0047
R10	0.0119	0.0129	0.0119	0.0129	R45	0.0029	0.0059	0.0029	0.0059
R11	0.0023	0.0053	0.0023	0.0053	R46	0.0009	0.0039	0.0009	0.0039
R12	0.0029	0.0059	0.0029	0.0059	R47	0.0108	0.0118	0.0108	0.0118
R13	0.0025	0.0055	0.0025	0.0055	R48	0.0044	0.0054	0.0045	0.0055
R14	0.0080	0.0090	0.0080	0.0090	R49	0.0024	0.0034	0.0024	0.0034
R15	0.0035	0.0045	0.0035	0.0045	R50	0.0128	0.0138	0.0127	0.0137
R16	0.0037	0.0047	0.0037	0.0047	R51	0.0067	0.0077	0.0067	0.0077
R17	0.0074	0.0084	0.0074	0.0084	R52	0.0073	0.0083	0.0073	0.0083
R18	0.0011	0.0041	0.0011	0.0041	R53	0.0011	0.0041	0.0011	0.0041
R19	0.0024	0.0034	0.0024	0.0034	R54	0.0062	0.0072	0.0062	0.0072
R20	0.0030	0.0040	0.0030	0.0040	R55	0.0009	0.0019	0.0009	0.0019
R21	0.0117	0.0147	0.0117	0.0147	R56	0.0019	0.0029	0.0019	0.0029
R22	0.0126	0.0156	0.0126	0.0156	R57	0.0019	0.0029	0.0019	0.0029
R23	0.0167	0.0197	0.0168	0.0198	R58	0.0022	0.0032	0.0022	0.0032
R24	0.0233	0.0263	0.0233	0.0263	R59	0.0006	0.0036	0.0006	0.0036
R25	0.0096	0.0126	0.0097	0.0127	R60	0.0062	0.0072	0.0062	0.0072
R26	0.0326	0.0356	0.0327	0.0357	R61	0.0007	0.0027	0.0007	0.0027
R27	0.0663	0.0673	0.0665	0.0675	R62	0.0012	0.0032	0.0012	0.0032
R28	0.0466	0.0476	0.0467	0.0477	R63	0.0028	0.0048	0.0028	0.0048
R29	0.0477	0.0487	0.0478	0.0488	R64	0.0035	0.0105	0.0035	0.0105
R30	0.0319	0.0329	0.0319	0.0329	R65	0.0130	0.0140	0.0130	0.0140
R31	0.0202	0.0212	0.0203	0.0213	R66	0.0085	0.0095	0.0085	0.0095
R32	0.0173	0.0183	0.0173	0.0183	R67	0.0088	0.0098	0.0088	0.0098
R33	0.0106	0.0176	0.0106	0.0176	R68	0.0039	0.0069	0.0039	0.0069
R34	0.0201	0.0211	0.0200	0.0210	R69	0.0031	0.0061	0.0031	0.0061
R35	0.0179	0.0189	0.0178	0.0188	R70	0.0020	0.0050	0.0020	0.0050

Note: *Mine Inc = Mine increment, Cml = Cumulative

Table C-3: Predicted incremental and cumulative maximum 24-hour average $PM_{2.5}$ (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1		Scenario 2		Receptor ID	Scenario 1		Scenario 2	
	Mine Inc	Cml	Mine Inc	Cml		Mine Inc	Cml	Mine Inc	Cml
R1	0.4678	15.4684	0.4717	15.4685	R36	0.8167	55.0315	0.8158	55.0322
R2	0.2258	15.4680	0.2275	15.4681	R37	0.5634	54.9991	0.5625	54.9995
R3	0.2265	15.4690	0.2396	15.4697	R38	0.1954	54.9575	0.1964	54.9575
R4	0.1535	15.4665	0.1921	15.4672	R39	0.1908	54.9577	0.1910	54.9577
R5	0.1301	15.4661	0.1696	15.4662	R40	0.6141	54.9783	0.6189	54.9788
R6	0.2271	15.4659	0.2297	15.4660	R41	0.5198	55.0187	0.5209	55.0194
R7	0.1888	54.9578	0.1896	54.9578	R42	0.4051	55.0489	0.4068	55.0497
R8	0.2779	54.9594	0.2800	54.9595	R43	0.5474	55.0999	0.5511	55.1000
R9	0.4133	54.9592	0.4141	54.9594	R44	0.1314	15.4656	0.1320	15.4656
R10	0.3256	54.9889	0.3280	54.9894	R45	0.1900	15.4660	0.1929	15.4660
R11	0.1317	15.4659	0.1453	15.4660	R46	0.1082	15.4654	0.1129	15.4654
R12	0.1636	15.4660	0.1668	15.4660	R47	0.5149	55.0186	0.5155	55.0191
R13	0.1787	15.4659	0.1815	15.4659	R48	0.1609	54.9915	0.1610	54.9916
R14	0.3099	54.9699	0.3122	54.9702	R49	0.0902	54.9768	0.0901	54.9768
R15	0.1198	54.9759	0.1204	54.9761	R50	0.6654	55.0299	0.6653	55.0305
R16	0.1149	54.9876	0.1154	54.9877	R51	0.3600	54.9601	0.3614	54.9603
R17	0.2466	54.9918	0.2463	54.9921	R52	0.2760	54.9606	0.2786	54.9608
R18	0.1180	15.4655	0.1256	15.4655	R53	0.1170	15.4655	0.1241	15.4655
R19	0.0876	54.9793	0.0882	54.9794	R54	0.3775	54.9922	0.3766	54.9925
R20	0.1289	54.9780	0.1292	54.9782	R55	0.1120	15.4655	0.1125	15.4655
R21	0.5829	15.4692	0.5869	15.4692	R56	0.1175	54.9570	0.1186	54.9570
R22	0.6767	15.4694	0.6790	15.4695	R57	0.1740	15.4659	0.1772	15.4659
R23	1.1170	15.4704	1.1171	15.4705	R58	0.1269	54.9577	0.1271	54.9578
R24	1.1299	15.4721	1.1331	15.4722	R59	0.0463	15.4652	0.0467	15.4652
R25	0.7130	15.4682	0.7151	15.4682	R60	0.2013	54.9991	0.2013	54.9992
R26	2.0239	15.4750	2.0254	15.4750	R61	0.1132	15.4654	0.1156	15.4654
R27	1.1953	55.2489	1.1965	55.2491	R62	0.1801	15.4656	0.1826	15.4656
R28	1.0094	55.2052	1.0125	55.2054	R63	0.1686	54.9572	0.1704	54.9572
R29	0.9787	55.1976	0.9821	55.1978	R64	0.1167	54.9837	0.1172	54.9837
R30	0.7923	55.1239	0.7947	55.1240	R65	0.3017	55.0359	0.3025	55.0360
R31	0.5895	55.0734	0.5908	55.0734	R66	0.2272	54.9987	0.2271	54.9988
R32	0.4634	55.0598	0.4658	55.0598	R67	0.2164	55.0049	0.2159	55.0050
R33	0.3315	55.0306	0.3331	55.0307	R68	0.2023	15.4662	0.2033	15.4662
R34	0.5914	55.0977	0.5929	55.0986	R69	0.2005	15.4661	0.2008	15.4661
R35	0.5609	55.0766	0.5580	55.0774	R70	0.1222	15.4657	0.1233	15.4657

Note: *Mine Inc = Mine increment, Cml = Cumulative

Table C-4: Predicted incremental and cumulative maximum 24-hour average PM_{10} (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1		Scenario 2		Receptor ID	Scenario 1		Scenario 2	
	Mine Inc	Cml	Mine Inc	Cml		Mine Inc	Cml	Mine Inc	Cml
R1	1.2773	37.7345	1.3065	37.7351	R36	1.9231	134.3252	1.9312	134.3297
R2	1.1994	37.7344	1.2739	37.7355	R37	1.5620	134.2266	1.5675	134.2295
R3	1.7145	37.7416	2.0465	37.7455	R38	0.8079	134.0447	0.8208	134.0448
R4	0.9022	37.7273	1.1869	37.7310	R39	0.7066	134.0454	0.7180	134.0455
R5	0.4690	37.7246	0.7196	37.7254	R40	1.8511	134.1635	1.8882	134.1662
R6	0.7448	37.7238	0.7632	37.7242	R41	1.5121	134.4007	1.5222	134.4043
R7	0.6065	134.0460	0.6258	134.0461	R42	1.2196	134.5581	1.2594	134.5622
R8	1.5408	134.0543	1.5706	134.0548	R43	1.7845	134.6417	1.8083	134.6430
R9	1.2989	134.0529	1.3086	134.0538	R44	0.3890	37.7218	0.3987	37.7219
R10	0.9209	134.2242	0.9396	134.2267	R45	0.5642	37.7239	0.6383	37.7242
R11	0.5247	37.7235	0.6803	37.7239	R46	0.4052	37.7211	0.4397	37.7211
R12	0.6781	37.7238	0.6882	37.7242	R47	1.3761	134.2915	1.3830	134.2943
R13	0.5563	37.7233	0.5648	37.7236	R48	0.5225	134.1755	0.5263	134.1761
R14	0.8498	134.1168	0.8744	134.1183	R49	0.2823	134.1173	0.2846	134.1177
R15	0.3716	134.1272	0.3788	134.1284	R50	1.5269	134.3305	1.5343	134.3339
R16	0.3724	134.1644	0.3791	134.1648	R51	1.0452	134.0591	1.0552	134.0599
R17	0.7337	134.2115	0.7394	134.2135	R52	0.7947	134.0617	0.8164	134.0627
R18	0.4375	37.7215	0.4913	37.7216	R53	0.4298	37.7214	0.4800	37.7215
R19	0.2516	134.1312	0.2575	134.1316	R54	0.8944	134.2033	0.8959	134.2052
R20	0.3821	134.1286	0.3883	134.1297	R55	0.3453	37.7215	0.3496	37.7216
R21	1.5967	37.7370	1.6270	37.7376	R56	0.4352	134.0422	0.4595	134.0423
R22	1.9040	37.7374	1.9326	37.7379	R57	0.6524	37.7232	0.6768	37.7234
R23	3.0640	37.7397	3.0869	37.7402	R58	0.3931	134.0468	0.3976	134.0471
R24	3.2350	37.7441	3.2605	37.7445	R59	0.2067	37.7204	0.2224	37.7204
R25	1.8408	37.7315	1.8588	37.7318	R60	0.6298	134.2033	0.6348	134.2041
R26	5.5837	37.7519	5.6074	37.7522	R61	0.4716	37.7210	0.4863	37.7210
R27	3.9811	135.3560	3.9977	135.3585	R62	0.8581	37.7222	0.8788	37.7223
R28	3.9002	135.2429	3.9126	135.2447	R63	0.5253	134.0430	0.5436	134.0431
R29	3.4879	134.9540	3.5216	134.9565	R64	0.3831	134.1650	0.3872	134.1651
R30	2.6794	134.8014	2.6911	134.8030	R65	1.1441	134.3488	1.1534	134.3496
R31	1.7558	134.4664	1.7737	134.4675	R66	0.7449	134.2031	0.7491	134.2041
R32	1.2262	134.4523	1.2450	134.4531	R67	0.6966	134.2241	0.7139	134.2250
R33	1.4155	134.4045	1.4314	134.4053	R68	0.6395	37.7245	0.6512	37.7247
R34	1.4310	134.6710	1.4585	134.6760	R69	0.5637	37.7238	0.5767	37.7239
R35	1.4546	134.5314	1.4540	134.5360	R70	0.4673	37.7224	0.5112	37.7225

Note: *Mine Inc = Mine increment, Cml = Cumulative

Table C-5: Predicted incremental and cumulative annual average $PM_{2.5}$ (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1		Scenario 2		Receptor ID	Scenario 1		Scenario 2	
	Mine Inc	Cml	Mine Inc	Cml		Mine Inc	Cml	Mine Inc	Cml
R1	0.0394	5.1644	0.0405	5.1655	R36	0.0676	5.4796	0.0682	5.4802
R2	0.0291	5.1541	0.0313	5.1563	R37	0.0732	5.4852	0.0735	5.4855
R3	0.0337	5.1587	0.0403	5.1653	R38	0.0108	5.4228	0.0117	5.4237
R4	0.0162	5.1412	0.0237	5.1487	R39	0.0117	5.4237	0.0126	5.4246
R5	0.0125	5.1375	0.0151	5.1401	R40	0.0402	5.4522	0.0418	5.4538
R6	0.0112	5.1362	0.0126	5.1376	R41	0.0535	5.4655	0.0552	5.4672
R7	0.0135	5.4255	0.0146	5.4266	R42	0.0656	5.4776	0.0672	5.4792
R8	0.0233	5.4353	0.0253	5.4373	R43	0.0864	5.4984	0.0866	5.4986
R9	0.0244	5.4364	0.0260	5.4380	R44	0.0075	5.1325	0.0077	5.1327
R10	0.0437	5.4557	0.0449	5.4569	R45	0.0128	5.1378	0.0137	5.1387
R11	0.0108	5.1358	0.0121	5.1371	R46	0.0052	5.1302	0.0055	5.1305
R12	0.0126	5.1376	0.0135	5.1385	R47	0.0431	5.4551	0.0436	5.4556
R13	0.0114	5.1364	0.0121	5.1371	R48	0.0178	5.4298	0.0179	5.4299
R14	0.0313	5.4433	0.0320	5.4440	R49	0.0104	5.4224	0.0105	5.4225
R15	0.0170	5.4290	0.0172	5.4292	R50	0.0498	5.4618	0.0504	5.4624
R16	0.0151	5.4271	0.0152	5.4272	R51	0.0277	5.4397	0.0286	5.4406
R17	0.0293	5.4413	0.0298	5.4418	R52	0.0277	5.4397	0.0287	5.4407
R18	0.0064	5.1314	0.0068	5.1318	R53	0.0062	5.1312	0.0066	5.1316
R19	0.0105	5.4225	0.0106	5.4226	R54	0.0278	5.4398	0.0282	5.4402
R20	0.0152	5.4272	0.0154	5.4274	R55	0.0051	5.1301	0.0054	5.1304
R21	0.0478	5.1728	0.0488	5.1738	R56	0.0105	5.4225	0.0108	5.4228
R22	0.0524	5.1774	0.0533	5.1783	R57	0.0099	5.1349	0.0105	5.1355
R23	0.0650	5.1900	0.0657	5.1907	R58	0.0123	5.4243	0.0125	5.4245
R24	0.0853	5.2103	0.0857	5.2107	R59	0.0032	5.1282	0.0033	5.1283
R25	0.0443	5.1693	0.0449	5.1699	R60	0.0230	5.4350	0.0232	5.4352
R26	0.1126	5.2376	0.1129	5.2379	R61	0.0049	5.1299	0.0051	5.1301
R27	0.2015	5.6135	0.2018	5.6138	R62	0.0078	5.1328	0.0082	5.1332
R28	0.1499	5.5619	0.1501	5.5621	R63	0.0147	5.4267	0.0151	5.4271
R29	0.1537	5.5657	0.1539	5.5659	R64	0.0130	5.4250	0.0131	5.4251
R30	0.1056	5.5176	0.1058	5.5178	R65	0.0459	5.4579	0.0461	5.4581
R31	0.0683	5.4803	0.0685	5.4805	R66	0.0323	5.4443	0.0325	5.4445
R32	0.0588	5.4708	0.0589	5.4709	R67	0.0325	5.4445	0.0327	5.4447
R33	0.0331	5.4451	0.0332	5.4452	R68	0.0157	5.1407	0.0161	5.1411
R34	0.0721	5.4841	0.0733	5.4853	R69	0.0123	5.1373	0.0126	5.1376
R35	0.0739	5.4859	0.0749	5.4869	R70	0.0086	5.1336	0.0090	5.1340

Note: *Mine Inc = Mine increment, Cml = Cumulative

Table C-6: Predicted incremental and cumulative annual average PM_{10} (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1		Scenario 2		Receptor ID	Scenario 1		Scenario 2	
	Mine Inc	Cml	Mine Inc	Cml		Mine Inc	Cml	Mine Inc	Cml
R1	0.1477	12.6477	0.1562	12.6562	R36	0.2310	13.4310	0.2377	13.4377
R2	0.1311	12.6311	0.1455	12.6455	R37	0.2537	13.4537	0.2580	13.4580
R3	0.1777	12.6777	0.2203	12.7203	R38	0.0426	13.2426	0.0483	13.2483
R4	0.0742	12.5742	0.1223	12.6223	R39	0.0466	13.2466	0.0526	13.2526
R5	0.0514	12.5514	0.0688	12.5688	R40	0.1827	13.3827	0.1938	13.3938
R6	0.0442	12.5442	0.0533	12.5533	R41	0.2323	13.4323	0.2445	13.4445
R7	0.0551	13.2551	0.0623	13.2623	R42	0.2706	13.4706	0.2826	13.4826
R8	0.1103	13.3103	0.1239	13.3239	R43	0.3586	13.5586	0.3610	13.5610
R9	0.1228	13.3228	0.1337	13.3337	R44	0.0283	12.5283	0.0301	12.5301
R10	0.1752	13.3752	0.1838	13.3838	R45	0.0512	12.5512	0.0569	12.5569
R11	0.0439	12.5439	0.0530	12.5530	R46	0.0193	12.5193	0.0213	12.5213
R12	0.0511	12.5511	0.0573	12.5573	R47	0.1497	13.3497	0.1545	13.3545
R13	0.0452	12.5452	0.0501	12.5501	R48	0.0667	13.2667	0.0680	13.2680
R14	0.1216	13.3216	0.1273	13.3273	R49	0.0390	13.2390	0.0399	13.2399
R15	0.0627	13.2627	0.0648	13.2648	R50	0.1730	13.3730	0.1786	13.3786
R16	0.0565	13.2565	0.0576	13.2576	R51	0.1079	13.3079	0.1146	13.3146
R17	0.1118	13.3118	0.1161	13.3161	R52	0.1121	13.3121	0.1194	13.3194
R18	0.0241	12.5241	0.0270	12.5270	R53	0.0231	12.5231	0.0258	12.5258
R19	0.0390	13.2390	0.0399	13.2399	R54	0.0998	13.2998	0.1035	13.3035
R20	0.0550	13.2550	0.0567	13.2567	R55	0.0196	12.5196	0.0218	12.5218
R21	0.1674	12.6674	0.1759	12.6759	R56	0.0396	13.2396	0.0422	13.2422
R22	0.1778	12.6778	0.1856	12.6856	R57	0.0400	12.5400	0.0444	12.5444
R23	0.2074	12.7074	0.2140	12.7140	R58	0.0474	13.2474	0.0494	13.2494
R24	0.2602	12.7602	0.2650	12.7650	R59	0.0125	12.5125	0.0131	12.5131
R25	0.1433	12.6433	0.1486	12.6486	R60	0.0871	13.2871	0.0887	13.2887
R26	0.3280	12.8280	0.3320	12.8320	R61	0.0184	12.5184	0.0197	12.5197
R27	0.9046	14.1046	0.9081	14.1081	R62	0.0297	12.5297	0.0327	12.5327
R28	0.6937	13.8937	0.6966	13.8966	R63	0.0551	13.2551	0.0581	13.2581
R29	0.6101	13.8101	0.6136	13.8136	R64	0.0510	13.2510	0.0518	13.2518
R30	0.4620	13.6620	0.4645	13.6645	R65	0.1781	13.3781	0.1800	13.3800
R31	0.2649	13.4649	0.2674	13.4674	R66	0.1196	13.3196	0.1218	13.3218
R32	0.2346	13.4346	0.2366	13.4366	R67	0.1231	13.3231	0.1251	13.3251
R33	0.1561	13.3561	0.1572	13.3572	R68	0.0576	12.5576	0.0604	12.5604
R34	0.2691	13.4691	0.2792	13.4792	R69	0.0462	12.5462	0.0482	12.5482
R35	0.2518	13.4518	0.2609	13.4609	R70	0.0338	12.5338	0.0366	12.5366

Note: *Mine Inc = Mine increment, Cml = Cumulative

Table C-7: Predicted incremental and cumulative annual average TSP (µg/m³) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1		Scenario 2		Receptor ID	Scenario 1		Scenario 2	
	Mine Inc	Cml	Mine Inc	Cml		Mine Inc	Cml	Mine Inc	Cml
R1	0.3143	34.8143	0.3306	34.8306	R36	0.5175	35.0175	0.5307	35.0307
R2	0.2904	34.7904	0.3206	34.8206	R37	0.5592	35.0592	0.5675	35.0675
R3	0.4132	34.9132	0.5110	35.0110	R38	0.0815	34.5815	0.0901	34.5901
R4	0.1534	34.6534	0.2773	34.7773	R39	0.0921	34.5921	0.1015	34.6015
R5	0.0982	34.5982	0.1324	34.6324	R40	0.4449	34.9449	0.4640	34.9640
R6	0.0912	34.5912	0.1065	34.6065	R41	0.5429	35.0429	0.5644	35.0644
R7	0.1106	34.6106	0.1218	34.6218	R42	0.6547	35.1547	0.6775	35.1775
R8	0.2525	34.7525	0.2758	34.7758	R43	0.8073	35.3073	0.8117	35.3117
R9	0.2756	34.7756	0.2937	34.7937	R44	0.0523	34.5523	0.0553	34.5553
R10	0.4110	34.9110	0.4259	34.9259	R45	0.0989	34.5989	0.1097	34.6097
R11	0.0812	34.5812	0.0985	34.5985	R46	0.0299	34.5299	0.0328	34.5328
R12	0.0985	34.5985	0.1106	34.6106	R47	0.3192	34.8192	0.3278	34.8278
R13	0.0856	34.5856	0.0949	34.5949	R48	0.1242	34.6242	0.1263	34.6263
R14	0.2616	34.7616	0.2707	34.7707	R49	0.0642	34.5642	0.0656	34.5656
R15	0.1059	34.6059	0.1090	34.6090	R50	0.3853	34.8853	0.3960	34.8960
R16	0.1020	34.6020	0.1036	34.6036	R51	0.2396	34.7396	0.2500	34.7500
R17	0.2259	34.7259	0.2329	34.7329	R52	0.2645	34.7645	0.2760	34.7760
R18	0.0393	34.5393	0.0438	34.5438	R53	0.0371	34.5371	0.0411	34.5411
R19	0.0651	34.5651	0.0664	34.5664	R54	0.1853	34.6853	0.1908	34.6908
R20	0.0867	34.5867	0.0890	34.5890	R55	0.0328	34.5328	0.0357	34.5357
R21	0.3649	34.8649	0.3816	34.8816	R56	0.0688	34.5688	0.0721	34.5721
R22	0.3859	34.8859	0.4013	34.9013	R57	0.0781	34.5781	0.0842	34.5842
R23	0.4720	34.9720	0.4854	34.9854	R58	0.0709	34.5709	0.0735	34.5735
R24	0.6209	35.1209	0.6309	35.1309	R59	0.0183	34.5183	0.0191	34.5191
R25	0.2812	34.7812	0.2905	34.7905	R60	0.1735	34.6735	0.1761	34.6761
R26	0.8080	35.3080	0.8162	35.3162	R61	0.0275	34.5275	0.0292	34.5292
R27	2.2657	36.7657	2.2727	36.7727	R62	0.0509	34.5509	0.0551	34.5551
R28	1.6885	36.1885	1.6937	36.1937	R63	0.0963	34.5963	0.1003	34.6003
R29	1.4616	35.9616	1.4681	35.9681	R64	0.0957	34.5957	0.0970	34.5970
R30	1.0609	35.5609	1.0654	35.5654	R65	0.3746	34.8746	0.3778	34.8778
R31	0.5893	35.0893	0.5938	35.0938	R66	0.2455	34.7455	0.2493	34.7493
R32	0.5093	35.0093	0.5129	35.0129	R67	0.2541	34.7541	0.2576	34.7576
R33	0.2879	34.7879	0.2895	34.7895	R68	0.1173	34.6173	0.1223	34.6223
R34	0.6412	35.1412	0.6609	35.1609	R69	0.0925	34.5925	0.0960	34.5960
R35	0.5821	35.0821	0.6001	35.1001	R70	0.0642	34.5642	0.0692	34.5692

Note: *Mine Inc = Mine increment, Cml = Cumulative

Table C-8: Predicted incremental and cumulative annual average dust deposition (g/m^2/month) for Scenario 1 and Scenario 2

Receptor ID	Scenario 1		Scenario 2		Receptor ID	Scenario 1		Scenario 2	
	Mine Inc	Cml	Mine Inc	Cml		Mine Inc	Cml	Mine Inc	Cml
R1	0.0581	1.6581	0.0603	1.6603	R36	0.0831	0.8831	0.0424	0.8424
R2	0.0601	1.6601	0.0642	1.6642	R37	0.0905	0.8905	0.0352	0.8352
R3	0.0903	1.6903	0.1040	1.7040	R38	0.0117	0.7117	0.0520	0.7520
R4	0.0280	1.6280	0.0457	1.6457	R39	0.0136	0.7136	0.0327	0.7327
R5	0.0173	1.6173	0.0214	1.6214	R40	0.0807	0.8807	0.0139	0.8139
R6	0.0139	1.6139	0.0156	1.6156	R41	0.1008	0.9008	0.0094	0.8094
R7	0.0172	0.7172	0.0185	0.7185	R42	0.1154	0.9154	0.0100	0.8100
R8	0.0439	0.7439	0.0468	0.7468	R43	0.1468	1.5468	0.0200	1.4200
R9	0.0508	0.8508	0.0531	0.8531	R44	0.0090	0.7090	0.0225	0.7225
R10	0.0695	0.8695	0.0715	0.8715	R45	0.0174	0.7174	0.0454	0.7454
R11	0.0138	1.6138	0.0160	1.6160	R46	0.0047	0.7047	0.0104	0.7104
R12	0.0169	0.7169	0.0185	0.7185	R47	0.0523	0.8523	0.0121	0.8121
R13	0.0147	0.7147	0.0159	0.7159	R48	0.0217	0.8217	0.0106	0.8106
R14	0.0426	0.8426	0.0439	0.8439	R49	0.0114	0.8114	0.0296	0.8296
R15	0.0175	0.8175	0.0180	0.8180	R50	0.0634	1.4634	0.0139	1.4139
R16	0.0178	0.8178	0.0180	0.8180	R51	0.0388	0.8388	0.0147	0.8147
R17	0.0369	0.8369	0.0379	0.8379	R52	0.0433	0.8433	0.0291	0.8291
R18	0.0063	0.7063	0.0068	0.7068	R53	0.0059	0.7059	0.0047	0.7047
R19	0.0114	0.8114	0.0116	0.8116	R54	0.0303	1.4303	0.0095	1.4095
R20	0.0147	0.8147	0.0151	0.8151	R55	0.0049	0.8049	0.0119	0.8119
R21	0.0638	1.6638	0.0660	1.6660	R56	0.0097	0.8097	0.0508	0.8508
R22	0.0650	1.6650	0.0671	1.6671	R57	0.0121	0.8121	0.0534	0.8534
R23	0.0764	1.6764	0.0782	1.6782	R58	0.0115	0.8115	0.0660	0.8660
R24	0.0979	1.6979	0.0993	1.6993	R59	0.0030	0.7030	0.0857	0.7857
R25	0.0471	1.6471	0.0484	1.6484	R60	0.0305	1.4305	0.0382	1.4382
R26	0.1296	1.7296	0.1307	1.7307	R61	0.0036	0.7036	0.1137	0.8137
R27	0.4266	1.8266	0.4276	1.8276	R62	0.0069	0.7069	0.2599	0.9599
R28	0.3214	1.7214	0.3221	1.7221	R63	0.0146	0.7146	0.1851	0.8851
R29	0.2634	1.6634	0.2644	1.6644	R64	0.0169	2.3169	0.1807	2.4807
R30	0.1971	1.5971	0.1977	1.5977	R65	0.0668	1.4668	0.1268	1.5268
R31	0.1049	1.5049	0.1056	1.5056	R66	0.0420	1.4420	0.0777	1.4777
R32	0.0918	1.4918	0.0923	1.4923	R67	0.0441	1.4441	0.0682	1.4682
R33	0.0557	2.3557	0.0559	2.3559	R68	0.0204	0.7204	0.0483	0.7483
R34	0.1102	0.9102	0.1130	0.9130	R69	0.0163	0.7163	0.0962	0.7962
R35	0.0952	0.8952	0.0978	0.8978	R70	0.0111	0.7111	0.0842	0.7842

Note: *Mine Inc = Mine increment, Cml = Cumulative

Appendix J

Greenhouse Gas Assessment

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Rasp Mine - Modification 13

Greenhouse gas assessment

Prepared for Broken Hill Operations Pty Ltd

February 2026

Rasp Mine - Modification 13

Greenhouse gas assessment

Broken Hill Operations Pty Ltd

E250352 R7

February 2026

Version	Date	Prepared by	Reviewed by	Comments
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Approved by

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9 February 2026

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1 Introduction

1.1 Background

Rasp Mine is an operating zinc, lead and silver mine which is located centrally within the City of Broken Hill, in the far west of New South Wales (NSW) (Figure 1.1). Rasp Mine produces zinc, lead and silver concentrates which are dispatched via rail to Port Pirie and Port Adelaide in South Australia (SA).

Rasp Mine operates in accordance with project approval MP 07_0018. Broken Hill Operations Pty Ltd (BHO) is seeking to modify MP 07_0018 (MOD13) pursuant to section 4.55(2) of the Environmental Planning and Assessment Act 1979 (EP&A Act) to extend operations until 31 December 2031. This report presents a greenhouse gas (GHG) assessment for MOD13, which has been compiled in accordance with the *NSW Guide for Large Emitters* (NSW EPA 2025).

1.2 Project summary

1.2.1 Existing approval

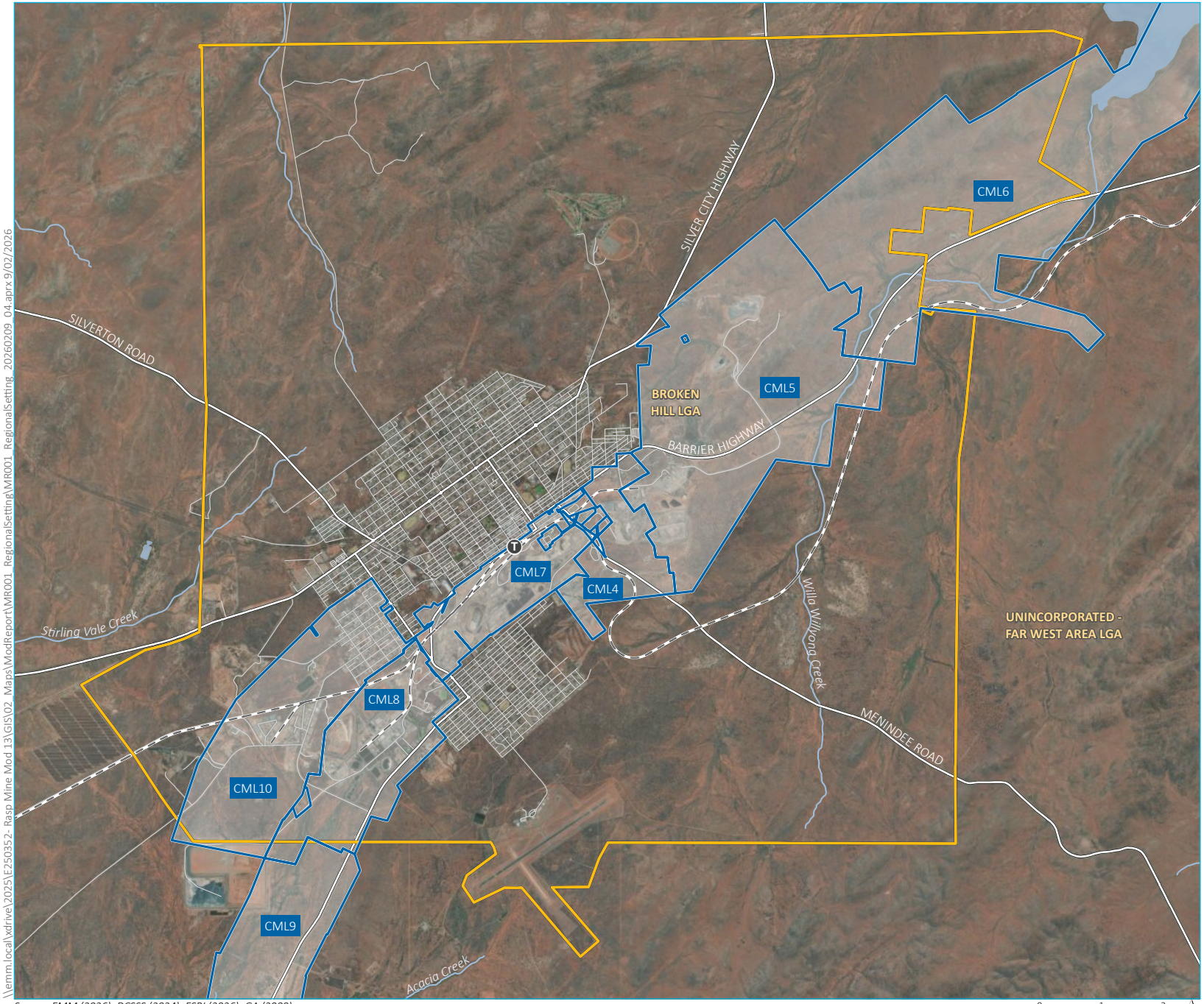
Rasp Mine has operated since 1885. BHO, owned by CBH Resources at the time, purchased the mine in 2001 and commenced works at the site in 2007 with the installation of an exploration decline. Underground mining re-commenced at the site in 2011 with ore processing recommencing in 2012. Broken Hill Mines Pty Ltd (BHM) has owned the mine since November 2024.

Rasp Mine operates in accordance with project approval (MP 07_0018) which was granted under delegation by the (then) Minister for Planning on 31 January 2011 under the since repealed Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Rasp Mine is authorised by MP 07_0018 to:

- extract up to 8.45 million tonnes (Mt) of ore from the mine at a rate of 500,000 tonnes per annum (tpa)[1]
- carry out mining operations until 31 December 2026
- process ore at the on-site processing plant
- operate three tailings storage facilities (TSFs)
- backfill underground voids with tailings and waste rock
- conduct crushing and screening activities in the Kintore Pit or the BHP Pit
- use stored waste rock to increase the capacity of TSF3 (the tailings storage facility in Kintore Pit)
- use waste rock material for various construction and rehabilitation activities on site
- transport ore concentrate off-site via rail to Port Pirie and Port Adelaide in SA.

[1] Rasp Mine can extract up to 750,000 tonnes or ore per annum subject to further air quality impact assessment undertaken to the satisfaction of NSW Environment Protection Authority (EPA) and a revised limit approved in writing by the Secretary.



KEY

- Mining lease

Existing environment

- Train station
- Rail line
- Major road
- Minor road
- Named watercourse
- Waterbody
- Local government area

INSET KEY

- NPWS reserve
- State forest

Source: EMM (2026); DCSSS (2024); ESRI (2026); GA (2009)

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Regional context

RASP Mine Mod 13
Modification Report
Figure 1.1

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Operations at Rasp Mine are supported by a range of on-site facilities, including crushing and processing plants, a tailings backfill plant, rail siding facilities, as well as administration offices, workshops and a storage warehouse. Mining activities are regulated under Consolidated Mining Lease CML7. Rasp Mine is also permitted to mine a small section within Mining Lease ML1249 under a sublease arrangement with Perilya Limited, which operates the adjacent Perilya Mine.

Since MP 07_0018 was granted, the project approval has been modified on 12 occasions.

The key activities authorised by MP 07_0018 (as modified) are summarised in Table 1.3 and illustrated in Figure 1.2.

Table 1.1 Rasp Mine approved activities

Activity	Details
Mine life	• To 31 December 2026.
Ore extraction	• 500,000 tpa (or up to 750,000 tpa with the approval of NSW EPA). • Total of 8.45 Mt over the life of the mine.
Ore processing	• On-site ore processing.
Ore concentrate transport	• By rail to Port Pirie and Port Adelaide
Underground mine access	• Via Kintore Pit and a box-cut
Tailing emplacement	Tailing stored in: • Tailing Storage Facility TSF1 • Blackwoods TSF (TSF2) • Kintore Pit (TSF3) • Underground voids.
Waste rock	• Mostly placed in underground voids and in surface storage (Little Kintore Pit). • Waste rock material with less than 0.5% lead content used for road repair, TSF2 embankment construction and bunding within the project area, and for rehabilitation of the site.
Ancillary infrastructure	Ancillary infrastructure includes: • crushing and processing plant • tailing backfill plant • water management systems • rail siding facilities • internal roads • ventilation systems • administration offices • workshops • storage warehouse • core shed.

KEY

- Broken Hill Operations mining lease
- British Mine underground workings

Project layout

1. CML7 boundary
2. Haul road (paved)
3. ROM pad
4. Old concentrator building (not used)
5. Old sand fill plant (not used)
6. Old No7 shaft (water pump)
7. Old No6 shaft (sealed)
8. Old No6 shaft (U/G intake air)
9. Electrical workshop
10. Maintenance workshop
11. Core shed
12. Old No7 underground offices (not used)
13. Telecommunications compound (not BHOP)
14. Administration offices
15. Former bowling green
16. Access road (paved)
17. Pipe corridor
18. Decant pond
19. 22kV power supply
20. Eyre St 22kV power supply
21. Federation Way access to Café and Miner's Memorial
22. Vehicle wash
23. Surface magazines
24. Primary ventilation exhaust rise
25. Change rooms and laundry
26. Car park
27. Backfill plant
28. Cement silo
29. Concrete batching plant
30. Extension to warehouse
31. Sublease region with Periyla
32. Surface escape ladderway
33. Box cut location
34. Ventilation intake shaft

Existing environment

- Rail line
- Major road
- Minor road

Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

0 0.5 1 km

GDA2020 MGA Zone 54

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Project layout

RASP Mine Mod 13
Modification Report
Figure 1.2

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1.2.2 Proposed modification

BHO is seeking to modify MP 07_0018 (MOD13) pursuant to section 4.55(2) of the EP&A Act to extend operations until 31 December 2031, supported by the following proposed activities:

- extending mining operations into the British Mine
- establishment of an emergency egress ladderway in mining block ML 15
- changes to onsite operations to include a tailings dewatering system
- importing and processing of 100,000 tpa of ore from Pinnacles Mine
- increase the total volume of ore allowed to be extracted to 12,200,000 tonnes of ore over the life of the project
- extending the life of PA07_0018 for five years, until 31 December 2031.

The proposed modifications are shown on Figure 1.3.

1.3 Purpose of this report

This GHG assessment has been compiled by EMM to support the application for MOD13. The *NSW Guide for Large Emitters* (NSW EPA 2025) defines the criteria for identifying whether a given project is a large emitter of GHGs. Based on these criteria, EMM concluded that MOD13 would **not** be a large emitter (see Section 4.1)**.**

1.4 Report structure

The remainder of this report is structured as follows:

- Chapter 2 outlines the key legislation and policy relating to GHGs.
- Chapter 3 describes the assessment method for MOD13.
- Chapter 4 provides the results of the GHG assessment.
- Chapter 5 outlines the GHG management measures proposed for MOD13.
- Chapter 6 provides the summary and conclusions of the GHG assessment.

KEY

- Broken Hill Operations mining lease
- Proposed ladderway
- British Mine underground workings

Tailings dewatering system

- Tie-in
- Electrical
- Infrastructure
- Process water
- Tailings line

Existing environment

- Rail line
- Major road
- Minor road

Proposed modification

Source: EMM (2026); DCSSS (2024); GA (2009); MetroMap (2026)

0 0.5 1 km

GDA2020 MGA Zone 54

RASP Mine Mod 13
Modification Report
Figure 1.3

EMM
creating opportunities

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2 Legislative and policy context

This chapter of the report introduces the main GHGs that are the focus of legislation and policy, and the concept of emission scopes. The chapter also summarises the legislative and policy context as it relates to the assessment, mitigation and reporting of GHG emissions. The chapter includes the international context, the Australian context and the NSW context.

2.1 Greenhouse gases and emission scopes

2.1.1 Greenhouse gases

When sunlight strikes the earth's surface, some of it is emitted back toward space as infrared radiation (heat). The term 'greenhouse gases' refers to gases that absorb this infrared radiation and trap its heat in the atmosphere. This process – the greenhouse effect – contributes to global warming and climate change.

The GHGs addressed under the Commonwealth *National Greenhouse and Energy Reporting Act 2007* (NGER Act – see Section 2.3.2) are summarised in Table 2.1. The most important gas in relation to mining is usually carbon dioxide (CO_2). Mines are also a source of methane (CH_4), nitrous oxide (N_2O) and sulfur hexafluoride (SF_6).

Table 2.1 Greenhouse gases and characteristics

Greenhouse gas	Characteristics	Global warming potential (GWP)[a]	Atmospheric lifetime (years)[a]
Carbon dioxide (CO_2)	The most abundant GHG in the atmosphere. At mines CO_2 is primarily released during fuel combustion.	1	N/A[b]
Methane (CH_4)	Released during fuel combustion.	28	12
Nitrous oxide (N_2O)	Released during fuel combustion.	265	121
Sulfur hexafluoride (SF_6)	Used as an insulator in electrical switchgear.	23,500	3,200
Hydrofluorocarbons (HFCs)	Used in cooling systems.	Dependent on HFC type	Dependent on HFC type
Perfluorocarbons (PFCs)	Used in a range of applications including solvents and insulators.	Dependent on PFC type	Dependent on PFC type

Notes

(a) From Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5).

(b) No single atmospheric lifetime can be given for carbon dioxide because it moves throughout the earth system at differing rates.

Given that the various GHGs have different global warming potentials (GWPs), it is convenient to express emissions using a common unit. For this purpose, the term 'carbon dioxide equivalent' (CO_2-e) has been defined. For any mass and type of GHG, CO_2-e signifies the mass of CO_2 which would have the equivalent global warming impact. CO_2-e emissions are calculated based on the GWPs of specific gases adopted by the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol. In this assessment, GHG emissions are presented in terms of CO_2-e.

2.1.2 Emission scopes

For accounting and reporting purposes, GHG emissions are referred to as 'direct' or 'indirect', and defined according to three 'scopes' (1, 2 and 3). Examples of scope 1, 2 and 3 emissions are provided in Figure 2.1. The purpose of differentiating between the emission scopes is to avoid the potential for double counting, where two or more organisations assume responsibility for the same emissions.

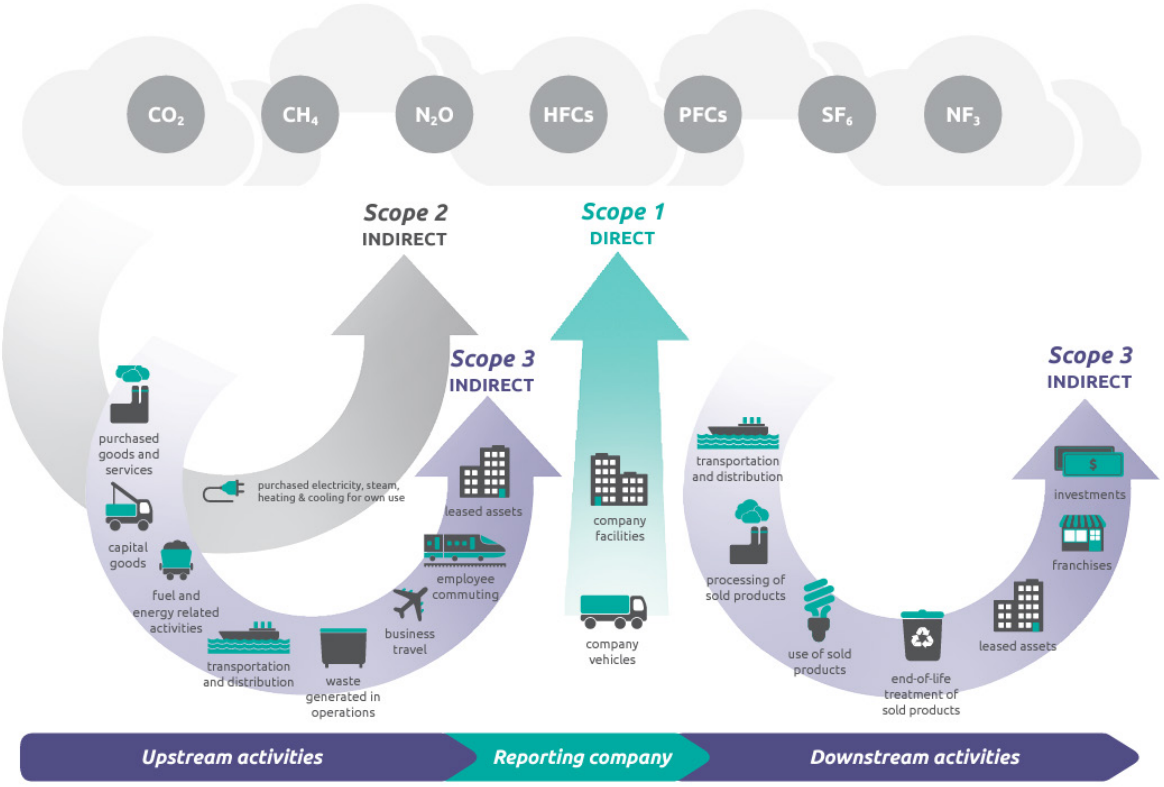

Figure 2.1 Overview of GHG emission scopes (WRI & WBCSD 2013)

The three scopes are defined as follows:

- Scope 1 relates to direct emissions from sources within the boundary of a given organisation (or project), and as a result of the organisation's activities. Scope 1 emissions are determined for the point of release (on-site). They include, for example, emissions from solid and liquid fuel combustion, fugitive emissions of methane, and leaks of SF_6.

- Scope 2 relates to indirect emissions associated with the purchase of electricity, steam, heat or cooling at a site. Scope 2 emissions are physically generated outside an organisation's boundaries, such as through the burning of fuel (e.g. coal, natural gas) at an external power station in the case of electricity, but they are included in an organisation's emissions as they are a result of its energy use.

- Scope 3 relates to all other indirect emissions (i.e. other than scope 2) which occur outside the boundary of an organisation but as a result of actions by the organisation, and are generated in the wider economy. Scope 3 emissions may occur upstream, such as during the extraction and production of fossil fuels, or downstream, such as from the transport of an organisation's product to customers.

This GHG assessment is mainly concerned with scope 1 and scope 2 emissions, as defined under the NGER Act, but it also considers scope 3 emissions, as defined within Australia's National Greenhouse Accounts for facility reporting (DCCEEW 2025a).

2.2 International context

2.2.1 Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science in relation to climate change. The IPCC prepares comprehensive assessment reports about the state of scientific, technical and socio-economic knowledge on climate change, its impacts and future risks, and options for reducing the rate at which climate change is taking place. The first assessment report of the IPCC served as the basis for negotiating the UNFCCC. The IPCC released its Sixth Assessment Report (AR6) in 2022/2023. The IPCC also produces a variety of guidance documents and recommendation methodologies for compiling GHG emission inventories.

2.2.2 United Nations Framework Convention on Climate Change

The UNFCCC entered into force in March 2004, and provides the basis for concerted international action to mitigate climate change and to adapt to its impacts. With 198 Parties, the UNFCCC has nearly universal membership. The Conference of the Parties to the Convention (COP) is used to advance the implementation of the UNFCCC.

The objective of the UNFCCC is to stabilise GHG emissions 'at a level that would prevent dangerous anthropogenic interference with the climate system'. It states that 'such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner'[2].

2.2.3 Paris Agreement

The Paris Agreement, which the Australian Government has signed, is a legally binding international treaty on climate change. It was adopted by the (then) 196 Parties to the UNFCCC at the 21st United Nations Climate Change Conference (COP21) in Paris, France in December 2015, and entered into force in November 2016. Its overarching goal is to hold the increase in the global average temperature to well below 2°C above pre-industrial levels, and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. Under the Paris Agreement, all parties are required to put forward GHG emission-reduction targets through Nationally Determined Contributions (NDCs). All parties are required to report on national emissions, with a review of targets every five years from 2020.

2.3 Australian context

2.3.1 Climate Change Act 2022

The Commonwealth *Climate Change Act 2022* (CC Act) provides the legislative framework for implementing Australia's net-zero commitments under the Paris Agreement, and sets out Australia's GHG emission-reduction targets. Australia has committed to reducing its GHG emissions by 43% below 2005 levels by 2030, and achieving net-zero emissions by 2050. The CC Act also introduced a requirement for an annual climate change statement to parliament, supported by independent advice from the Climate Change Authority (CCA).

[2] https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change

2.3.2 The National Greenhouse and Energy Reporting Act and Scheme

The NGER Act, administered by the Commonwealth Government, establishes a national framework (the NGER Scheme) for corporations to report GHG emissions, energy consumption and energy production. The framework covers the measurement, reporting and verification of GHG emissions.

Companies that exceed the NGER Scheme thresholds[3] of 25,000 t CO_2-e per year for a facility, or 50,000 t CO_2-e per year for a corporation, are required to register and report annually on their scope 1 and scope 2 emissions to the Clean Energy Regulator (CER).

The NGER Act is underpinned by the Commonwealth *National Greenhouse and Energy Reporting Regulations 2008* and the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (the Measurement Determination). The Measurement Determination provides methods, criteria and measurement standards for calculating GHG emissions and energy data. It covers scope 1 and scope 2 emissions, energy production and consumption. It identifies several calculation methodologies to account for GHGs from specific sources relevant to coal mining, based primarily on the National Greenhouse Accounts (NGA) Factors.

2.3.3 The Safeguard Mechanism

The NGER Act also provides a framework for Australia's highest emitting facilities to manage and report on their GHG emissions. This framework is the Safeguard Mechanism[4], which was first legislated in 2014 and has been in place since 2016. Reforms to the Safeguard Mechanism took effect in 2023, to ensure that the facilities it covers will contribute to meeting Australia's GHG emission-reduction targets.

In general terms, the Safeguard Mechanism applies to facilities[5] with scope 1 emissions[6] of more than 100,000 t CO_2-e per year, known as Safeguard facilities. It sets legislated limits – known as baselines – on the GHG emissions of these facilities. These baselines decrease on a trajectory that is consistent with achieving Australia's GHG emission-reduction targets of 43% below 2005 levels by 2030, and net zero by 2050. The baselines will decrease at 4.9% per year from 2023 to 2030, followed by 3.285% per year thereafter.

If a Safeguard facility exceeds its baseline, then it must take actions to reduce its emissions, such as surrendering Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs) equal to the excess emissions. Facilities that have emissions below their baselines may apply to receive SMCs.

In 2023-24 there were 219 Safeguard facilities. These facilities produced 31% of Australia's GHG emissions in that year (CER 2025).

Rasp Mine is not a Safeguard facility.

2.4 NSW context

The overarching NSW Government legislation and policy documents on GHG emissions and climate that are broadly relevant to this study are summarised in Table 2.2.

The EPA is the primary environmental regulator for NSW. Although it has historically regulated some GHGs, the EPA has traditionally focussed on the local and regional impacts of projects and developments on health and the environment. It has recently expanded its focus to more explicitly regulate the causes and consequences of climate change in NSW. The EPA policy documents that are relevant to this study are summarised in Table 2.3.

[3] The thresholds are also stated in terms of energy production/consumption.

[4] https://www.dcceew.gov.au/climate-change/emissions-reporting/national-greenhouse-energy-reporting-scheme/safeguard-mechanism

[5] Grid-connected electricity generators are treated separately.

[6] The threshold applies to actual (gross) emissions from a facility, and does not consider any offset or displaced emissions.

Table 2.2 NSW Government legislation and policy on GHG emissions and climate

Title	Description	Reference
NSW *Climate Change (Net Zero Future) Act 2023* (the Net Zero Future Act)	Establishes guiding principles for action to address climate change that consider the impacts, opportunities and need for action in NSW. Legislates NSW target reductions in GHG emissions of 50% of 2005 levels by 2030, 70% of 2005 levels by 2035, and net zero emissions by 2050. Sets an objective for NSW to be more resilient to a changing climate. Establishes an independent, expert Net Zero Commission to monitor, review, report on and advise on progress towards the targets.	-
NSW Climate Change Policy Framework	Sets out the NSW Government's long-term goals of achieving net-zero emissions by 2050, and making NSW more resilient and better adapted to a changing climate.	NSW OEH (2016)
Net Zero Plan Stage1: 2020–2030 (the Net Zero Plan)	Foundation for NSW's action on climate change. It outlines the NSW Government's plan to grow the economy, create jobs and reduce emissions during the 2020s.	NSW DPIE (2020)
Net Zero Plan Stage 1: 2020–2030 Implementation Update *Net Zero Plan Implementation Update 2022*	These provide updates on the key achievements of NSW Government under the Net Zero Plan, and commit NSW to reducing emissions by 50% below 2005 levels by 2030, and 70% below 2005 levels by 2035.	NSW DPIE (2021a) NSW OECC (2022)
NSW Climate Change Adaptation Strategy	Sets out the NSW Government's strategic approach for managing the impacts of climate change on the State.	NSW Government (2022)
NSW Waste and Sustainable Materials Strategy 2041	Sets out how NSW will transition to a circular economy over the next 20 years, including key reforms for reducing GHG emissions from materials (embedded carbon) and the waste sector.	NSW DPIE (2021b)
NSW Guide for Large Emitters	This defines the GHG assessment requirements for new projects and modifications to existing facilities that are likely to have 'large' emissions.	NSW EPA (2025)

Table 2.3 Key NSW EPA legislation and policy on GHG emissions and climate

Title	Description	Reference
Protection of the Environment Administration Act 1991	Outlines the EPA's statutory objectives and duty to address climate change. Section 6 of the Act outlines the EPA's statutory objectives to protect the environment and human health. The key elements are: • to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development • to reduce the risks to human health and prevent the degradation of the environment, including by taking action in relation to climate change. Section 9 of the Act imposes a statutory duty on the EPA to develop environmental quality objectives, guidelines and policies to ensure environment protection. This includes protection of the environment from climate change.	-
Protection of the Environment Operations Act 1997 (POEO Act)	Sets out EPA's statutory powers and regulatory tools, including environment protection licensing. Schedule 1 of the Act sets out the types of activities that need a licence. The EPA is required to consider its statutory objectives (above) when exercising its licensing functions.	-

Title	Description	Reference
Climate Change Policy	Supports and builds upon NSW Government's climate change policies and initiatives. The main purpose is to address: • the EPA's statutory objectives to protect, restore and enhance the quality of the environment in NSW, and to reduce the risks to human health and prevent the degradation of the environment • the EPA's statutory duty to develop environmental quality objectives, guidelines and policies to ensure environment protection from climate change.	NSW EPA (2023a)
Climate Change Action Plan 2023–26	Designed to deliver the Climate Change Policy. The Action Plan sets out: • the specific actions the EPA will take over the three years that it covers • the regulatory action the EPA will consider over the medium to longer term, where an increased regulatory response may be required to support the NSW Government's climate change commitments and policies, including achieving net-zero emissions in NSW by 2050.	NSW EPA (2023b)
Strategic Plan 2024–29	Describes how the EPA will deliver stewardship for the environment to protect, restore and enhance the environment and human health. It sets out commitments to effective regulation and a focus on high quality environmental outcomes across all of EPA's work. The plan details objectives and outcomes for three key areas: • caring for country • driving action on climate change • enabling a safe circular economy.	NSW EPA (2024)
Waste Delivery Plan	Outlines the actions the EPA take to reduce the harmful impact of waste and drive behaviours that create a circular economy. The Waste Delivery Plan includes actions to reduce carbon emissions and building the resilience of the waste sector to climate change.	NSW EPA (2021)

3 GHG assessment methodology

3.1 Categorisation of project

The *NSW Guide for Large Emitters* distinguishes between two categories of project:

1. new proposals that are likely to have large emissions

2. proposed modifications to existing licensed premises that are likely to have large *additional* GHG emissions.

MOD13 has been assessed as a proposed modification.

The assessment requirements of the *NSW Guide for Large Emitters* apply to a given project if it is identified as a large emitter. NSW EPA considers a project to have large emissions if it meets three criteria. The application of these criteria to the project is shown in Table 3.1. The third criterion actually requires the definition of assessment scenarios and the calculation of GHG emissions. The assessment scenarios followed on from the categorisation of the project, and they are defined in Section 3.3.

The results of the supporting GHG calculations for MOD13 are presented in Section 4.1. The threshold for large emitters of 25,000 t CO_2-e was **not** projected to be exceeded during any future operational year for MOD13, and therefore MOD13 was determined **not** to be a large emitter.

Table 3.1 NSW EPA criteria for identifying large emitters

Criterion	Applicability to MOD13
Does the project require development assessments and approvals under the EP&A Act?	Yes
Does the project involve one or more scheduled activities under Schedule 1 of the POEO Act and/or will be carried out at an existing licensed premises?	Yes
Is the project likely to emit (within the GHG assessment boundary) 25,000 t or more of scope 1 and 2 emissions (CO_2-e) in any financial year during the operational life of the project? [(a)]	No (see summary of emission calculations in Section 4.1)

Note:

(a) Based on the planned operational throughput as required by the NSW Guide for Large Emitters.

3.2 Project stages and timeframe

The *NSW Guide for Large Emitters* states that the GHG assessment must consider all relevant stages of the project (as appropriate), such as construction, operation, decommissioning, closure and post-closure. Given that MOD13 is not a large emitter, only the operational phase was considered to be relevant to the GHG assessment (including the use of fossil fuels during progressive mine rehabilitation). Moreover, as MOD13 is a continuation of mining there would be no construction activities, and emissions during decommissioning, closure and post-closure are expected to be relatively small.

The GHG assessment covers the financial years from 2026-27 to 2031-32 (six years). Financial years are considered as 1 July to 30 June the following year. Current mining operations are approved to 31 December 2026. Therefore, the emissions for MOD13 in the financial year 2026-27 only cover a six-month period. Similarly, the extension for MOD13 would end on 31 December 2031, and so the emissions for MOD 3 in the financial year 2031-32 also only cover a six-month period.

3.3 Emissions scenarios

The *NSW Guide for Large Emitters* requires the definition of emission scenarios. Given that MOD13 would involve a modification to an existing operation, scope 1, scope 2 and scope 3 emissions were calculated for the scenarios in Table 3.2. In accordance with *NSW Guide for Large Emitters*, the GHG assessment applies to Scenario 3 (the 'project only' scenario for MOD13).

Table 3.2 Emission scenarios

NSW EPA terminology		Terminology in GHG assessment	
		Scenario no.	Scenario description
Business-as-usual (BAU)	Represents the emissions that are expected to occur without the proposed project.	1	Represents the emissions from Rasp Mine as currently approved (i.e. to 31 December 2026).
Modified business	Represents the emissions associated with existing operations and including the proposed project as designed.	2	Represents emissions from Rasp Mine with MOD13.
Project only	Represents emissions for the project only, in the context of total facility emissions. **NB**: This scenario determines whether or not a project is a large emitter.	3	Represents emissions from MOD13 only. Determined as emissions in Scenario 2 minus emissions in Scenario 1.

The *NSW Guide for Large Emitters* also requires scope 1 and scope 2 emissions to be estimated based on both planned operational throughput and maximum capacity. For the purposes of this report, future emissions under MOD13 have been estimated based on the maximum capacity ore extraction rate of 500,000 tpa throughput.

3.4 Assessment boundary

In this report, the GHG assessment boundary for MOD13 has been treated *conceptually* in terms of emission sources, as shown in Figure 3.1. The figure shows the emission sources that were included, and those that were potentially relevant but excluded (the reasons for exclusion are explained later in this section).

The emission sources that were included in the assessment represented the most significant sources associated with MOD13.

For scope 1 emissions, the sources included were:

- on-site diesel consumption ('stationary' equipment)
- on-site diesel consumption (transport)
- on-site LPG consumption
- on-site petrol consumption
- on-site consumption of oils
- on-site consumption of greases
- SF_6 leakage

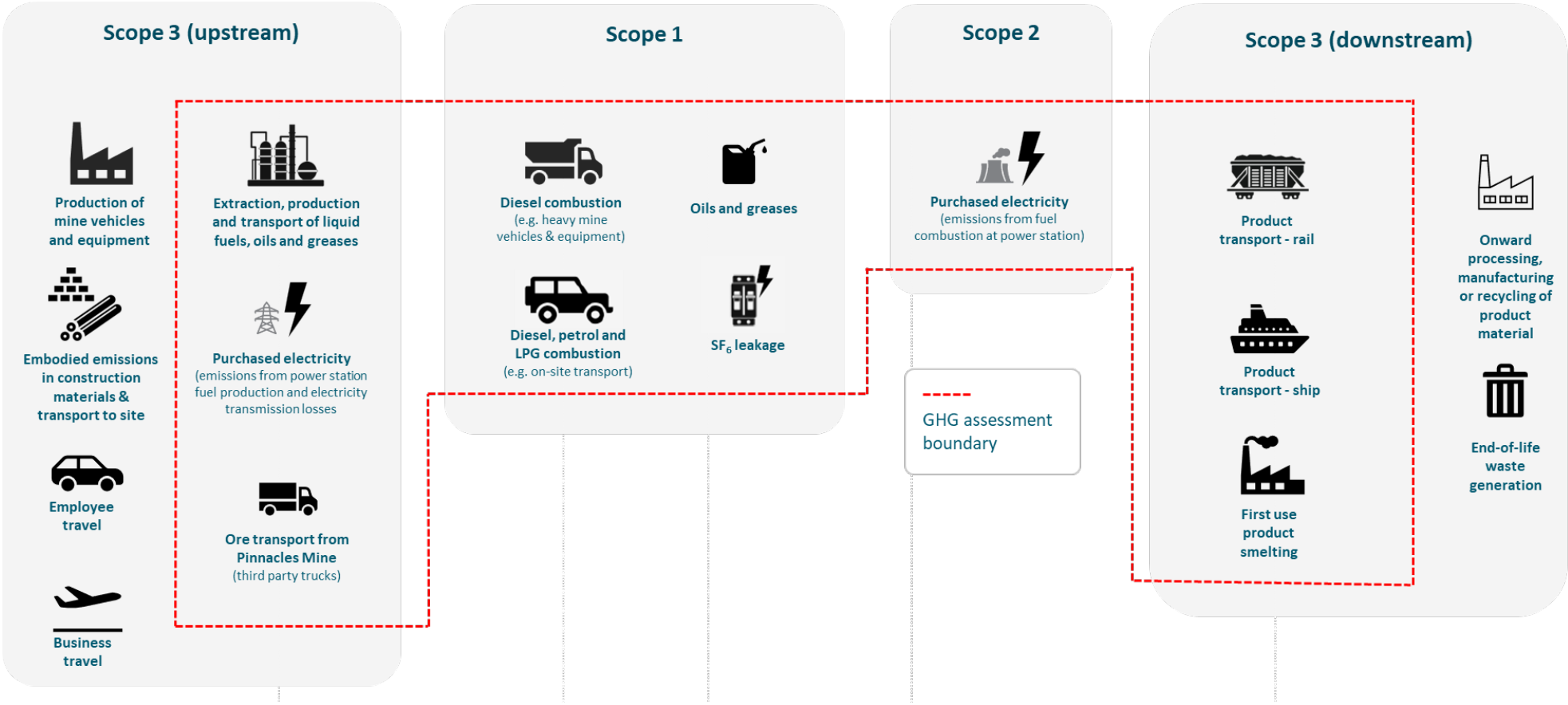

Figure 3.1 **GHG assessment boundary and emission sources**

For scope 2 emissions, the relevant source was the purchase of grid electricity for on-site use.

For upstream scope 3 emissions, the sources included were:

- the extraction, production and transport of the diesel consumed on-site
- the extraction, production and transport of the LPG consumed on-site
- the extraction, production and transport of the petrol consumed on-site
- the extraction, production and transport of the oils and greases consumed on-site
- the purchase of grid electricity for on-site use[7].

For downstream scope 3 emissions, the sources included were:

- the transport of product concentrate by rail from Broken Hill to Port Adelaide in South Australia
- the transport of product concentrate by sea from Port Adelaide to South-East Asia markets; for the purpose of the GHG calculation, these markets were assumed to be in South Korea
- the product concentrate would be used as feed stock at a smelter facility to produce secondary products (classed as a 'first use' customer).

Excluded emission sources were either considered to be negligible contributors to total project emissions, or beyond the 'first use' customer level for project product material.

3.5 Calculation of GHG emissions

3.5.1 Calculation methods

The GHGs that were relevant to the assessment were CO_2, CH_4, N_2O and SF_6.

Details of the GHG emission calculation methodology for MOD13 are provided in Appendix A. Emissions in Scenario 3 were calculated as the difference between those in Scenario 2 and those in Scenario 1. The supporting activity data (e.g. ore extraction and transport, fuel consumption, electricity consumption) for the scenarios are given in Appendix B. The estimation of GHG emissions for MOD13 was based primarily on the *National Greenhouse Accounts Factors* (NGAF) *Workbook* (DCCEW 2025a).

3.5.2 Planned mitigation

i Scope 1 emission sources

With respect to on-site fuel consumption, various mitigation measures are inherent to operations at Rasp Mine, and are systematically implemented as best practice. For MOD13, these measures would include:

- Mine planning:
  - optimisation of haul routes
  - payload management and loading equipment productivity.

[7] Here, scope 3 emissions are indirect emissions from the extraction, production and transport of the fuel burned during electricity generation, and the indirect emissions attributable to the electricity lost in delivery in the transmission and distribution network.

- Mine vehicles and equipment:
    - scheduling activities so that equipment use and vehicle operation are optimised
    - minimising engine idling
    - ensuring that all equipment is serviced and maintained according to manufacturers' specifications.

These measures were effectively included as 'planned' measures for the purpose of calculating GHG emissions. The emission reductions of these measures have not been quantified separately, as there is no counterfactual case of deliberately inefficient mine operation.

The removal of the dewatering plant (diesel combustion) from 2027-28 will reduce diesel consumption (this was taken into account in the GHG calculations as a 15% reduction from 2027-28 onwards).

ii Scope 2 emission sources

In relation to scope 2 emissions, the main measure would be the optimisation of ore processing operations and electrical equipment.

The GHG emission calculations took into account the anticipated decarbonisation of the NSW electricity grid (i.e. emissions from the purchase of grid electricity will decrease as the NSW grid decarbonises).

4 GHG emission estimates

The results of the GHG emission calculations for Scenario 3 are summarised in the following sections. A breakdown of the emission results by scenario, year and emission source is provided in Appendix C. For ease of presentation, the results for individual gases are not included.

The estimated emissions are likely to be conservative, as the calculations do not reflect potential measures for emissions reduction which may become practicable and feasible in the future, such as fleet electrification or alternative fuels.

4.1 Scope 1 and scope 2 emissions

The scope 1 and scope 2 emissions in Scenario 3 (the incremental increase for MOD13), and in each financial year of the project life, are given in Table 4.1. The average annual and total emissions for the project life are also provided. Figure 4.1 compares the combined scope and scope 2 emissions with the threshold of 25,000 t CO_2-e/year in the *NSW Guide for Large Emitters*.

As noted earlier, emissions were below the threshold in all years of operation. The scope 1 and scope 2 emissions for MOD13 would peak at around 23.3 kt CO_2-e/year in 2027-28. The reductions in emissions after 2027-28 would be due to the impacts of decarbonisation of the electricity grid. The average annual scope 1 and scope 2 emission rate would be 13.3 kt CO_2-e/year, and the aggregated emissions over the project life would be 79.9 kt CO_2-e.

Figure 4.1 also shows that the largest contributors to scope 1 and scope 2 emissions over the life of MOD13 would be purchased electricity (66% of the total) stationary diesel consumption (33% of the total).

Table 4.1 Annual scope 1 and scope 2 emissions (Scenario 3)

Financial year	GHG emissions (kt CO_2-e/year)		
	Scope 1	Scope 2	Scope 1 + scope 2
2026-27	3.1	11.8	15.0
2027-28	5.3	18.0	23.3
2028-29	5.3	11.4	16.7
2029-30	5.3	5.2	10.5
2030-31	5.3	4.3	9.6
2031-32	2.7	2.1	4.8
Average (kt CO_2-e/year)	**4.5**	**8.8**	**13.3**
Total (kt CO_2-e)	**27.1**	**52.8**	**79.9**

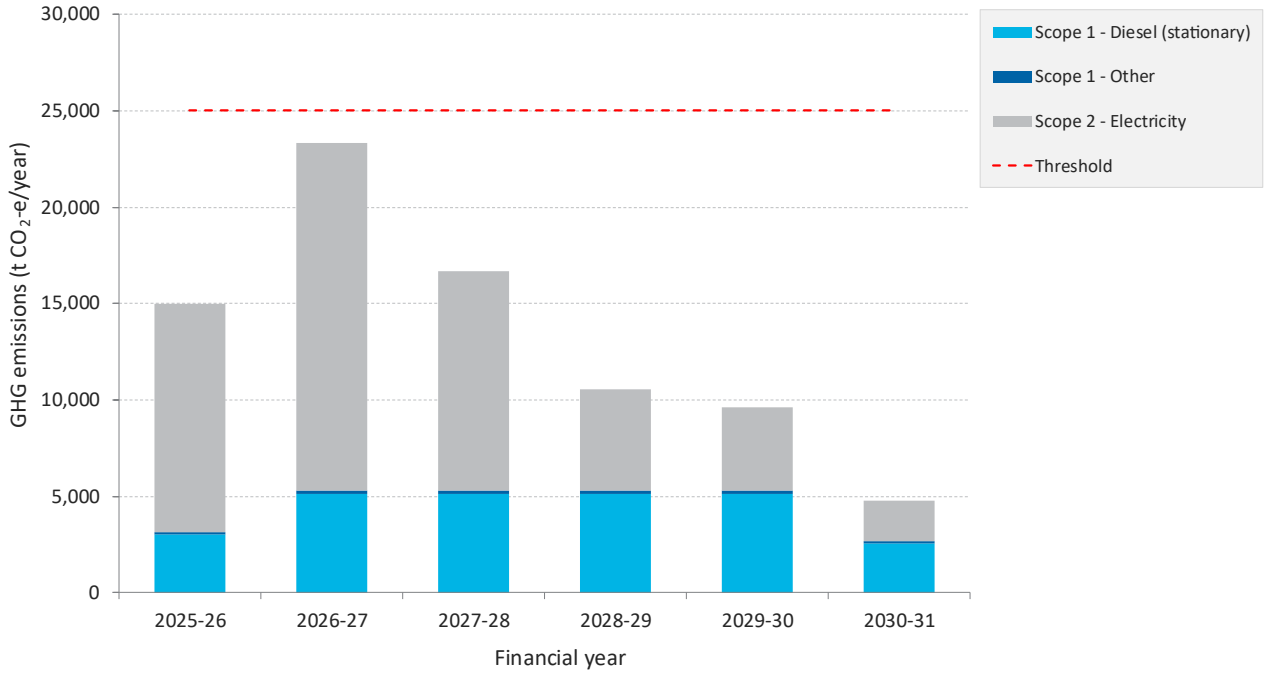

Figure 4.1 Annual scope 1 and scope 2 emissions (Scenario 3)

4.2 Scope 3 emissions

The scope 3 emissions in Scenario 3, and in each financial year of MOD13, are given in Table 4.2 and Figure 4.2. The scope 3 emissions would be larger than the scope 1 and scope 2 emissions, and would represent 72% of all emissions. Scope 3 emissions would peak at around 43 kt CO_2-e/year. The aggregated scope 3 emission over the life of MOD13 is anticipated to be around 204 kt CO_2-e.

The largest contributor to scope 3 emissions would be the smelting of metal concentrate by the end user; this would be responsible for 91% of scope 3 emissions.

Table 4.2 Annual scope 3 emissions (Scenario 3)

Financial year	GHG emissions (kt CO_2-e/year)
2026-27	15.3
2027-28	37.1
2028-29	43.4
2029-30	43.4
2030-31	43.0
2031-32	21.8
Average (kt CO_2-e/year)	**34.0**
Total (kt CO_2-e)	**204.0**

Figure 4.2 Annual scope 3 emissions (Scenario 3)

5 Management of GHG emissions

5.1 Scope 1 emissions

The planned mitigation measures for scope 1 and scope 2 emissions from MOD13 were summarised in section\ 3.5.2.

BHO is proposing the following additional mitigation measures for scope 2 emissions:

- use of some solar-powered lighting at major on-site road intersections
- use of solar-powered monitoring equipment for noise, blasting and air quality.

In addition, BHO will investigate the feasibility of the following measures for MOD13:

- installation of energy-efficient technology
- procurement of low-emission vehicles (e.g. electric, hybrid) for surface activities
- increasing employee training and awareness related to reducing GHG emissions
- engagement in projects related to the reduction of GHG emissions, innovations and technologies
- internal company GHG emissions and energy consumption reduction targets.

A periodic review of new technologies will be conducted to evaluate if these could be adopted as mitigation measures.

5.2 Scope 3 emissions

The majority of scope 3 emissions are due to product use at end user facilities. As far as possible, BHO will continue to sell the products to countries that have NDCs under the Paris Agreement (or have followed international standards recognised by the UNFCCC and published their own NDCs document in support of the Paris Agreement).

6 Summary and conclusions

This report presents a GHG assessment for MOD13 for Rasp Mine, which has been compiled in accordance with the *NSW Guide for Large Emitters*. The assessment included estimates of scope 1, scope 2 and 3 emissions for continued operation at the mine to 31 December 2031 with the proposed modification. For the purposes of this report, future emissions under MOD13 have been estimated based on the maximum capacity ore extraction rate of 500,000 tpa throughput.

The scope 1 and scope 2 emissions for MOD13 would peak at 23.3 kt CO_2-e/year in 2027-28. There were therefore no financial years in which the *NSW EPA Guide for Large Emitters*' threshold of 25,000 t CO_2-e/year was exceeded, and therefore the project was not considered to be a large emitter. The largest contributors to scope 1 and scope 2 emissions over the life of MOD13 would be purchased electricity (66% of the total) stationary diesel consumption (33% of the total).

The scope 3 emissions for MOD13 would peak at around 43 kt CO_2-e/year. The smelting of metal concentrate by the end user would be responsible for 91% of scope 3 emissions.

Various mitigation measures are inherent to operation at mines (e.g. mine planning, vehicle maintenance), and these were effectively included as 'planned' measures for the purpose of calculating GHG emissions. BHO will implement additional mitigation measures involving the use of solar power, and will investigate the feasibility of more extensive measures.

BHO will continue to sell the products to countries that have NDCs under the Paris Agreement (or have followed international standards recognised by the UNFCCC and published their own NDCs document in support of the Paris Agreement).

7 Abbreviations

ACCU	Australian Carbon Credit Unit
CER	Clean Energy Regulator
CH_4	methane
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
COP	Conference of the Parties (to the UNFCCC)
EPA	(NSW) Environment Protection Authority
GHG	greenhouse gas
GWP	global warming potential
IPCC	Intergovernmental Panel on Climate Change
kWh	kilowatt-hour
Mt	million tonnes
MWh	megawatt-hour
N_2O	nitrous oxide
NDC	Nationally Determined Contribution
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
NSW	New South Wales
ROM	run-of-mine
SA	South Australia
SF_6	sulfur hexafluoride
SMC	Safeguard Mechanism Credit
tpa	tonnes per annum
TSF	Tailing Storage Facility
UNFCCC	Nations Framework Convention on Climate Change

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Appendix A

GHG emission calculation methods

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A.1 Scope 1 emissions

A.1.1 Liquid fuel consumption

For each greenhouse gas *i* (CO_2, CH_4 and N_2O), annual scope 1 emissions from the on-site consumption (through combustion) of liquid fuels were estimated using the following equation:

$$E_i = \frac{Q \times EC \times EF_i}{1{,}000}$$

Equation A.1

where:

E_i = GHG emission for gas *i* (t CO_2-e/year)

Q = quantity of fuel (kL/year)

EC = energy content of fuel (GJ/kL)[8]

EF_i = emission factor for gas *i* (kg CO_2-e/GJ)[9]

The energy content and scope 1 emission factors for liquid fuels are presented in Table A.1. The emission factors for mining equipment are those provided for stationary energy use in the NGAF Workbook (DCCEEW 2025a). The NGAF Workbook states 'No transport factors are provided for vehicles not registered for road use. Stationary energy factors for individual fuel types should be used in these cases'. The quantities of fuel (kL) used in the assessment are given in Appendix B.

Table A.1 Energy content and emission factors – liquid fuel consumption

Fuel	Energy content (GJ/kL)	Scope 1 emission factor (kg CO_2-e/GJ)			Reference
		CO_2	CH_4	N_2O	
Diesel (stationary)	38.6	69.9	0.1	0.2	DCCEEW (2025a) (Table 8, diesel oil)
Diesel (transport)	38.6	69.9	0.4	0.2	DCCEEW (2025a) (Table 9, Heavy duty vehicles, diesel oil, Euro III)
LPG	25.7	60.2	0.2	0.2	DCCEEW (2025a) (Table 8, LPG)
Petrol	34.2	67.4	0.02	0.2	DCCEEW (2025a) (Table 8, Petrol)

A.1.2 Oils and greases

The energy content and scope 1 emission factors for petroleum-based oils and greases are presented in Table A.1. The quantities of fuel (kL) used in the assessment are given in Appendix B.

[8] GJ = gigajoules

[9] kg CO_2-e/GJ = kilograms of carbon dioxide equivalents per gigajoule

Table A.2 Energy content and emission factors – liquid fuel consumption

Fuel	Energy content (GJ/kL)	Scope 1 emission factor (kg CO_2-e/GJ)			Reference
		CO_2	CH_4	N_2O	
Oils	38.8	13.9	0	0	DCCEEW (2025a) (Table 8, petroleum-based oils)
Greases	38.8	3.5	0	0	DCCEEW (2025a) (Table 8, petroleum-based greases)

A.1.3 SF_6 leakage

SF_6 leakages occur from gas-insulated switchgear and circuit breaker applications. GHG emissions from SF_6 were estimated using the following equation:

$$E = \frac{stock \times L \times GWP_{SF6} \times F_{year}}{1000}$$

Equation A.2

Where:

E	=	GHG emission	(t CO_2-e/year)
stock	=	stock of SF_6	(kg)
L	=	leakage rate of SF_6	(proportion of stock per year)
GWP_{SF6}	=	global warming potential of SF_6	
F_{year}	=	fraction of the year over which the leakage occurs	(1 = full year; 0.5 = six months)

The default leakage gas rate for SF_6 is 0.0089 per year (DCCEEW 2021). To convert the mass of SF_6 into CO_2-e, it was multiplied by the GWP of SF_6 (23,500). The SF_6 stock is given in Appendix B. For periods of less than a year, the SF_6 emission was adjusted accordingly.

A.2 Scope 2 emissions

Annual scope 2 GHG emissions associated with on-site electricity consumption were estimated using the following equation:

$$E_{CO_2-e} = \frac{Q \times EF}{1{,}000}$$

Equation A.3

where:

E_{CO2-e}	=	GHG emissions associated with on-site electricity consumption (t CO_2-e/year)
Q	=	quantity of electricity (MWh/year)[10]
EF	=	emission factor for electricity consumption (kg CO_2-e/MWh)

[10] MWh = megawatt hours

The scope 2 emission factors for electricity consumption were taken from *Australia's emissions projections 2025* (DCCEEW 2025b). These values are presented in Table A.3. The amount of electricity consumed in each year is given in Appendix B.

Table A.3 Scope 2 GHG emission factors for electricity consumption

Financial year	Emission factor (t CO_2-e/MWh)	Reference
2026-27	0.50	DCCEEW (2025b) (values for NSW/ACT in Table 42)
2027-28	0.38	
2027-29	0.24	
2029-30	0.11	
2030-31	0.09	
2031-32	0.09	

A.3 Scope 3 emissions (upstream)

A.3.1 Extraction, production and transport of liquid fuel

Upstream scope 3 emissions for liquid fuel consumption were calculated using Equation A.1. The energy content and scope 3 GHG emission factors for liquid fuels are presented in Table A.4. The quantities of fuel (kL) used in the assessment are given in Appendix B.

Table A.4 Energy content and scope 3 emission factors – liquid fuel consumption

Fuel	Energy content (GJ/kL)	Scope 3 emission factor (kg CO_2-e/GJ)	Reference
Diesel (stationary)	38.6	17.3	DCCEEW (2025a) (Table 8, diesel oil)
Diesel (transport)	38.6	17.3	DCCEEW (2025a) (Table 9, Heavy duty vehicles, diesel oil, Euro iii)
LPG	25.7	20.2	DCCEEW (2025a) (Table 8, LPG)
Petrol	34.2	17.2	DCCEEW (2025a) (Table 8, Petrol)

A.3.2 Extraction, production and transport of oils and greases

Upstream scope 3 emissions for oils and greases were calculated using Equation A.1. The energy content and scope 3 GHG emission factors for oils and greases are presented in Table A.4. The quantities of fuel (kL) used in the assessment are given in Appendix B.

Table A.5 Energy content and scope 3 emission factors – oils and greases

Material	Energy content (GJ/kL)	Scope 3 emission factor (kg CO_2-e/GJ)	Reference
Oils	38.8	18.0	DCCEEW (2025a) (Table 8, petroleum-based oils)
Greases	38.8	18.0	DCCEEW (2025a) (Table 8, petroleum-based greases)

A.3.3 Electricity consumption

Annual scope 3 emissions associated with on-site electricity consumption were estimated using Equation A.3, in combination with the electricity consumption values in Appendix B and the scope 3 emission factors in Table A.6. The scope 3 emission factors for electricity consumption were taken from *Australia's emissions projections 2025* (DCCEEW 2025b).

Table A.6 Scope 3 GHG emission factors for electricity consumption

Financial year	Scope 3 emission factor (t CO_2-e/MWh)	Reference
2026-27	0.02	DCCEEW (2025b) (derived from values for NSW/ACT in Tables 42 and 43)
2027-28	0.02	
2027-29	0.01	
2029-30	0.01	
2030-31	0.00	
2031-32	0.01	

A.3.4 Ore transport from Pinnacles Mine to Rasp Mine

Annual scope 3 emissions were calculated for the transport (by road) of ore from Pinnacles Mine to Rasp Mine. It was assumed that 100,000 tpa of ore would be transported, with a return distance of 40 km.

Based on a truck load capacity of 39.7 tonnes, the number of return truck movements per year was determined to be 2,519. Truck fuel consumption was calculated based on an Australian average value for articulated trucks of 52.1 L/100 km (ABS 2020).

A.4 Scope 3 emissions (downstream)

A.4.1 Product transport

Scope 3 emissions were calculated for the following transport of product:

- transport by rail from Broken Hill to Port Adelaide for export
- transport by sea from Port of Adelaide to South Korea.

The GHG emission factors for product transport are presented in Table A.7. The distance by rail from Broken Hill to Port Adelaide was taken to be 520 km. For the purpose of simplicity in these calculations, it was assumed that the international transport route to Asia (as South Korea) by sea would be 6,000 nautical miles long (or 11,112 km). The amount of product being transported is given in Appendix B.

Table A.7 Scope 1 emission factors – product coal transport

Transport mode	Scope 1 emission factor (kg CO_2-e/tonne-km)	Reference
Rail	0.02779	DEFRA (2024) (Freighting goods / freight train)
Sea	0.00353	DEFRA (2024) (Freighting goods / cargo ship, bulk carrier)

A.4.2 Product use – smelting

Scope 3 emissions associated with the smelting of lead and zinc concentrate product were estimated using default emissions estimation factors from the IPCC Emission Factor Database (IPCC 2025) as follows:

- Lead concentrate - Emission factor 214159 – lead production – 0.52 t CO_2/t lead produced by smelting.
- Zinc concentrate - Emission factor 214162 – zinc production – 1.72 t CO_2/t zinc produced by smelting.

The amount of metal produced per tonne of concentrate was based on information provided by Broken Hill Mines (2026):

- Lead content of lead concentrate = 65%
- Zinc content of zinc concentrate = 50%.

Appendix B
Activity data

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The activity data used in the GHG emission calculations for MOD13 were provided by BHO and based on the maximum approved throughput of 500,000 tpa of ROM ore extraction. The annual activity data are provided in Table B.1.

Table B.1 Annual activity data (mining and product)

Financial year	ROM ore extracted (t/year)	Waste rock extracted (t/year)	Lead concentrate produced (t/year)	Zinc concentrate produced (t/year)
Scenario 1				
2026-27	216,301	187,328	5,081	13,479
2027-28	-	-	-	-
2028-29	-	-	-	-
2029-30	-	-	-	-
2030-31	-	-	-	-
2031-32	-	-	-	-
Scenario 2				
2026-27	466,301	345,081	10,162	26,959
2027-28	500,000	315,506	14,057	33,020
2028-29	500,000	315,506	17,953	39,082
2029-30	500,000	315,506	17,953	39,082
2030-31	500,000	315,506	17,953	39,082
2031-32	250,000	157,753	8,976	19,541
Scenario 3				
2026-27	250,000	157,753	5,081	13,479
2027-28	500,000	315,506	14,057	33,020
2028-29	500,000	315,506	17,953	39,082
2029-30	500,000	315,506	17,953	39,082
2030-31	500,000	315,506	17,953	39,082
2031-32	250,000	157,753	8,976	19,541

Table B.2 Annual activity data (fuel, oil and grease)

Financial year	On-site diesel use [stationary] (kL/year)	On-site diesel use [transport] (kL/year)	On-site petrol use (kL/year)	On-site LPG use (kL/year)	Oil consumption (kL/year)	Grease consumption (kL/year)
Scenario 1						
2026-27	1,102.0	20.7	1.2	12.4	28.9	1.4
2027-28	-	-	-	-	-	-
2028-29	-	-	-	-	-	-
2029-30	-	-	-	-	-	-
2030-31	-	-	-	-	-	-
2031-32	-	-	-	-	-	-
Scenario 2						
2026-27	2,215.3	41.5	2.4	24.8	58.0	2.8
2027-28	1,892.6	41.8	2.4	25.0	58.3	2.8
2028-29	1,892.6	41.8	2.4	25.0	58.3	2.8
2029-30	1,892.6	41.8	2.4	25.0	58.3	2.8
2030-31	1,892.6	41.8	2.4	25.0	58.3	2.8
2031-32	946.3	20.9	1.2	12.5	29.2	1.4
Scenario 3						
2026-27	1,113.3	20.9	1.2	12.5	29.2	1.4
2027-28	1,892.6	41.8	2.4	25.0	58.3	2.8
2028-29	1,892.6	41.8	2.4	25.0	58.3	2.8
2029-30	1,892.6	41.8	2.4	25.0	58.3	2.8
2030-31	1,892.6	41.8	2.4	25.0	58.3	2.8
2031-32	946.3	20.9	1.2	12.5	29.2	1.4

Table B.3 Annual activity data (other)

Financial year	SF_6 (kg, stock)	Electricity consumption (kWh/year)
Scenario 1		
2026-27	36.0	23,447,203
2027-28	-	-
2028-29	-	-
2029-30	-	-
2030-31	-	-
2031-32	-	-
Scenario 2		
2026-27	36.0	47,133,996
2027-28	36.0	47,373,586
2028-29	36.0	47,373,586
2029-30	36.0	47,373,586
2030-31	36.0	47,373,586
2031-32	36.0	23,686,793
Scenario 3		
2026-27	-	23,686,793
2027-28	36.0	47,373,586
2028-29	36.0	47,373,586
2029-30	36.0	47,373,586
2030-31	36.0	47,373,586
2031-32	36.0	23,686,793

Appendix C
Emissions data

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For the three scenarios, and operational throughput, the emission estimates (CO_2-e) for scope 1 and scope 2 emissions (by source and by year) are given in Tables C.1, C.2 and C.3.

The scope 3 emission estimates are given in Tables C.4, C.5 and C.6.

Table C.1 Scope 1 and scope 2 emissions by source and year (Scenario 1)

Financial year	GHG emissions by financial year (kt CO_2-e/year)[a]									
	Scope 1							Scope 2	Scope 1 total	Scope 1 + scope 2 total
	Diesel (stationary)	Diesel (transport)	LPG	Petrol	Oil	Grease	SF_6 leakage	Electricity		
2026-27	2.99	0.06	0.02	0.00	0.02	0.00	0.00	11.72	3.08	14.81
2027-28	-	-	-	-	-	-	-	-	-	-
2028-29	-	-	-	-	-	-	-	-	-	-
2029-30	-	-	-	-	-	-	-	-	-	-
2030-31	-	-	-	-	-	-	-	-	-	-
2031-32	-	-	-	-	-	-	-	-	-	-
Average (kt CO_2-e/year) [c]	2.99	0.06	0.02	0.00	0.02	0.00	0.00	11.72	3.08	14.81
Total (kt CO_2-e)	2.99	0.06	0.02	0.00	0.02	0.00	0.00	11.72	3.08	14.81

Notes:

(a) Values stated to two decimal places.
(b) '-' = not applicable.
(c) Based on non-zero years only.

Table C.2 Scope 1 and scope 2 emissions by source and year (Scenario 2)

Financial year	GHG emissions by financial year (kt CO_2-e/year)[a]									
	Scope 1							Scope 2	Scope 1 total	Scope 1 + scope 2 total
	Diesel (stationary)	Diesel (transport)	LPG	Petrol	Oil	Grease	SF_6 leakage	Electricity		
2026-27	6.00	0.11	0.04	0.01	0.03	0.00	0.01	23.57	6.20	29.77
2027-28	5.13	0.11	0.04	0.01	0.03	0.00	0.01	18.00	5.33	23.33
2028-29	5.13	0.11	0.04	0.01	0.03	0.00	0.01	11.37	5.33	16.70
2029-30	5.13	0.11	0.04	0.01	0.03	0.00	0.01	5.21	5.33	10.54
2030-31	5.13	0.11	0.04	0.01	0.03	0.00	0.01	4.26	5.33	9.59
2031-32	2.56	0.06	0.02	0.00	0.02	0.00	0.00	2.13	2.66	4.79
Average (kt CO_2-e/year)	4.85	0.10	0.04	0.01	0.03	0.00	0.01	10.76	5.03	15.78
Total (kt CO_2-e)	29.08	0.62	0.21	0.03	0.17	0.00	0.04	64.55	30.16	94.71

Notes:

(a) Values stated to two decimal places.

Table C.3 Scope 1 and scope 2 emissions by source and year (Scenario 3)

Financial year	GHG emissions by financial year (kt CO_2-e/year)[a]									
	Scope 1							Scope 2	Scope 1 total	Scope 1 + scope 2 total
	Diesel (stationary)	Diesel (transport)	LPG	Petrol	Oil	Grease	SF_6 leakage	Electricity		
2026-27	3.02	0.06	0.02	0.00	0.02	0.00	0.00	11.84	3.12	14.96
2027-28	5.13	0.11	0.04	0.01	0.03	0.00	0.01	18.00	5.33	23.33
2028-29	5.13	0.11	0.04	0.01	0.03	0.00	0.01	11.37	5.33	16.70
2029-30	5.13	0.11	0.04	0.01	0.03	0.00	0.01	5.21	5.33	10.54
2030-31	5.13	0.11	0.04	0.01	0.03	0.00	0.01	4.26	5.33	9.59
2031-32	2.56	0.06	0.02	0.00	0.02	0.00	0.00	2.13	2.66	4.79
Average (kt CO_2-e/year)	4.35	0.09	0.03	0.00	0.03	0.00	0.01	8.80	4.51	13.32
Total (kt CO_2-e)	26.09	0.57	0.19	0.03	0.16	0.00	0.04	52.82	27.08	79.90

Notes:

(a) Values stated to two decimal places.

Table C.4 Scope 3 emissions by source and year (Scenario 1)

Financial year	GHG emissions by financial year (kt CO_2-e/year)[a]											
	Upstream							Downstream				Scope 3 total
	On-site diesel (stationary)	On-site diesel (transport)	On-site LPG	On-site petrol	Oils	Greases	Electricity consumption	Ore import from Pinnacles Mine	Transport of product to end user (rail)	Transport of product to end user (sea)	Product use by end user smelter	
2026-27	0.74	0.01	0.01	0.00	0.02	0.00	0.47	-	0.07	0.53	13.31	15.16
2027-28	-	-	-	-	-	-	-	-	-	-	-	-
2028-29	-	-	-	-	-	-	-	-	-	-	-	-
2029-30	-	-	-	-	-	-	-	-	-	-	-	-
2030-31	-	-	-	-	-	-	-	-	-	-	-	-
2031-32	-	-	-	-	-	-	-	-	-	-	-	-
Average (kt CO_2-e/year) [c]	0.74	0.01	0.01	0.00	0.02	0.00	0.47	-	0.07	0.53	13.31	15.16
Total (kt CO_2-e)	0.74	0.01	0.01	0.00	0.02	0.00	0.47	-	0.07	0.53	13.31	15.16

Notes:

(a) Values stated to two decimal places.
(b) '-' = not applicable.
(c) Based on non-zero years only.

Table C.5 Scope 3 emissions by source and year (Scenario 2)

Financial year	GHG emissions by financial year (kt CO_2-e/year)[(a)]											
	Upstream							Downstream				Scope 3 total
	On-site diesel (stationary)	On-site diesel (transport)	On-site LPG	On-site petrol	Oils	Greases	Electricity consumption	Ore import from Pinnacles Mine	Transport of product to end user (rail)	Transport of product to end user (sea)	Product use by end user smelter	
2026-27	1.48	0.03	0.01	0.00	0.04	0.00	0.94	0.15	0.15	1.06	26.62	30.48
2027-28	1.26	0.03	0.01	0.00	0.04	0.00	0.95	0.15	0.20	1.30	33.15	37.09
2028-29	1.26	0.03	0.01	0.00	0.04	0.00	0.47	0.15	0.26	1.53	39.68	43.44
2029-30	1.26	0.03	0.01	0.00	0.04	0.00	0.47	0.15	0.26	1.53	39.68	43.44
2030-31	1.26	0.03	0.01	0.00	0.04	0.00	0.00	0.15	0.26	1.53	39.68	42.97
2031-32	0.63	0.01	0.01	0.00	0.02	0.00	0.24	0.15	0.13	0.77	19.84	21.79
Average (kt CO_2-e/year)	1.48	0.03	0.01	0.00	0.04	0.00	0.94	0.15	0.15	1.06	26.62	30.48
Total (kt CO_2-e)	7.17	0.15	0.07	0.01	0.22	0.01	3.07	0.87	1.26	7.72	198.64	219.20

Notes:

(a) Values stated to two decimal places.

Table C.6 Scope 3 emissions by source and year (Scenario 3)

Financial year	GHG emissions by financial year (kt CO_2-e/year)											
	Upstream							Downstream				Scope 3 total
	On-site diesel (stationary)	On-site diesel (transport)	On-site LPG	On-site petrol	Oils	Greases	Electricity consumption	Ore import from Pinnacles Mine	Transport of product to end user (rail)	Transport of product to end user (sea)	Product use by end user smelter	
2026-27	0.74	0.01	0.01	0.00	0.02	0.00	0.47	0.15	0.07	0.53	13.31	15.32
2027-28	1.26	0.03	0.01	0.00	0.04	0.00	0.95	0.15	0.20	1.30	33.15	37.09
2028-29	1.26	0.03	0.01	0.00	0.04	0.00	0.47	0.15	0.26	1.53	39.68	43.44
2029-30	1.26	0.03	0.01	0.00	0.04	0.00	0.47	0.15	0.26	1.53	39.68	43.44
2030-31	1.26	0.03	0.01	0.00	0.04	0.00	0.00	0.15	0.26	1.53	39.68	42.97
2031-32	0.63	0.01	0.01	0.00	0.02	0.00	0.24	0.15	0.13	0.77	19.84	21.79
Average (kt CO_2-e/year)	0.74	0.01	0.01	0.00	0.02	0.00	0.47	0.15	0.07	0.53	13.31	15.32
Total (kt CO_2-e)	6.43	0.14	0.06	0.01	0.20	0.01	2.61	0.87	1.18	7.19	185.33	204.04

Note

(a) Values stated to two decimal places.

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Appendix K
Social Impact Assessment

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Social Impact Assessment (SIA)

Rasp Mine Modification 13

Prepared for Broken Hill Operations Pty Ltd (BHO)

February 2026

Social Impact Assessment (SIA)

Rasp Mine Modification 13

Broken Hill Operations Pty Ltd (BHO)

E250352 RP1

February 2026

Version	Date	Prepared by	Reviewed by	Comments
V1.1	15 January 2026	Caroline Wilkins Malcolm McDowell	Sam McCrea Paul Freeman	Draft
V1.2	6 February 2026	Caroline Wilkins Malcolm McDowell	Sam McCrea Paul Freeman	Final

Approved by

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9 February 2026

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This report has been prepared in accordance with the brief provided by Broken Hill Operations Pty Ltd (BHO) and, in its preparation, EMM has relied upon the information collected at the times and under the conditions specified in this report. All findings, conclusions or recommendations contained in this report are based on those aforementioned circumstances. This report is to only be used for the purpose for which it has been provided. Except as permitted by the Copyright Act 1968 (Cth) and only to the extent incapable of exclusion, any other use (including use or reproduction of this report for resale or other commercial purposes) is prohibited without EMM's prior written consent. Except where expressly agreed to by EMM in writing, and to the extent permitted by law, EMM will have no liability (and assumes no duty of care) to any person in relation to this document, other than to Broken Hill Operations Pty Ltd (BHO) (and subject to the terms of EMM's agreement with Broken Hill Operations Pty Ltd (BHO)).

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1 Introduction

The Rasp Mine is an operating lead, zinc and silver mine situated within the City of Broken Hill Local Government Area (LGA), in the far west of New South Wales (NSW). The mine has operated since 1885 and as of 2024, is owned and operated by Broken Hill Operations Pty Limited (BHO), a wholly owned subsidiary of Broken Hill Mines Pty Limited (BHM).

EMM Consulting Pty Ltd (EMM) has prepared this Social Impact Assessment (SIA) for the modification application of the Rasp Mine to assess potential social impacts and benefits of Modification 13 (MOD 13) of the project approval 07_0018 (PA).

This report presents an assessment of social impacts and benefits from the proposed MOD 13 construction activities and future Rasp Mine operations.

1.1 Existing mining operations

BHO purchased the mine in 2001 and commenced works at the site in 2007 with the installation of an exploration decline. Underground mining re-commenced at the site in 2011 with ore processing recommencing in 2012. Broken Hill Mines Pty Ltd (BHM) has owned the mine since November 2024.

Under clause 6 of Schedule 2 of the Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017, the project approval was transitioned to State significant development (SSD) by order, which took effect by publication in the NSW Government Gazette on 4 July 2018.

PA 07_0018 allows mining operations until 31 December 2026. The project approval has been modified on 12 occasions since project approval was granted in 2011.

Existing approved mining operations at the Rasp Mine consist mainly of underground mining operations, on-site facilities including crushing and processing plants, tailings backfill plant, waste rock haulage to in-pit storage areas, crushing and screening, processing of ore, harvesting and storage of tailings as well as administration offices, workshops and a storage warehouse. Infrastructure also includes rail sliding facilities for dispatch of ore concentrate products via rail to Port Pirie and Port Adelaide in South Australia (SA).

The Rasp Mine is authorised by MP 07_0018 to:

- extract up to 8.45 Million tonnes (Mt) of ore from the mine at a rate of 500,000 tonnes per annum (tpa) or up to no more than 750,000 tonnes of ore per annum subject to further air quality impact assessment undertaken to the satisfaction of the EPA and a revised limit approved in writing by the Secretary
- carry out mining operations until 31 December 2026
- process ore at the on-site processing plant
- operate three Tailing Storage Facilities (TSF)
- backfill underground voids with tailings and waste rock
- conduct crushing and screening activities in either the Kintore Pit or BHP Pit
- use stored waste rock to increase the capacity of TSF3
- use waste rock material for various construction and rehabilitation activities on site
- transport ore concentrate off-site via rail to Port Pirie and Port Adelaide in SA.

KEY

- Mine boundary
- Pinnacles mine

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody
- Local government area

INSET KEY

- NPWS reserve
- State forest

\\emm.local\xdrive\2025\E250352- Rasp Mine Mod 13\GIS\02_Maps\ModReport\MR001_RegionalSetting\MR001_RegionalSetting_20251209_02.aprx 9/12/2025

Source: EMM (2025); DCSSS (2024); ESRI (2025); GA (2009)

0 2.5 5 km

GDA2020 MGA Zone 54

N

Regional setting

RASP Mine Mod 13
Social Impact Assessment
Figure 1.1

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The key activities authorised by MP 07_0018 (as modified) are summarised in Table 1.1.

Table 1.1 Rasp Mine approved activities

Activity	Details
Mine life	• To 31 December 2026.
Ore extraction	• 500,000 tpa (or up to 750,000 tpa with approval of the EPA). • Total of 8.45 Mt over the life of the mine.
Ore processing	• On-site ore processing.
Ore concentrate transport	• By rail to Port Pirie and Port Adelaide
Underground mine access	• Via Kintore Pit and a box-cut
Tailing emplacement	Tailing stored in: • Tailing Storage Facility TSF1 • Blackwoods TSF (TSF2) • Kintore Pit (TSF3) • Underground voids.
Waste rock	• Mostly placed in underground voids and in surface storage (Little Kintore Pit). • Waste rock material with less than 0.5% lead content used for road repair, TSF2 embankment construction and bunding within the project area, and for rehabilitation of the site.
Ancillary infrastructure	Ancillary infrastructure includes: • crushing and processing plants • tailing backfill plant • water management systems • rail siding facilities • internal roads • ventilation systems • administration offices • workshops • storage warehouse • core shed

1.2 Proposed modification

BHO is seeking to modify MP 07_0018 (MOD 13) pursuant to section 4.55(2) of the EP and A Act to extend operations until 31 December 2031, supported by the following proposed activities:

- extending underground mining operations into the British Mine
- establishment of an emergency egress ladderway in ML 16
- changes to onsite operations to include a tailings dewatering system
- BHO intends to receive 100,000tpa of ore from the Pinnacles Mine at Rasp Mine and process this ore at the Project site
- increase the total volume of ore allowed to be extracted to 12,200,000 tonnes of ore over the life of the project

- extending the life of PA07_0018 for five years, until 31 December 2031.

KEY

- Mine boundary
- Proposed ladderway
- Proposed underground mining

Mine feature

- Admin offices & warehouse
- BHP pit
- Blackwood pit TSF2
- Core shed
- Historic TSF1
- Kintore pit TSF3
- Little Kintore pit
- Processing plant
- Workshops

Tailings dewatering system

- Tie-in
- Electrical
- Infrastructure
- Process water
- Tailings line

Existing environment

- Rail line
- Major road
- Minor road
- Vehicular track

Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

0 0.5 1 km

GDA2020 MGA Zone 54

N

\\emm.local\xdrive\2025\E250352- Rasp Mine Mod 13\GIS\02_Maps\ModReport\MR003_ProposedModifications\MR003_ProposedModifications_20251209_02.aprx 9/12/2025

Rasp Mine modified project layout

RASP Mine Mod 13
Social Impact Assessment
Figure 1.2

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1.3 Assessment approach and requirements

This SIA supports the planning and approval process for the proposed modification. It has been prepared in accordance with the Scoping Letter sent to the NSW Department of Planning, Housing and Infrastructure (DPHI) as well as relevant government assessment requirements, guidelines, and policies, including:

- the *Social Impact Assessment Guideline for State Significant Projects* (SIA Guideline 2025) (DPHI, 2025)
- the *Technical Supplement: Social Impact Assessment Guideline for State significant Projects* (SIA Technical Supplement 2025) (DPHI, 2025)
- State significant development guidelines – preparing a modification report (DPIE, 2022).

1.4 Authorship and SIA declarations

1.4.1 Authorship

This report has been prepared by suitably qualified and experienced authors and social scientists, Caroline Wilkins and Malcolm McDowell, and reviewed by a suitably qualified and experienced practitioner, Sam McCrea, consistent with SIA Guideline requirements.

1.4.2 SIA declarations

The lead author declares that:

- The lead author's qualifications include a Master of Social Science (International Development) and a Bachelor of Arts/Bachelor of Commerce. The lead author has four years' experience conducting SIA in Australia and twenty years' experience in monitoring and evaluation and social research internationally.
- The lead author's professional memberships include International Association for Impact Assessment (IAIA) and Australasian Evaluation Society (AES).

The lead author declares that this SIA report:

- was completed in January 2026
- has been prepared in accordance with the *Environmental Planning and Assessment Act 1979* (EP and A Act)
- has been prepared in accordance with the SIA Guideline 2025
- contains all reasonably available project information relevant to the SIA
- as far as EMM Consulting Pty Limited (EMM) is aware, contains information that is neither false nor misleading, in line with its legal and ethical obligations.

Assumptions and limitations of this report are outlined in Section 3.2.

2 Proposed modification

2.1 Extension of mining

BHO is seeking to extend mining operations into the British Mine that sits within ML Block 16 (Figure 2.1). This area has historically been mined, first in the 1880s and again in the 1970s.

Underground mining would be conducted using approved methods and occur 24 hours per day, seven days a week.

Parallel to this modification application, BHO has applied for a new mining lease from EL5818 for the small portion of land outside of Consolidated Mining Lease (CML) 7 in which the British deposit also sits.

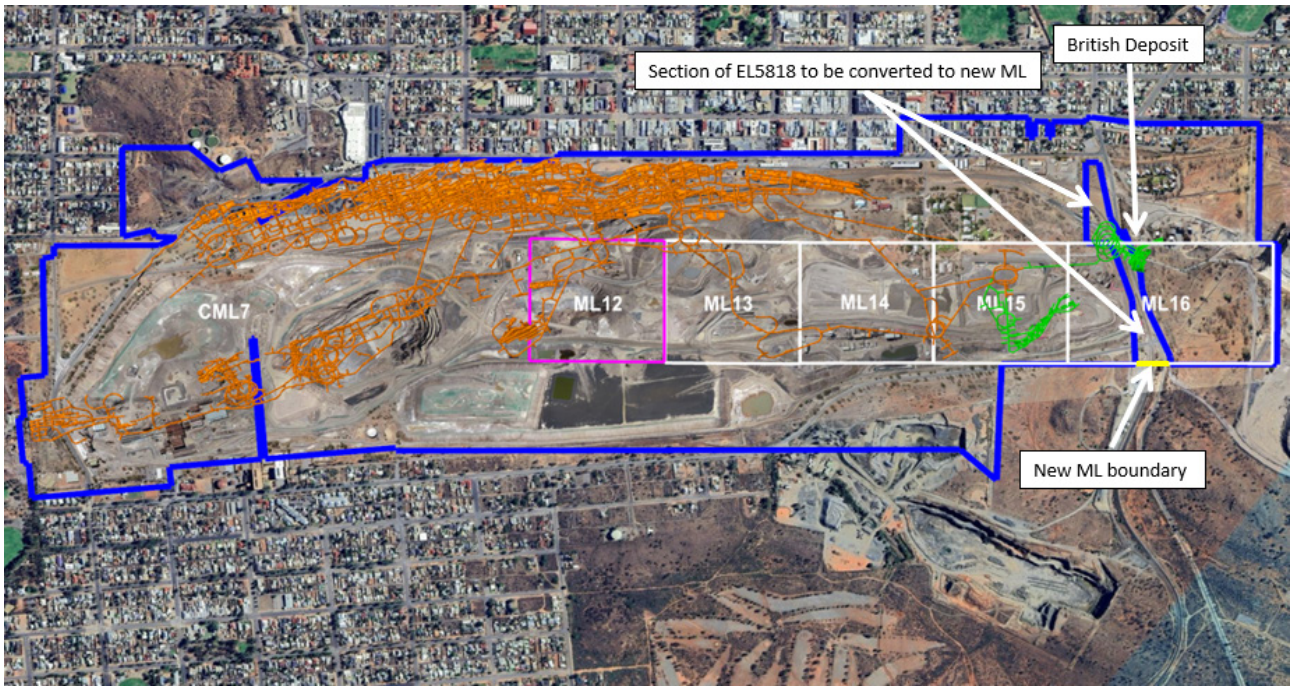


Figure 2.1 Proposed extension of mining area and area requiring new mining lease

2.2 Installation of an emergency egress ladderway

BHO is seeking to install an emergency egress ladderway from the proposed underground workings to the surface. BHO currently maintains two means of egress from the mine; the main portal and emergency escape egress ladderway from Stockpile 1 underground to the surface (approved by MOD 9). The proposed emergency egress ladderway will ensure that there exists a further suitable means of emergency egress from the northern areas of the mine as mining continues moving north into the British deposit.

2.3 Tailings dewatering system

BHO is proposing to install a tailings dewatering system to continue to manage geotechnical concerns related to inrush into underground workings at the sites approved processing rate. The current approved tailings management procedures are limited to solar and wind desiccation of tailings (to approximately 65% solid and 35% moisture) at TFS2 before transport via truck to Kintore Pit (TSF3). Dried tailings are placed in near horizontal layers at TFS3 and compacted with a roller.

The tailings dewatering system would significantly increase the amount of water recycled back into the operation. Tailings dewatering will reduce the water content of the tailings to below the threshold for liquification. The dewatering plant, together with ongoing compaction of deposited tailings, the portal plug and placement of rock (as approved in MOD6) will continue to mitigate the risk of inrush into the mine. Dewatering will also achieve a moisture content so the tailings material will not slump or liquefy from seismic events or mining blasting activity.

2.4 Importing and processing ore from Pinnacles Mine

BHO intends to receive up to 100,000 tpa of ore from the Pinnacles Mine at Rasp Mine and process this ore at Rasp. Pinnacles Mine, owned by Pinnacles Mines Pty Ltd and operated by BHM, is located approximately 14 kilometres west of Rasp Mine. Parallel to this modification, Pinnacles Mines Pty Ltd is proposing to submit its own modification application to modify its consent (DA 13/13732) to allow for haulage of up to 100,000 tpa of crushed ore from the Pinnacles Mine to Rasp Mine (via the Eyre Street entrance).

Ore receipt would occur in B-double trucks on a campaign basis at fortnightly or monthly intervals to support processing requirements at Rasp Mine. Rasp Mine would receive up to 1,512 deliveries of ore from Pinnacles Mine per year

Pinnacles ore would be unloaded at the existing Rasp Mine ROM Pad and processed using the existing processing facility. Final concentrate products would be transported via rail to Port Adelaide. Tailings would be managed in accordance with approved Rasp Mine tailings management procedures.

The receipt and processing of Pinnacles ore would diversify the ore sources, enabling the Rasp Mine to optimise production, reduce costs and create greater operational stability. Pinnacles Mine ore is a key factor in extending the life of the Rasp Mine and supports the long-term future of the operation.

2.5 Extension of mine life

BHO is seeking to extend mining operations by five years, from 31 December 2026 to 31 December 2031. The extension of time is supported by the proposed mine plan, importation of ore from Pinnacles Mine and long-term planning for the site.

2.6 Hours of operation

Some of the proposed construction activities will be restricted to the Interim Construction Noise Guideline (ICNG) standard hours between 7:00 am and 6:00 pm Monday to Friday, 8:00 am to 1:00 pm on Saturdays, and no work on Sundays or public holidays.

The exceptions are the raise boring activity during the proposed ladderway construction and filter plant construction. The proposed ladderway construction is proposed to occur 24 hours seven days a week and hence during the ICNG standard hours, as well as during the day, evening and night out-of-hours (OOH) periods. The filter plant construction is proposed to occur from 7:00 am to 6:00 pm Monday to Saturday and from 8:00 am to 6:00 pm Sundays, and hence during the ICNG standard hours and day OOH period.

3 Methodology

This section presents the methodology which guided completion of the SIA for the modification. The methodology was specifically tailored to meet the requirements of the SIA Guideline (DPHI, 2025) to consider the changes arising from the modification in accordance with the SIA Guideline 2025 (DPHI, 2025).

A preliminary Socio-Economic Impact Assessment (SEIA) was prepared for the Rasp Mine Rehabilitation Strategy in 2022 (HillPDA, 2022). While this SEIA did not prepare a SIA in accordance with the NSW SIA Guideline 2021 (DPIE, 2021), the report provided a social baseline and scoping of potential social impacts and benefits. A SIA has not been conducted for the Rasp Mine as it was not required for project approval when it was transitioned to SSD in 2018 and the first NSW SIA Guideline was issued in 2021.

The project approval has been modified on 12 occasions since project approval was granted in 2011 (approval reference MP 07_0018). As the original environmental approval was provided in 1885, data to evidence the development for which the consent was originally granted is not available. This SIA therefore assesses the Rasp Mine as last modified in November 2025 (Mod 12), of the original approval granted on 31 January 2011.

This SIA conducts an initial assessment of social impacts of the continuation of mining operations (the development as last modified) before assessing the social change due to the proposed modification 13.

3.1 Methodological phases

The phases of the SIA methodology are described below.

3.1.1 Phase I

i Review of documents

An initial undertaking was the review of project documents. These documents included:

- previous modification reports
- complaints from ongoing operations
- environmental monitoring reports
- engagement records.

The review of these documents considered:

- potentially affected stakeholders and the feedback generated through engagement processes
- the SIA study area identified negative and positive social impacts of the modification
- the level of assessment required to address potential social impacts associated with the modification.

While this modification is addressed in terms of its potential combined effects on the community, the above considerations provide an understanding of the cumulative context, social locality and existing concerns and opportunities.

3.1.2 Phase 2

i Stage 1 - Social baseline study

Building upon the initial understanding of the existing social environment attained in the scoping phase, a social baseline study was compiled. Key sources of information included existing demographic, health, housing, and socio-economic data collected by the Australian Bureau of Statistics (ABS), other government agencies and local government; published literature and social research; government policies and plans; and research completed on similar projects. A wide range of social indicators were reviewed and assessed for relevance.

The selection of social baseline indicators was informed by the social impact categories defined in the SIA Guideline and the outcomes of initial scoping and review of relevant literature (DPHI, 2025). The social baseline study provides a comprehensive socio-economic profile and analysis of social infrastructure and its capacity within SIA study areas.

The social baseline study provides the benchmark against which potential social impacts are identified and assessed. The social baseline study is presented in Section 5.

Triangulation of data was employed in the baseline to facilitate a more in-depth analysis. Using multiple sources, including qualitative and quantitative data, enhanced the validity of the baseline analysis. The social baseline has drawn on a range of primary and secondary information sources.

Quantitative data sources included:

- ABS including for Census and population data
- Government of NSW's population projection data
- Australian Government's Labour Market Information Portal, including data on unemployment and labour force participation trends, and skills and occupation shortages and projections
- Australian Institute of Health and Welfare, including for data on health and wellbeing indicators
- SQM Research for data on property and housing.

Qualitative data sources included:

- outcomes of targeted stakeholder engagement undertaken for this SIA
- review of literature, including from:
    - peer-reviewed academic journal articles
    - industry-commissioned surveys and research reports
    - Government policy and other publications
- desktop review of mapping tools, for data on location of social infrastructure and other areas of social interest.

The community profiles and social baseline analysis is presented in Section 5 of this SIA.

ii Stage 2 - Engagement informing the SIA Modification

A key source of information drawn upon by the SIA was feedback generated through engagement with potentially affected stakeholders and communities through the approved project and previous modifications. Three in-depth interviews were conducted to verify potential social impacts and benefits. BHO has also undertaken further engagement to understand the effects of the modification. The specific activities and outcomes of the community engagement are presented in Section 6.3.

Data from submissions phase on previous modifications and complaints during ongoing operations were also identified as a key source of engagement data.

Information obtained through project engagement has been used to:

- validate baseline data and assumptions
- identify/test impacts that may be experienced by nearby neighbours and the broader community
- confirm identified impacts and determine potential management strategies
- provide stakeholders an opportunity to express any concerns.

i Stage 3 – Data analysis and review

Qualitative and quantitative data collected during engagement for the proposed modification was analysed to identify changes to community values, strengths and vulnerabilities. Data analysis provided a basis to identify and develop social impact themes and confirm potential social impacts.

ii Stage 4 - Social impact identification

Social impacts and benefits relevant to the proposed modification were identified by suitably qualified social scientists (see Appendix B) through analysis of the nature of project activities, baseline characteristics of potentially affected communities and feedback generated through engagement processes.

The SIA Guideline 2025 (DPHI, 2025) notes that social impacts may be tangible and intangible or may manifest as rational or justified fears or aspirations. As such, valid social impacts are both perceived and actual. Social impacts may be experienced differently by individuals within a community or by different communities and at different times/stages of the modification.

Identification and assessment of impacts was undertaken with consideration of the impact categories outlined in the SIA Guideline 2025 (DPHI, 2025), which refers to potential changes to people's:

- **way of life**: how people live, work, play and interact
- **community:** its composition, cohesion, character, how it operates and sense of place
- **accessibility:** how infrastructure provided by public, private or not for profit organisations, including services and facilities is accessed and used
- **culture:** shared beliefs, customs, values and stories, and connection to Country, land, places, waterways and buildings, both Aboriginal and non-Aboriginal
- **health and wellbeing:** physical and mental health
- **surroundings:** access to and use of ecosystem, public safety and security, access to and use of natural and built environment, aesthetic value and/or amenity

- **livelihoods:** how people sustain themselves through employment or business, their capacity to do so and whether disadvantage is experienced
- **decision-making systems:** extent community can have a say in decisions that affect their lives, access to complaint, remedy, and grievance mechanisms.

Identification of the modification's potential social impacts and benefits was completed through several complementary approaches, helping to triangulate the findings and confirm accuracy. These approaches included consideration of:

- environmental impacts – review of similar projects in the area, as well as available academic and grey literature to identify potential impacts
- local plans and policies – findings from the review aided to contextualise and understand the local priorities as well as to identify local values
- the existing social environment – demographic and social analysis in the form of an updated social baseline study
- feedback generated through stakeholder engagement including findings from SIA engagement along with ongoing broader engagement with respect to the Rasp Mine, previous Modification Reports, submissions and complaints
- findings from other technical disciplines that contributed to the Modification Report (EMM, 2025) were reviewed and potential social impacts defined. These included:
    - greenhouse gas impact assessment (EMM, 2025a)
    - water resources impact assessment (EMM, 2025e)
    - noise impact assessment (EMM, 2025c)
    - blast vibration assessment (Fromble Corp, 2025)
    - air quality impact assessment (Zephyr, 2025)
    - Rasp Mine Lead Management Plan (BHO, 2023c)
    - Site Water Management Plan (BHO-PLN-ENV-006) (BHO, 2019)
    - Noise and Blast Management Plan (BHO-PLN-ENV-009) (BHO, 2023a)
    - Waste Management Plan (BHO-PLN-ENV-005) (BHO, 2023d)
    - Rehabilitation Management Plan Rasp Mine (E211010 RP#2) (EMM, 2022)
    - Rehabilitation Strategy Rasp Mine (E220501 RP3) (EMM, 2023).
- consideration of cumulative impacts – review of documentation from other existing projects in the study area.

A full description of each social impact is provided in Section 7 of this SIA.

iii Stage 5 - Social risk assessment

This stage involved the systematic identification and assessment of each social impact to predict the nature and scale of potential social impacts associated with operation of the modification. A social risk approach was adopted to assess the magnitude and likelihood of potential positive and negative social impacts with and without mitigation. The social risk assessment matrix, including the assessment framework used for the assessment, is outlined in the SIA Guideline Technical Supplement (DPHI, 2025) and as provided below.

Table 3.1 Social impact significance matrix

		Magnitude level				
		1	2	3	4	5
Likelihood level		Minimal	Minor	Moderate	Major	Transformational
A	Almost certain	Low	Medium	High	Very high	Very high
B	Likely	Low	Medium	High	High	Very high
C	Possible	Low	Low	Medium	High	High
D	Unlikely	Negligible	Low	Low	Medium	High
E	Very unlikely	Negligible	Negligible	Low	Medium	Medium

Source: SIA Guideline Technical Supplement, Social impact significance matrix

iv Stage 6 – Social impact mitigation and management

The mitigation and management framework considers all potential social impacts and benefits to allow for the identification of:

- required impact mitigation measures
- enhancement measures to maximise potential benefits
- partnership opportunities to manage broader cumulative effects.

Findings from Stages 1 to 5 were used to distil and analyse recommendations for the SIA Modification. This stage involved a multidisciplinary approach led by EMM's social scientists supported by environmental advisers.

v Stage 7 – SIA reporting

Development of this SIA technical report and internal peer review were conducted by EMM's social scientists and environmental advisers.

3.2 Research limitations

This SIA has been based on the best available information relevant to modification 13.

The SIA relies on several assumptions, including that the Rasp Mine operations workforce is not expected to change as a result of the modification.

Other assumptions and limitations of the research include the following:

- A key source of data describing social conditions is the ABS Census of Population and Housing, the latest of which was in 2021. There may have been changes to social characteristics since this census event. A consideration is that the 2021 Census occurred during the height of COVID epidemic restrictions which may have impacted upon socio-economic trends and characteristics as recorded.

- Social infrastructure reviewed in the social baseline predominantly considers government-provided facilities or services. In some instances, it is possible that local communities access services through private providers for which data is not available.

- SIA engagement for the proposed modification was undertaken directly by the author. The SIA also relied on operational data such as complaints and grievances, environmental monitoring reports and ongoing consultation records.

- Engagement feedback drawn upon in this report includes insights from stakeholder and community engagement activities. While these provide valuable perspectives, they may not be representative of the views of all community members.

- Engagement feedback is based on a small number of stakeholders, so cannot be taken to be representative of broader community sentiment. As such, given the limitations on current up to date baseline data (social and health) and small stakeholder the significance ratings should be revisited once further data and engagement outcome become available.

4 SIA context and scope

This chapter provides a summary of the relevant policy, plans, strategies, and guidelines that inform an appreciation of potential social impacts and benefits associated with Rasp Mine. Rasp Mine's overall consistency with relevant policies and plans is also addressed in Chapter 4 of the Modification Report.

4.1 State strategies, plans, and guidelines

Table 4.1 provides a summary of the relevant strategies, plans, and guidelines to Rasp Mine at the state, regional and local level.

Table 4.1 Regional and local plans

Name	Description and relevance to the Project
The *Far West Regional Plan 2036* (DPE, 2017)	The Far West Regional Plan 2036 acknowledges and promotes a sustainable mining sector in Broken Hill, Cobar, Wentworth and Balranald. The plan recognises that the mining industry is the primary economic driver in Broken Hill, which generates direct employment and provides flow-on benefits to communities.
Broken Hill: A Blueprint - Advocating for our future (Broken Hill City Council, 2018)	The Blueprint commits to fostering investment in infrastructure, innovation and entrepreneurship towards a diversified and sustainable future economy. The plain aims to leverage opportunities in tourism, technology, renewables and education, to build long-term prosperity.
Community Strategic Plan – Your Broken Hill 2040 (Broken Hill City Council, 2025)	The Broken Hill Community Strategic Plan sets a vision for Broken Hill over the next two decades. The plan recognises Broken Hill as Australia's longest lived mining city, with mining greatly contributing to the local economy and employment. Rasp Mine is integral to the delivery of the community strategic plan given its close links with Council and the local funding opportunities and partnerships it has with community organisations.
The *Broken Hill Local Strategic Planning Statement 2020–2040* (Broken Hill City Council , 2020)	The Broken Hill Local Strategic Planning Statement lists Broken Hill as one of the world's great "mineralogical rainforests," where mining revenues are vital to Broken Hill and the rest of Australia. The plan also acknowledges mining as a major employer and primary driver of the Broken Hill economy.
Broken Hill Sustainability Strategy and Implementation Plan 2025-2030 (Broken Hill City Council , 2025a)	The Strategy aims to steer Broken Hill City Council toward a greener, more resilient future by focusing on reducing the city's environmental footprint, protecting and enhancing natural ecosystems and biodiversity, and embedding sustainability across planning, infrastructure and community life.

4.2 SIA study area

As outlined in the SIA Guideline, review of project documents is the first phase of this SIA and involves gaining an appreciation of the social context and the nature of the project in order to complete initial identification of potential impacts and benefits to be taken forward for further assessment.

This section outlines the SIA study areas, provides a summary of key features of the area within which the project operates, the policy and planning context and the outcomes of the review of the EIS SIA to determine which impacts and benefits need to be re-assessed due to project modifications.

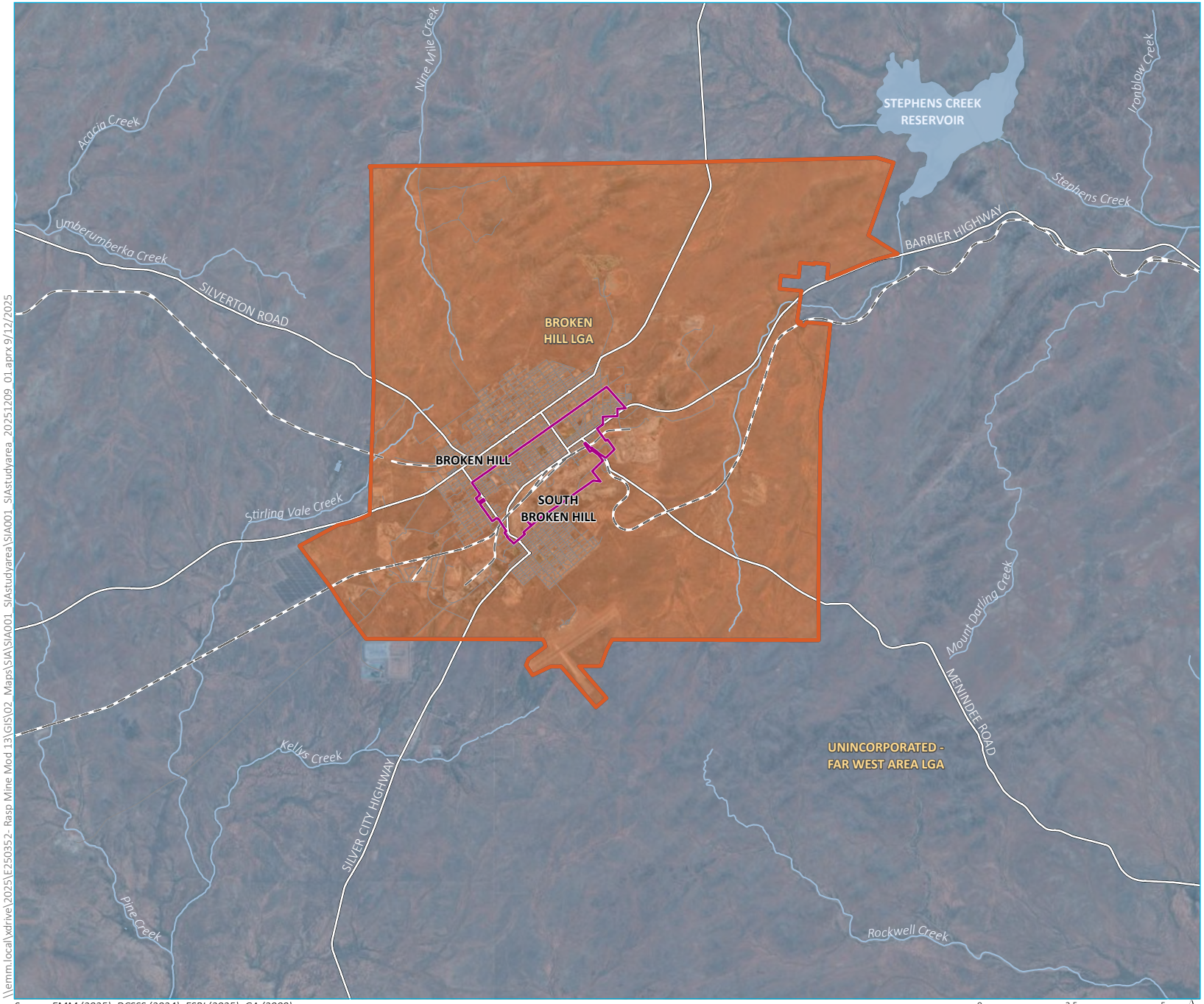
The SIA study area (referred to as 'social locality' in the SIA Guideline) is defined with reference to stakeholders who could potentially be directly or indirectly affected by the project. This includes landholders, nearby neighbours, community members, businesses, service providers and indigenous groups who may have an interest in the project or could be directly or indirectly impacted.

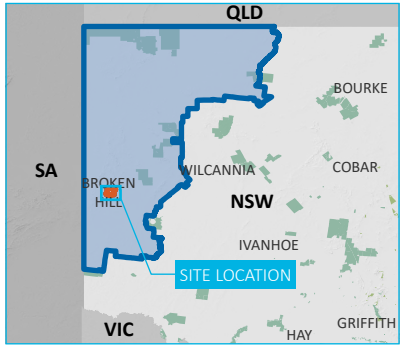
Details of the social locality are provided in Table 4.2.

Table 4.2 Project social locality mapped to Australian Statistical Geography Standard (ASGS)

Social locality	Geographic area	ABS data category	Description/relevance to Project
Local area Key urban area	Broken Hill	LGA 11250	Rasp Mine is situated within the Broken Hill UCL and Broken Hill LGA.
Regional area	Unincorporated NSW	LGA 19399	The City of Broken Hill is the regional centre for the western half of New South Wales and the strategic centre of Far West NSW. The City of Broken Hill provides a range of health and community services for Far West NSW. As Rasp Mine is a key industry and employer for the City of Broken Hill, any significant social change that may impact the City of Broken Hill will impact Far West NSW.
Area of reference	NSW	S/T 1	Rasp Mine is situated within NSW. Where appropriate, NSW data has been referred to as a basis for comparison.

Note: While there is a Broken Hill Urban Centre or Localities (UCL), there is little difference in area and population compared to the Broken Hill LGA, for simplification purposes, the LGA has been chosen to represent the local area and key urban area.





KEY

- Mine boundary
- Local area / Key urban area
- Regional area

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

INSET KEY

- NPWS reserve
- State forest

SIA study area

\\emm.local\xdrive\2025\E250352- Rasp Mine Mod 13\GIS\02_Maps\SIA\SIA001_SIAstudyarea\SIA001_SIAstudyarea_20251209_01.aprx 9/12/2025

Source: EMM (2025); DCSSS (2024); ESRI (2025); GA (2009)

0 2.5 5 km

GDA2020 MGA Zone 54

N

RASP Mine Mod 13
Social Impact Assessment
Figure 4.1

EMM
creating opportunities

5 Social baseline

This chapter provides a summary of the existing social conditions (as of December 2025) in the social locality of the Project with reference to specific and relevant social indicators that align to the following key themes:

- population and demography
- community health and wellbeing
- labour market and income
- housing and short-term accommodation
- vulnerabilities and vulnerable groups
- educational attainment and qualifications
- social infrastructure and services
- road infrastructure and transport.

The social baseline provides an understanding of pre-existing social conditions and identifies vulnerable groups. Data relating to housing and accommodation and local workforce skill and capacity also informs workforce and accommodation recommendations, to maximise benefits to the local community.

Unless otherwise stated, the data included in this social baseline is derived from the 2021 Census of Population and Housing (ABS, 2021; ABS, 2016; ABS, 2011).

5.1 Community profile

Community profiles (set out below in this section) provide a qualitative description of key trends and issues in an area or community (Vanclay, Esteves, Aucamp, & Franks, 2015). Key social trends and characteristics of each community are identified by comparing population, dwelling and labour force indicators to those for the State (NSW).

5.2 Local area / key urban area

5.2.1 Broken Hill LGA

The 2021 ABS Census shows that the Broken Hill LGA had a total population of 17,588, with an Aboriginal and Torres Strait Islander population of 1,751 (10.0%), significantly higher than the state average (3.4%). The LGA has a median age of 44 higher than the NSW average of 39 years. Around one quarter of the population was aged 65 years and over (23.2%) highlighting an ageing population.

The Broken Hill LGA had a labour force participation rate of 52.0%, lower than NSW which was 58.7%. This may be due to a larger proportion of the population being retired. The top industry of employment was healthcare and social assistance (21.8%) indicative of Broken Hill as a key service centre for the region. There was 11.0% of the population working in mining and 10.8% working in retail trade.

Household structures and indicators depict that the median weekly household income for the Broken Hill LGA was $1,173 compared to NSW's average of $1,829. There were high rates of households who owned their property outright or with a mortgage (72.0% relative to NSW at 64.0%), with 23.8% of households renting. This compares with the state average of 32.6%. More recent housing data indicates that in November 2025, the median house price for Broken Hill was $210,000 (REA Group , 2025), and the weekly asking rent prices for the Broken Hill postcode (2880) was $365 (SQM Research, 2025).

In relation to health, social determinants of health are described as "the circumstances in which people grow, live, work, age, and the systems put in place to deal with illness…which are shaped by political, social, and economic forces" (CSDH, 2008). Meaning, social determinants of health can indicate the health of a population.

These include factors such as conditions of employment, provision of social services and support, and socioeconomic position. Broken Hill recorded 38.2% of the population as having long-term health conditions, with elevated rates of arthritis, asthma, cancer, heart disease and lung conditions, significantly higher than the NSW average. There were also elevated rates of diabetes and mental health conditions in Broken Hill.

Lead exposure continues to be a serious health concern in Broken Hill, particularly for young children. The Broken Hill Lead Program conducts voluntary annual blood-lead testing for children under five, with over 700 children tested in 2024. The average blood-lead level (BLL) was 4.3 micrograms per decilitre (mg/dL), which is below the National Health and Medical Research Council (NHMRC) level guideline of 5 mg/dL.

However, the distribution of lead exposure is uneven. Among Aboriginal and Torres Strait Islander children tested, 68% had BLLs above the recommended level, compared with 35% of non-Aboriginal children, highlighting a significant health disparity. Even infants show measurable exposure with children aged six to twelve months having an average BLL of 2.5 mg/dL, and newborns screened at birth had a mean of 0.6 mg/dL (Far West Local Health District, 2025).

The high levels of lead in Broken Hill are largely due to the town's long history of mining which has left contamination in soil, dust and homes. Peer-reviewed research confirms the health impact of this exposure. Longitudinal studies of Broken Hill children born between 2009 and 2015 found that a significant portion had blood-lead levels above the guideline, with some children reaching 10 µg/dL or higher (Public Health Research and Practice, 2022).

The Broken Hill LGA is shaped by its remote location, strong community identity and long mining history. The city functions as a regional service hub for Far West NSW, supporting residents with essential health, education and recreation facilities. Key social infrastructure includes a major hospital, an airport, schools and TAFE services, childcare centres, aged-care facilities and a range of community centres and sporting venues.

Access to specialist health care, higher education, and diverse employment opportunities requires travel to larger centres. There is a significant tourism industry, with visitors and tourists drawn to Broken Hill's heritage nature and surrounding national parks which play a role in the local economy.

5.3 Unincorporated NSW

Unincorporated NSW is a large, sparsely populated area in the Far West region of NSW. The area had a total population of 1,016 people with a median age of 45 years despite having low proportion of youth (aged 15 to 19 years) and young people (aged 20 to 29 years). The LGA had an Aboriginal and Torres Strait Islander population of 3.5% on par with the State's average of 3.4%.

The LGA had a high labour force participation rate of 68.1% relative to NSW at 58.7%. In terms of industry of employment, 34.2% of the population worked in the agriculture, forestry and fishing industry. The Census recorded 22.9% of the population as having a long-term health condition, with only 1.9% identified as having a need for assistance.

Unincorporated NSW is home to diverse and striking landscapes with outback settings and wide-open spaces. Key features include the Fowlers Gap Arid Zone Research Station (UNSW, 2025) and the Mutawintji National Park (NSW National Parks and Wildlife Services, 2025). The area has no direct local government, but its closest main service centre is Broken Hill with residents travelling there to access amenities and services.

The City of Broken Hill provides a range of health, community and social services to the wider Far West region including Unincorporated NSW. Given the Rasp Mine is a major employer and key industry within Broken Hill, any significant social changes affecting the city is likely to have broader implications for communities across Far West NSW.

5.4 Key social trends and characteristics

A summary of the key social trends and characteristics within Broken Hill LGA and Unincorporated NSW and the area of reference (i.e. NSW) is provided in Table 5.1.

Table 5.1 Key relevant social characteristics and trends

Social themes	Trends and characteristics
Population	In 2021, the local area recorded a population of 17,588 residents, and the regional area had a population of 1,016 people. The population in the Broken Hill LGA stabilised in the five years to 2021 with a small increase of 0.7%. The population of Unincorporated NSW decreased by 3.8%, compared to NSW population growth over the same period of 7.9%. Broken Hill LGA had a relatively high proportion of residents aged 65 years and over (elderly) compared to NSW (23.2% compared to 17.6%). Unincorporated NSW LGA had a high proportion of residents aged over 65 years (elderly) (20.5%) compared to NSW. Broken Hill LGA had a higher proportion of Aboriginal and/or Torres Strait Islander residents (10.0% respectively) compared to Unincorporated NSW (3.5%) and NSW (3.4%).
Health	Arthritis, asthma and mental health were the three most prevalent long-term health conditions reported within the local area. Broken Hill LGA had a higher proportion of arthritis (14.2%), with a proportion (12.0%) of asthma, and high rates of mental health conditions (11.8%). Unincorporated NSW LGA had lower prevalence of all long-term health conditions including asthma (7.4% compared to 7.8% across NSW). Public Health Information Development Unit (PHIDU) data highlights the 2023 hospital admissions for illnesses and conditions per 100,000 people in Broken Hil LGA. Hospital admissions for mental-health related conditions saw a rate of 1,343.0 per 100,000, with a higher rate of 2,708.8 per 100,000 admitted to hospital for respiratory system diseases and a rate of 495.3, with a rate of 3,166.4 admitted for injury, poisoning and other external causes (PHIDU, 2025). Respiratory diseases include acute diseases such as influenza and pneumonia, as well as chronic diseases such as chronic obstructive pulmonary disease, which includes chronic bronchitis and emphysema, asthma, and lung diseases such as asbestosis and silicosis (AIHW, 2024). According to the Western NSW Public Health Network, in the 2021-22 financial year, there was a rate of 1519.2 per 100,000 people of hospitalisations due to respiratory diseases in western NSW, compared to the rest of NSW average 1,385 per 100,000 population (HealthStats NSW, 2021).
Housing	The proportion of occupied dwellings was lower in the Broken Hill LGA (82.7%). Unincorporated NSW LGA exhibits high levels of dwelling occupancy (85.5%) both lower than for NSW (90.6%). Unoccupied dwellings include vacant houses, holiday homes and dwellings due for demolition or repair. Unincorporated NSW had the highest level of home ownership (79.3%) compared to Broken LGA (72.0%), and 64% in NSW. At the 2021 Census, the median rent for Broken Hill LGA was $220 per week. Median rent in Unincorporated NSW LGA was slightly higher at $263 per week.
Short term accommodation	Within the key urban area of Broken Hill LGA, there were 24 short-term accommodation options identified, of which 14 were hotels or motels, and 10 were holiday rentals listed on Airbnb. Broken Hill also has camping and caravan sites.

Social themes	Trends and characteristics
Tourism	In 2023 and 2024, total tourism sales in Broken Hill City were $147.5 million, and the total value to the economy was $71.0 million (.idcommunity, 2025). The value of tourism to local employment within the Broken Hill LGA between 2019 and 2024 was 27.0% compared to 8.8% in NSW (.idcommunity, 2025). Broken Hill and the surrounding area are known for tourist attractions and events including: • Silver City Mint and Art Centre • Mundi Mundi Bash • Living Desert Sculptures • National Parks including Mutawintji National Park • Historic Daydream Mine tours.
Social infrastructure and services in Broken Hill LGA	The Silver City Highway is the main connecting road across the Broken Hill region, passing through the City and connecting to the surrounding outback area. The main hospital is in the Broken Hill Base Hospital with other medical centres and clinics in the city. Other social services in Broken Hill include primary and secondary schools, libraries, parks and recreation facilities, as well as an airport and a range of community and social support services.
Labour force	Broken Hill LGA had a lower labour force participation rate of 52.0%. Unincorporated NSW LGA is characterised by a labour force participation rate of 68.1%. The NSW average labour force participation rate was 58.7%. Across the area, the unemployment rate varied, with higher unemployment in Broken Hill (5.5%) and lower unemployment in Unincorporated NSW (2.8%). Aboriginal and/or Torres Strait Islander unemployment was high in Broken Hill when compared to Unincorporated NSW LGA and the state.
Local business and industry	The top industry of employment for Broken Hill was health care and social assistance (21.8%) which reflects Broken Hill's role as a regional service centre particularly for the provision of health services and social services. This was followed by mining (11.0%) and retail trade (10.8%). Education and training were also a significant employer at 8.4%. The top industry of employment in Unincorporated NSW was agriculture, forestry and fishing industry, followed by accommodation and food services, then public administration and safety.
Community values	Local and regional elements valued by the community include quiet country living and local visual amenity; access to services in the City of Broken Hill, strong sense of community; the environment; the area's rich history and culture, unique landscapes and attractions, and a place where arts, culture, heritage and technology meet (Broken Hill City Council, 2025b) Key features in the regional area include a range of national parks, conservation areas and outback deserts which have rich cultural and recreational value, including the Original Silverton Hotel.
Vulnerability	According to the 2021 Socio-Economic Indexes for Areas (SEIFA), Broken Hill LGA had an Index of Relative Socio-economic Disadvantage (IRSD) decile ranking of 2, this decile indicate that Broken Hill LGA is in the top 20% of most disadvantaged LGAs. The local area has higher levels of vulnerability, with lower incomes and a relatively high proportion of elderly residents. Broken Hill LGA had a higher proportion of residents earning less than $650 per week (24.8%) when compared to NSW (15.3%). However, Unincorporated NSW LGA had a lower proportion at 12.5%. Broken Hill LGA had a lower estimated number of homeless persons with 33 people recorded in 2021, or a rate of 19 persons (per 10,000 people).

5.5 Social infrastructure

The desktop social infrastructure audit establishes the existing social infrastructure for Broken Hill in accordance with NSW SIA Guideline (DPHI, 2025) (see Table 5.2). The audit categorises facilities within the Project's area of influence and accounts for essential social infrastructure which services Broken Hill and surrounds.

Table 5.2 Social infrastructure

Facility Name	Category	Address	Status
Broken Hill Base Hospital	Health	176 Thomas St	Operational (Recently Upgraded)
Maari Ma Health (Primary Care)	Health	439-443 Argent St	Operational
RFDS Wellbeing Place	Health	170 Oxide St	Operational (New Facility)
Broken Hill High School	Education	54 Garnet St	Operational
Willyama High School	Education	Murton St	Operational (Maintenance Issues)
Morgan Street Public School	Education	442 Morgan St	Operational
TAFE NSW Broken Hill	Education	248 Argent St	Operational
Barrier Police District HQ	Emergency	80 Blende St	Operational
Broken Hill Fire Station (Town)	Emergency	248 Blende St	Operational
Service NSW	Community	Westside Plaza, Galena St	Operational (Relocated from CBD)
Broken Hill City Library	Community	249 Blende St	Operational
Broken Hill Civic Centre	Community	31 Chloride St	Operational
Broken Hill Regional Art Gallery	Community	404-408 Argent St	Operational
Busy Kids Child Care	Childcare	121 Bagot St	Operational (Waitlisted)
Happy Day Preschool	Childcare	358-360 Kaolin St	Operational
YMCA OSHC (Burke Ward)	Childcare	Rakow St	Operational
Rainbow Preschool	Childcare	2A Patton St	Operational
Silverlea Early Childhood Services	Childcare	158 Rakow St	Operational
Playtime Preschool Centre	Childcare	Cnr Comstock and Patton St	Operational
Memorial Oval	Sport	Williams St	Operational
Alma Oval	Sport	Wilson St	Operational
PCYC Broken Hill	Sport	58 Gypsum St	Operational
Musicians Club	Sport/Social	276 Argent St	Operational
SCC St Anne's Nursing Home	Aged Care	238 Piper St	Operational (Merged Entity)
SCC Harold Williams Home	Aged Care	267 Eyre St	Operational (Merged Entity)
SCC Aruma Lodge	Aged Care	229 Beryl St	Operational (Merged Entity)
Broken Hill War Veteran's Home	Aged Care	168 Thomas St	Operational
Eureka Shorty O'Neil Village	Aged Care	16 Blende St	Operational (Rental/Sale Risk)
Concordia Aged Care	Aged Care	345 Chloride St	Operational

5.6 Community contributions

BHM continues to support the local community through ad-hoc financial contributions and practical initiatives. BHM has regularly donated to local schools and events across 2024–25. Employees also contribute to the Dolly's Dream charity, with the company matching their donations. In addition to these community investments, BHM is covering the lease costs to help re-establish the Line of Lode café-restaurant. This ongoing contribution ensuring one of the region's iconic tourism sites can return to full operation and continue benefiting both locals and visitors (Crown Lands, 2025).

6 Community and stakeholder engagement

This chapter provides a summary of stakeholder and community engagement associated with ongoing operations of the Rasp Mine. It provides an overview of the engagement approach and a review of stakeholder identification and engagement activities undertaken in 2025.

The feedback generated through community and stakeholder engagement, as well as wider sentiment investigation, directly informed preparation of the identification and assessment of social impacts and benefits of the modification.

The majority of engagement used to inform this modification was undertaken directly by the Rasp Mine and has been reviewed as a secondary source. Three semi-structured interviews with key stakeholders were conducted to verify potential social impacts and benefits from the perspective of the stakeholder.

6.1 Stakeholder mapping

A summary of the stakeholders currently identified is provided in Table 6.1.

Table 6.1 Key stakeholders

Who	Detail
Rasp Mine employees and contractors, and their families	• Current employees and their families • Current contractors and their families • Mining and Energy Union (Broken Hill branch)
Nearby neighbours	• Occupants of adjoining properties e.g. properties with frontage to Eyre Street (entire length), Proprietary Square, Iodine Street, McGillvray Drive, Federation Way
Broken Hill Lead Reference Group	• BHCC • Maari Ma Health • Far West Local Health District (FWLHD) • EPA • SafeWork • Essential Water • Aboriginal Affairs • TfNSW • BHO • Perilya.
Rasp Mine agency consultative group	• NSW Resource Regulator • Mining Exploration and Geoscience • EPA • NSW Health (Western NSW Local Health District) • DPE Water • DPE Regional office • Heritage NSW
First Nations groups	• Broken Hill LALC • Murdi Paaki Regional Assembly (Broken Hill Community Working Party) • Barkandji Traditional Owners #8

Who	Detail
Local residents	• Local residents • Local businesses • Broken Hill Chamber of Commerce • Destination Broken Hill / Broken Hill Visitor Information Centre • CWA Broken Hill branch
Government agencies	• See Table 6.2 below.
Elected Representatives (Local, State and Federal)	• Local member - Tom Kennedy • State member - Roy Butler • Federal member - Jamie Chaffey
Local government	• Broken Hill City Council (BHCC)
Regional Non-Government Organisations (NGO's) and Community Groups	• Broken Hill Lead Reference Group
Health providers	• Far West LHD Child and Family Health • Broken Hill Base Hospital • Flying Doctor Service • Maari Ma Aboriginal Health
Education providers	• TAFE NSW Broken Hill Campus • Sydney University Rural health • Charles Sturt University
Local community groups	• Broken Hill Historical Society • Broken Hill Art exchange
Visitors and tourists	• Broken Hill Regional Tourism Association • Destination Country and Outback NSW • Broken Hill Regional Tourism Association • Broken Hill Tourism Advisory Group (• Mundi Mundi Bash Organizers • St Pat's Race Club • Broken Hill City Art Gallery • Foundation Broken Hill • West Darling Arts

6.2 Government agencies

Government and regulatory stakeholder engagement carried out on the proposed modification to date is summarised as follows:

NSW Department of Planning, Housing and Infrastructure (DPHI)

BHO undertook multiple engagements with DPHI – Resource Assessments in relation to Mod 13:

- 5 September 2025 – BHO provided a presentation to DPHI outlining current mine operations and future proposed modifications, including the elements of Mod 13.
- 5 September 2025 – A draft scoping letter for Mod 13 was provided to DPHI for review and comment. DPHI provided feedback on the draft scoping letter, which was subsequently addressed in revised versions.

- 25 November 2025 – BHO submitted a scoping report for Mod 13 to DPHI.
- 26 November 2025 – DPHI provided feedback on the scoping letter, which was incorporated into a revised scoping letter.

These engagements informed the final scope of the proposed modification and the suite of environmental assessments to be undertaken.

NSW Environment Protection Authority (EPA)

- 1 December 2025 – BHO provided a detailed notification letter to the NSW EPA requesting comment on the proposed modification.
- The EPA responded that it had no initial comments and advised that it would review the Modification Report and supporting environmental assessments when formally submitted.

NSW Resources Regulator – Safety

- 1 December 2025 – BHO provided a detailed notification letter to the NSW Resources Regulator (Safety).
- In a follow-up phone conversation on 5 December 2025, the Regulator indicated that it had **no initial comments or issues** in relation to the proposed modification at that time.

NSW Resources Regulator – Environment

- 1 December 2025 – BHO provided a detailed notification letter to the NSW Resources Regulator (Environment).
- Feedback received noted that the proposal lacked detail regarding land use changes and rehabilitation requirements associated with tailings dewatering system dams once decommissioned.
- BHO advised that the proposed modification would not change the approved final land use or closure plans for tailings facilities, and that relevant matters would be addressed in the Modification Report.

NSW Health

- 3 December 2025 – BHO provided a detailed notification letter to NSW Health requesting comment on the proposed modification.
- NSW Health advised that it had no comments on the proposal.

6.3 SIA engagement

6.3.1 Overview

In-depth interviews with three community members were conducted via telephone between 7 January 2026 and 9 January 2026. The interviews involved Broken Hill residents who represented key sectors of the community. These residents included local business leaders, health service providers, and board members of community development organisations.

6.3.2 Key findings

i Community identity and economic confidence

The local mining industry remains as a major component of Broken Hill's community identity. While there is a strategic desire for the town to become self-sustaining, participants acknowledged the current economy relies heavily on the resource sector. Stakeholders viewed the Project's extension as an opportunity for ongoing employment and commercial procurement driving business confidence through to the Project's cessation. A stable Project outlook encourages investment in commercial real estate and small, while additionally providing certainty for prospective families to relocate or remain in the region.

ii Workforce and housing

Stakeholders expressed a clear preference for residential workforce over Fly-In-Fly-Out (FIFO) workforce models. One stakeholder noted that the FIFO workforce wasn't the preferred workforce model, as residential workers drive flow on benefits for local schools, clubs and local commerce. Despite this preference, the pressure that a transient workforce model places on the housing market is a specific challenge. Securing affordable quality housing to accommodate FIFO or transient workforces' remains a significant constraint for the community.

iii Social infrastructure

The recent closure of a local childcare facility has placed added stress to on families within the local workforce. Stakeholders noted the shortage of childcare facilities is a critical barrier to recruitment and retention, acting as direct barrier to spousal employment. An example was provided by a stakeholder of skilled partners such as nurses being unable to enter the workforce because they cannot secure daycare. This is an immediate constraint on the town's capacity to attract and retain new residential families.

iv Health, environment, and legacy issues

Managing lead levels in newborns and children remains a long-standing issue within the Broken Hill community. A stakeholder representing health confirmed blood levels have plateaued in recent years, yet anxiety persists regarding any potential exacerbation of contamination. Specific concerns were raised regarding tailings management during heavy rainfall events. Runoff from these rain events can potentially flow into surrounding residential developments and nearby bushland. Any worsening of lead contamination attributed to mining operations would be unacceptable and harmful to the community.

v Cumulative impacts and communication

There was some confusion regarding the status of other major projects, such as Cobalt Blue and Hydrostor. Visible progress is often slow despite ongoing communication. Consequently, there is an expectation that the Project distinguishes itself through clear, early communication. This is particularly important regarding operational changes like blasting or shifts which directly impact residential amenity. As one stakeholder summarised, the mine needs to be "liked" and trusted to maintain its social licence to operate.

7 Assessment of social impacts and benefits

This chapter assesses social impacts and benefits generated by the proposed modification and provides an assessment of relative social risk utilising the methodology outlined in the SIA Guideline Technical Supplement (DPHI, 2025a).

As the contemporary environmental approval was provided in 2011, the modification therefore assesses the project as last modified. This modification has been assessed as being in general the same as the project as last modified. The SIA therefore conducted an initial assessment of social impacts of the continuation of mining operations before assessing the social change due to the proposed modification.

Assessment of social impacts considers a range of factors and potentially competing interests. The impact assessment is reflective of this and has included potential impacts and benefits on local communities, the broader region and for vulnerable sectors of affected communities.

Social impacts (including health impacts) and benefits have been assessed using a precautionary approach, and residual impacts have been re-assessed on the basis that proposed mitigation or enhancement measures are effectively implemented. The assessment uses the terms 'unmitigated' and 'mitigated' when referring to negative impacts and 'un-enhanced' or 'enhanced' when referring to positive impacts (benefits).

Social impacts and benefits relevant to the proposed modification were identified through analysis of social impacts and benefits identified in recent Project modification reports, technical studies, other SIA reports of similar projects, the proposed changes to the nature of project activities, baseline characteristics of potentially affected communities and feedback generated through engagement processes.

Application of the SIA Guideline's likelihood and magnitude framework (as outlined in Section 3.1.2 of this SIA) informs assessment of the level of significance of a social impact as being negligible, low, moderate, high, or very high.

Table 7.1 presents the assessment of social impacts and benefits due to the proposed modification.

Table 7.1 Social and community health impacts, benefits and proposed management measures

#	Impact category	Approved operations				Modification 13			
		Original project activity/factor	Social impact identified	Current mitigated significance	Original management measure	Changes to project activity/factor (modification)	Latest baseline	Mitigated significance	Changes to management measures
1	• Community • Decision making systems • Health and Wellbeing	• Project contributes to further lead, silver and zinc extraction used for batteries, galvanised steel and electronics. • Mining operation generates exposure of local community, in particular children, to lead at unsafe levels. • Sources of lead exposure include on-site air, dust, soils and water.	**Reduced community cohesion due to divergent opinion on lead mines with regard to health impacts** • Exposure of local residents, in particular children to lead in air, dust, soils and water. • High blood lead levels found in toddlers and children in Broken Hill, with higher rates found in Aboriginal children.	**Mitigated significance: Medium**	• Mitigation measures as per previous Modifications include: – Implementation of Broken Hill Environmental Lead Program (BHELP) – Implementation of Implement Lead Management Plan (Community) 2023 – Implementation of Occupational Lead Management Plan for construction and operation workers – Updating of Human Health Risk Assessment every five years.	• Continued mining operations for a further five years. • Extending mining operations into the British Mine. • Importing and processing ore from Pinnacles Mine.	• **Stakeholder engagement:** Supporting the need to continue current lead monitoring, especially for sensitive receptors close to the Project. • **Stakeholder engagement:** Transparent communication through keeping the community up to date with information reduces the shock of any negative impacts associated with the Project. • **Stakeholder engagement:** Lead issues are described as "politically hot" with a long-standing history in the community. While general blood lead geometric means are low, there is a noted disparity with higher levels in Aboriginal children, fuelling community concern. • **Document baseline:** The Community Lead Management Plan acknowledges the need to address historical lead burdens and maintain social license through the Broken Hill Environmental Lead Program.	**Mitigated significance: Medium**	• Continue communication measures from the Lead Management Plan (Community) - Section 8 and Section 9.2 (BHO, 2023c): – **Air quality monitoring data:** BHOP publishes monthly updates on its website summarising air quality monitoring data and reviewing it against relevant criteria. Upon request, BHOP also presents this information at Broken Hill Lead Reference Group meetings. – **Lead blood level monitoring data:** BHOP links its website to the Far West Local Health District site, which provides independent data on Broken Hill blood lead monitoring and offers public education resources for personal blood lead management. – **Funding contributions:** BHOP allocates up to $50,000 annually to support the Western NSW Local Health District and Western Public Health Unit in: a) Monitoring public health, particularly child blood lead levels b) Delivering public education campaigns on lead-related health risks, including lead hygiene, lead and children, tank water contamination, and soil lead risks c) Annual review of research funding to determine if any further research or treatments is required in addition to current funding pool.

#	Impact category	Approved operations				Modification 13			
		Original project activity/factor	Social impact identified	Current mitigated significance	Original management measure	Changes to project activity/factor (modification)	Latest baseline	Mitigated significance	Changes to management measures
2	• Community • Decision making systems	• Project contributes to further lead, silver and zinc extraction used for batteries, galvanised steel and electronics. • Employment of approximately 215 FTE personnel including 145 permanent employees and 70 contractors. • Procurement opportunities for local businesses and contractors. • Payment of royalties and taxes.	**Reduced community cohesion due to perceived inequitable distribution of project benefits**	**Mitigated significance: Low**	• Mitigation measures as per previous Modifications include: – Implementation of Environment Management Strategy 2023 • **BHO Community contributions:** Ad hoc financial contributions to community events. Additional employer community financial contributions matched by BHO	• Continued mining operations for a further five years.	• **Stakeholder engagement**: Local businesses express concern over "gouging" where suppliers charge the mine double, creating economic friction. Conversely, the community values the mine's investment in local assets like the Line of Lode	**Mitigated significance: Low**	• Continue implementation of community engagement activities outlined in the Environmental Management Strategy – Section 6.3 (BHOP, 2023e): – **Stakeholder engagement**: BHOP communicates activities through newsletters distributed via letterbox drops to residents. For significant changes, such as Project Approval Modifications, BHOP advertises the changes via local media with the public able to submit comments on the proposed modifications. BHOP also maintains the Project's website, publishing documents in line with Project approval requirements, including environmental monitoring reports • **Financial contributions:** Financial contributions to include: – Prioritise local procurement where financially viable to support local business stability – Continued implementation of community investment initiatives – Ongoing financial support to the line of the Lode Café – Continue support for community events which enable interaction between community members
3	• Way of life • Livelihood	• Mining operations adjacent to land and properties generating amenity impacts	**Perceived or actual changes to the value of land and properties surrounding the project area**	**Mitigated significance: Medium**	• Implementation of Noise and Blast Management Plan 2023	• Continued mining operations for a further five years. • Extending mining operations into the British Mine. • Importing and processing ore from Pinnacles Mine.	• **Stakeholder engagement:** Property market supply and demand fluctuates (workforce accommodation) with market demand for Project relevant resources which increases property prices during high demand periods. • **Stakeholder engagement:** Extension of mine life is seen as improving market confidence and encouraging housing investment/renovation. • **Document baseline:** Vibration limits are strictly set for sensitive receivers (e.g., residential areas) to prevent structural damage that could devalue properties.	**Mitigated significance: Medium**	• Continue implementation of Noise and Blast Management Plan – Section 9 (BHO, 2023a): – **Vibration management:** Strict adherence to vibration limits (5mm/s for 95% of blasts) at private residents to prevent structural damage and protect property values – Continue deed of agreement with RMS for South Road protection. • **Stakeholder engagement:** Commitment to undertake an SIA for mine closure prior to ceasing operations. Engage with host and nearby land/property owners as part of this closure planning SIA.

#	Impact category	Approved operations				Modification 13			
		Original project activity/factor	Social impact identified	Current mitigated significance	Original management measure	Changes to project activity/factor (modification)	Latest baseline	Mitigated significance	Changes to management measures
4	• Way of life • Surroundings	• Mine closure planned for December 2026	**Diminished enjoyment of landscapes due to postponement of mine closure and extended operations (including visual amenity).**	**Mitigated significance: Low**	• Implementation of Rehabilitation Strategy 2023	• Life of Mine extended to December 2031 (five years)	• **Stakeholder engagement:** The "Mining Landscape" is considered integral to Broken Hill's heritage tourism. Stakeholders prefer heritage preservation over "greening" the site. • **Document baseline**: The Rehabilitation Strategy confirms the final land use as a "safe, stable, non-polluting mining landscape" suitable for tourism.	**Mitigated significance: Low**	• Continue the implementation of the Rehabilitation Strategy 2023 – section 3 (EMM, 2023): – **Tourism:** Retention and conservation of heritage items as part of the final landform to support tourism – **Visual amenity:** Progressive rehabilitation of free areas with inert waste rock to improve visual amenity and reduce dust • **Rehabilitation options:** Ongoing refinements to mine design and layout based on the findings of technical studies and feedback generated through stakeholder engagement. • **Community awareness:** Education and engagement with broader community and visitors about the need for continued lead/silver/zinc production, and its benefits to the whole community. • **Communication:** Continued implementation of grievance mechanism, ideally including direct mobile numbers and names of locally based project staff. • **Stakeholder feedback:** Targeted engagement to identify, notify and understand the values of recreational users, service providers, and related businesses.
5	• Health and wellbeing	• Impacts on health and wellbeing of local children residing near the mine, in particular lead levels in blood, due to historical mining activity	**Community health impacts (exposure of children to lead in air, dust, soils and water) of continued operations** • Dust generation during project operations impacting air quality and surface water.	**Mitigated significance: High**	• Minimise dust and lead bearing dust generation of project activities and from wind take up of dust across surface areas. • Implementation of Implement Lead Management Plan (Community) 2023. • Updating of Human Health Risk Assessment every five years. • Implementation of Air Quality Management Plan including: – dust control strategy for all exposed mine areas and roads within the mine area – Use of dust suppressants on exposed areas of the mine and unsealed roadways – wind breaks for stockpiles – dust control strategy for Tailings Storage Facility (TSF) including use of a sprinkler system on TSF2 – water sprays at outlet of ventilation shaft – crusher circuit and concentrate handling. – Other measures include vehicle wash down, showering and laundering, advanced weather warning and air quality monitoring including auto alert system. Implementation of the Broken Hill Environmental Lead Program (BHELP) since 2015. Measures include blood screening of children, home remediation, air quality monitoring, and awareness	• Extension of mining operations for five years. • Extending mining operations into the British Mine. • Importing and processing ore from Pinnacles Mine.	• **Stakeholder engagement:** Specific concerns raised regarding lead dust affecting properties on Halton Drive and the rail corridor. Aboriginal community having disproportionately high lead levels. • **Document baseline**: 95% of lead-bearing dust potentially originates from "free areas". Air Quality Management Plan requires chemical suppression efficiency of >80%. • In December 2020, an updated Human Health Risk Assessment (and addendum to the HHRA, 2021) was conducted for Mod 6 (BHO, 2023). The HHRA used air quality data from the air quality assessment completed for Mod 6. • The HHRA results noted: – Predicted incremental increases in soil lead (Pb) potentially arising from approximate 12-month Mod 6 construction phase were small (i.e. 0.005-0.43% of existing soil Pb).	**Mitigated significance: High**	Continue existing management measures.

#	Impact category	Approved operations				Modification 13			
		Original project activity/factor	Social impact identified	Current mitigated significance	Original management measure	Changes to project activity/factor (modification)	Latest baseline	Mitigated significance	Changes to management measures
					and education, to address childhood lead exposure in Broken Hill. BHELP Is coordinated by the Broken Hill Lead Reference Group. Members include Broken Hill Environmental Lead Program (BHELP), BHCC, Maari Ma Health, Far West Local Health District (FWLHD), EPA, SafeWork, Essential Water, Aboriginal Affairs, TfNSW, BHO and Perilya. Management measures include: • Home Remediation and Abatement program of Aboriginal and non-Aboriginal residents. There were 10 residences completed for the latest round (Round 10). • Environmental lead screening program for childcare centres, preschools and primary schools. • If deemed effective, implement continuous air monitoring using advanced X-ray fluorescence Spectron (XRF) technology. • Dust monitoring • Landscape supply testing • Funding contributions: BHOP allocates up to $50,000 annually to support the Western NSW Local Health District and Western Public Health Unit in: – Monitoring public health, particularly child blood lead levels, and – Delivering public education campaigns on lead-related health risks, including lead hygiene, lead and children, tank water contamination, and soil lead risks.		– Mod 6 operations were not expected to change absolute geometric mean blood Pb in children living in Broken Hill. – Blood Pb concentrations in children living in Broken Hill not anticipated to be affected by activities associated with Mod 6. – The risk of exceeding health-based toxicity reference values for other metals as a result of Mod 6 was assessed as very low. – Stakeholder engagement: Ensuring the surrounding properties have the protection they need in relation to lead / dust (noting importance on Halton Drive properties) • BHELP conduct blood lead testing in children aged 1 to 5 years with 160 children tested in Q3, 2025. Results found the blood lead level geometric mean was below the guideline (<5µg/dL) at 3.3 µg/dL with 160 children tested. This was less than Q2, 2025 at 3.7 µg/dL with 205 children tested and Q1, 2025 at 4.0 µg/dL with 315 children tested (BHELP, 26 November 2025). • There were 341 children aged 6 months to <12 months were tested in Q3, 2025. Geometric mean was 2.2 µg/dL, similar to the previous two quarters. • It was noted that 44% of 57 Aboriginal children aged 0-4 years tested in Q3, 2025 had high lead levels (≥ 5 µg/dL) (BHELP, 26 November 2025).		

#	Impact category	Approved operations				Modification 13			
		Original project activity/factor	Social impact identified	Current mitigated significance	Original management measure	Changes to project activity/factor (modification)	Latest baseline	Mitigated significance	Changes to management measures
6	• Health and wellbeing	• Impacts on health and wellbeing of project workers • Ongoing employee training support	**Community safety risks (perceived and actual) associated with operational activity e.g. employee health and safety, road safety**	**Mitigated significance: Medium**	• Implementation of Occupational Lead Management Plan for construction and operation workers. • Implementation of Pollution Incident Management Plan • Implementation of Air Quality Management Plan	• Extension of mining operations for five years. • Installation of an emergency egress ladderway	• **Stakeholder engagement:** Concerns regarding heavy vehicle traffic on Crystal Street and transport of ore from Pinnacles Mine. • **Stakeholder engagement:** Fears of "brain drain" and lack of succession planning for safety critical roles as the workforce ages • **Document baseline:** The Pollution Incident Response Management Plan (PIRMP) outlines protocols for notifying neighbours and emergency services during incidents.	**Mitigated significance: Low**	Continue existing management measures. • Continuing implementation of Pollution Incident Management Plan – Section 2 (BHOP, 2023b): – **Pollution incident management:** Maintenance of up-to-date emergency contact lists for neighbours and authorities – **Incident response:** Immediate notification protocols for incidents causing material harm. • Continuing measures from Air Quality Management Plan – Section 6 (BHOP, 2022): – **Traffic management:** Adherence to designated heavy vehicle routes to segregate mine traffic from residential traffic where possible. – **Dust suppression**: Covering of all ore trucks entering/ leaving the site.
7	• Surroundings • Livelihood	• Impact of ongoing operations on water resources with a focus on surface and groundwater quality and supply. • Modification 12 Report noted that given that the measured water table is well below the mine, significant volumes of groundwater are unlikely to be intercepted by the extension of ML mine workings. Should groundwater be intercepted during mining operations, it is unlikely to result in a material increase in groundwater take above expected values (361 megalitres per year (ML/yr)) (EMM, 2025g). • Exceedances to BHO's water access licence limit due to groundwater inflows to underground mining are not expected due to MOD 12. The predicted minimal groundwater inflows due to the proposed modification will also not alter the mine's water management system located at the surface (EMM, 2025g). • The main uses for water on site are ore processing and operation of underground machinery. Minor uses of water include dust suppression, fire water, worker showering and laundering facilities, evaporation, and vehicle washing.	**Livelihood/health Impacts (perceived and actual) associated with impacts to water security**	**Mitigated significance: Medium**	Site Water Management Plan including adherence to water licencing obligations.	• Extension of mining operations for five years. • Installation of a tailings dewatering system to increase water recycling from tailings back into the operation. • Dewatering will also achieve a moisture content so the tailings material will not slump or liquefy from seismic events or mining blasting activity.	• **Stakeholder engagement:** Concerns about tailings runoff into public zones/creeks during heavy rain. • **Document baseline:** The site is a net consumer of water. The Site Water Management Plan mandates zero discharge of contaminated process water. • **Document baseline:** Surface water quality and quantity is not expected to be adversely affected by the placement of the ore sorting plant and tailings dewatering system (EMM, 2025e). • **Document baseline:** There is not expected to be interference with the groundwater environment as a result of the construction and operation of the MOD 13 components (EMM, 2025e).	**Mitigated significance: Low**	• Community engagement and education to address concerns relating to drinking water safety and security. • Updates to the existing Site Water Management Plan – Section 5, Section 7 and Section 8 (BHO, 2019): – **Water use:** Separation of clean and dirty water circuits to maximise recycling and reduce draw down on town ware supply – **Overland flow:** Maintenance of Horwood Dam freeboard and pump back systems to prevent overland flow into public creeks – **Groundwater monitoring:** Quarterly groundwater monitoring to detect seepage toward public lands.

#	Impact category	Approved operations				Modification 13			
		Original project activity/factor	Social impact identified	Current mitigated significance	Original management measure	Changes to project activity/factor (modification)	Latest baseline	Mitigated significance	Changes to management measures
8	• Way of life	• Continued generation of noise and vibration due to ongoing mining operations. Noise sources include surface ore haulage, waste rock haulage to in-pit storage areas, crushing and screening, processing of ore, harvesting and storage of tailings, dispatch of ore products via rail and mine rehabilitation.	**Deterioration of local amenity due to the extended generation of noise and vibration**	**Mitigated significance: Medium**	Implementation of measures from the Moise and Blast Management Plan	• Extension of mining operations for five years. • Extending mining operations into the British Mine. • Importing and processing ore from Pinnacles Mine.	• **Stakeholder engagement:** Community is generally accepting but sensitive to "firings" and vibration. • **Document baseline:** Noise and Blast Management Plan set strict limits (e.g., 5mm/s vibration for 95% of blasts) and restricts blasting times. • **Document baseline:** Peak vector ground vibration levels are likely to remain compliant at all sensitive receivers. There is the potential for compliance challenges at the private residences at Chettle Street and the Perilya-owned residences at Junction Circle (Fromble Corp, 2025)	**Mitigated significance: Low**	• Continued implementation of measures outlined in the Noise and Blast Management Plan – Section 1, Section 8, Section 9, and Section 10 (BHO, 2023a): – **Blasting restrictions:** Restriction of production blasting to approved windows (6:45am – 7:15pm) – **Monitoring:** Maintain the network of fixed and roving noise monitors to validate compliance – **Mitigate vibration:** Implementation of deck charging and electronic detonators to minimise ground vibration – **Complaints management:** Investigate all noise complaints within 24 hrs • **Stakeholder engagement:** Ongoing engagement with local community and key stakeholders.
9	• Way of life	• Continued generation of dust and exposure to diminished air quality a concern raised by stakeholders.	**Deterioration of local amenity due to the extended generation of dust from ongoing operations and additional infrastructure**	**Mitigated significance: Medium**	Implementation of measures from Air Quality Management Plan 2022	• Extension of mining operations for five years. • Extending mining operations into the British Mine. • Importing and processing ore from Pinnacles Mine.	• **Stakeholder engagement:** Dust is a primary environmental concern for residents. • **Document baseline**: Air Quality Management Plan identifies crushing and TSF surfaces as key sources. Real-time monitoring is active. • **Document baseline:** In 2025, one complaint regarding dust was received. The complaint was received in August 2025 reporting dust leaving the Southern end of the site on 26 August. Predominant winds were from the North on that day. No dust was observed upon inspection.	**Mitigated significance: Low**	• Continue existing management measures • Continuing implementation of measures in the Air Quality Management Plan Section 6 and Section 11 (BHOP, 2022): – **Dust suppression:** Use of water sprays and wind breaks for ROM stockpiles – **Response planning:** Stop work triggers based on real time wind speed (>40km/hr and 5>50km/hr) – **Traffic dust mitigation:** Sealing high traffic haul roads and grading unsealed roads to minimise silt loading.
10	• Way of life • Accessibility	• Continuation of traffic generated by haulage of material within site	**Temporary disruption to access and connectivity on local and regional road network** •	**Mitigated significance: Medium**	• Requirements of Condition 6 of Schedule 3 of the Rasp Mine Project Approval 07_0018	• Extension of mining operations for five years. • Importing and processing ore from Pinnacles Mine.	• **Stakeholder engagement:** Traffic congestion concerns on Crystal Street due to mine-related transport	**Mitigated significance: Low**	• Continue requirements of Rasp Mine Project Approval 07_0018 – Traffic conditions (NSW DPHI, 2024): – Traffic management: Adherence to designated transport routes to minimise interaction with local school / residential traffic • Schedule shift traffic changes to reduce peak hour congestion where feasible

#	Impact category	Approved operations				Modification 13			
		Original project activity/factor	Social impact identified	Current mitigated significance	Original management measure	Changes to project activity/factor (modification)	Latest baseline	Mitigated significance	Changes to management measures
11	• Way of life • Livelihood	• Mine closure due December 2026	**Community concerns and opportunities regarding planning for decommissioning**	**Mitigated significance: Medium**	• Implementation of Rehabilitation Strategy 2023	• Extension of mining operations for five years.	• **Stakeholder engagement:** High interest in "sustainability" post-mining and diversifying the economy beyond reliance on the mine. • **Document baseline:** Rehabilitation Strategy outlines domains for closure and retention of heritage assets.	**Mitigated significance: Low**	• Continued implementation of Rehabilitation Strategy – Section 1 and Section 3 (EMM, 2023): – **Closure Plan:** Implementation of a Mine Closure Plan and submission of a rehabilitation strategy within 6 months of modification approval – **Rehabilitation design:** Implementation of heritage infrastructure for tourism / educational use – **Visual amenity:** Capping of TSFs with inert waste rock to create safe, stable landforms compatible with public access
12	• Livelihood	• Mine closure due December 2026	**Loss of employment, business and community investment from company upon cessation of operations**	**Mitigated significance: High**	• Implementation of Rehabilitation Strategy 2023	• Extension of mining operations for five years.	• **Stakeholder engagement:** Extension is viewed positively for keeping families in town, closure is a major economic risk. • **Document baseline:** Forward Program forecasts production until 2026, sustaining the workforce.	**Mitigated significance: High**	• Continue implementation of the Rehabilitation Strategy – Section 1 and Section 6 (EMM, 2023): – **Workforce engagement:** Early engagement with workforce regarding redeployment, retaining, or redundancy packages – **Ongoing support:** Support Foundation Broken Hill or similar bodies to foster non-mining development (tourism / arts)

Table 7.2 Social benefits

#	Benefit category	Continuation of mining operations			Modification 13			
		Original project activity/factor	Original benefit identified	Original enhancement measure proposed and enhanced significance	Changes to project activity/factor (modification)	Latest baseline	Changes to benefit and significance level	Changes to enhancement measures
1	Livelihoods	• Employment of approximately 215 FTE personnel including 145 permanent employees and 70 contractors. • Local and regional employment contributing to population retention and expenditure in the local economy	**Extension of direct and indirect employment opportunities for local and regional workers, including Aboriginal and young people**	**Enhanced significance: High**	• Continuation of local employment and training opportunities. • Additional opportunities for construction of infrastructure.	• **Document baseline:** Approximately 215 FTE personnel including 145 permanent employees and 70 contractors. • **Document baseline:** Additional 25 contract contractors to construct new infrastructure. • **Stakeholder engagement:** The mines were meant to have been closed 10 years ago. I'm thinking they're looking for an extension to '31."	**Enhanced significance: High**	No change
	Livelihoods	• Employment of approximately 215 FTE personnel including 145 permanent employees and 70 contractors.	**Skilled labour training and apprenticeship opportunities for local residents and existing workforce**	**Enhanced significance: High**	• Continuation of local employment and training opportunities.	• **Stakeholder engagement:** "I love apprenticeships for kids coming up. And, you know, it's not about necessarily them having to stay, but about giving back to the community in that way."	**Enhanced significance: High**	No change.
2	Livelihoods	• Procurement opportunities for local businesses and contractors • Contribution to the viability and profitability of local businesses.	**Extension of supply and procurement opportunities for local and regional businesses**	**Enhanced significance: Medium**	• Continuation of procurement opportunities for local and regional businesses. • Additional opportunities for construction of infrastructure.	• Procurement opportunities for construction of new infrastructure.	**Enhanced significance: Medium**	No change
3	Community Accessibility Surroundings	• Payment of royalties and taxes.	**Contribution to the provision of public goods and services that benefit local and regional communities.**	**Enhanced significance: Medium**	• Continuation of royalties and tax payments, contributing to the provision of public goods and services that benefit local and regional communities.	• Ongoing payment of state royalties and payroll tax.	**Enhanced significance: Medium**	No change
4	Community Accessibility	• Community benefit programs.	**Contribution of personnel to support identified community groups and local services.**	**Enhanced significance: Medium**	• Continuation of community benefit programs.	• Financial contribution to Foundation Broken Hill to renovate the Broken Earth Complex next to the Line of Node Memorial including establishment of a BHM community office and cafe. • **Stakeholder engagement:** Findings noted BHO's ongoing contributions to the community. • **Stakeholder engagement:** findings recognised BHO's financial support of the Line of Lode Café as an important community investment.	**Enhanced significance: Medium**	No change

8 Conclusion

The proposed modification involves a five-year extension to the time that mining activities can be conducted. The proposed modification is for an extension of mining into the British deposit (underground); incorporation of a tailings dewatering system; installation of an additional escape ladder to surface; and extension of the life of PA07_0018 for five additional years, until 31 December 2031.

Modification 13 is generally the same as the development as last modified. Therefore, the SIA conducted an initial assessment of social impacts and benefits due to the modification, before assessing the social impacts and benefits after the application of proposed mitigation and enhancement measures.

Twelve social impacts and four social benefits were identified as a result of the assessment. It was assessed that the modification will not result in any change to the majority of the social impacts and benefits. Potential social impacts relate to amenity including community health and wellbeing, generation of dust, noise and vibration, impacts relating to community cohesion, and potential water quality impacts.

Potential social benefits relate to ongoing employment and procurement opportunities improving the viability of local businesses, contribution to the provision of public goods and services that benefit local and regional communities and community benefits program.

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Appendix A
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Appendix L

Human Health Risk Assessment

EMM
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SLR Consulting Australia Pty Ltd
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24 February 2026

SLR Ref No.: 640.032181.00001-L01-v3.0 (MOD 13 HHRA Letter)

Attention: Devon Roberts/Senior Environmental Advisor
Broken Hill Operations Pty Ltd
130 Eyre Street, Broken Hill NSW 2880 Australia

SLR Project No.: 640.032181.00001

RE: Potential impact of MOD13 on MOD6 HHRA conclusions

1.0 Background

SLR has previously conducted a human health risk assessment for the RASP Mine in Broken Hill entitled "*Human Health Risk Assessment for RASP Mine, Modification 6*" (SLR Report Reference 640.12028-R01-v3.0, dated 14 December 2020) (termed 'the 2020 HHRA' or SLR 2020 in this letter). An addendum to the HHRA (termed 'HHRA addendum' or SLR 2021 in this letter) was also issued to consider minor changes to the project description which relate to the location and alignment of the Tails Harvesting Haul Road. In addition, a letter which examined the potential impact of MOD10 on the MOD6 HHRA conclusions (termed 'MOD10 letter' or SLR 2022) was also issued which considered the proposal by Broken Hill Operations Pty Ltd (BHOP) to temporarily 'dry stack' tailings at the western end of TSF2 against the high wall for a period of 9-16 months before TSF3 is available. All assessments were conducted in accordance with the 2012 enHealth guidance – *Guidelines for assessing human health risks from environmental hazards* (enHealth 2012) using the still current national NHMRC (2015) blood lead management goal of 5 µg/dL. This is also the same blood lead management goal cited in a recently released report by Taylor et al. (2019) entitled *Environmental Lead Risks at Broken Hill, New South Wales, Australia: Sources, Exposures and Forward Solutions.*

BHOP is now seeking an additional modification (termed Modification 13, or MOD13) to their current mining operations (Project Approval PA 07_0018, as modified) at the RASP Mine. The proposal involves the following (BH Mines 2025):

- Extending mining operations into the British deposit.
- Installation of an escape ladder way from the underground workings to the surface.
- Changes to onsite operations to include a tailings dewatering system.
- Receipt and processing of ore from the Pinnacles Mines. This would maintain the same volumes of ore processing (i.e. 500,000 tpa) but proposes for a proportion of this crushed ore (up to 500,000 tpa) to be sourced from another mine (i.e. the Pinnacles Mine) located 15 km south-west of the Broken Hill township.
- Extending the life of PA07_0018 for five years, until 31 December 2031.

Zephyr Environmental (2025a, b, c)[1] conducted air quality modelling to determine whether the proposal is likely to change the air quality emissions from the existing situation which

[1] SLR was provided with a draft air quality assessment (Zephyr Environmental 2025a), as well as two spreadsheets via BHOP:

- Zephyr Environmental (2025b). Excel spreadsheet entitled "MOD13 Results Summary". Received from BHOP 25/09/2025.

underpins the data also used in the 2020 HHRA. The results provided were used by SLR on face value; no data checks or verification were undertaken.

The following two modelled scenarios were considered by Zephyr Environmental (2025a).

- Scenario 1: Current approved operations, (i.e. existing situation), with 500,000 tpa of ore extracted from the RASP Mine, continued operation of concrete batching plant, tailings harvesting at TSF2 and trucking tailings to TSF.
- Scenario 2: Most conservative proposed situation, i.e. 500,000 tpa from Pinnacles (0 tpa from RASP), continued operation of concrete batching plants, tailings harvesting at TSF2 and trucking tailings to TSF. Note whilst only a fraction of ore may come from Pinnacles, this scenario is considered to be the most conservative scenario as there is a longer haul path from the gate of the RASP Mine for Pinnacles ore than if ore were to continue to come solely from the RASP Mine.

Since Scenario 2 also still includes tailings harvesting from TSF2, any future introduction of a dewatering facility would remove the need for this tailings harvesting and would therefore likely result in lower air emissions (Zephyr Environmental 2025a).

Zephyr Environmental (2025a, b) undertook predictions for each air quality metric and averaging period for all 70 receptors referenced within the 2020 HHRA. Whilst a small increase in TSP, PM_{10}, $PM_{2.5}$ and overall dust deposition was predicted by the modelling, no change or a decrease was predicted for the cumulative annual ambient air lead concentration (as TSP) and cumulative annual lead deposition (see **Table 1**). Zephyr Environmental (2025a) concluded that the proposed modification is not predicted to cause any new exceedances of the established air quality standards at any of the sensitive receptor locations.

Table 1: Summary of predicted change in cumulative air quality parameters for Scenario 2 (MOD13 proposal) compared with Scenario 1 (existing situation) (Zephyr Environmental 2025a, c)

Air quality parameter	Predicted change presented as range across all receptors (Scenario 2 vs. Scenario 1) [average ±SD]	Predicted change (Scenario 2 vs. Scenario 1) expressed as a percentage (%)
Annual TSP (µg/m^3)	0.001 to 0.126 (0.015 ± 0.02)	0.003 to 0.36% (0.04 ± 0.06%)
Annual PM_{10} (µg/m^3)	0.0007 to 0.049 (0.007 ± 0.008)	0.006 to 0.06% (0.06 ± 0.06%)
Annual $PM_{2.5}$ (µg/m^3)	0.0001 to 0.0076 (0.0009 ± 0.001)	0.002 to 0.15% (0.02 ± 0.02%)
Monthly dust deposition (g/m^2/month)	-0.13 to 0.25 (0.012 ± 0.06)	-11 to 36% (2 ± 7%)
Annual lead (µg/m^3), as TSP	-0.00002 to -0.002 (-0.0004 ± 0.0004)	-0.02 to -1.3% (-0.3 ± 0.29%)
Annual lead deposition (g/m^2/year)	-0.0001 to -0.005 (-0.001 ± 0.001)	-2.2 to -26% (-9.7 ± 4.5%)
SD = Standard Deviation.		

- Zephyr Environmental (2025c). Excel spreadsheet entitled “Results for HHRA – 19.09.25”. Received from BHOP 19/09/2025.

BHOP have requested SLR to consider whether the changes to the air quality predictions impact on the conclusions made in the HHRA Report, and the associated addendum (SLR 2021).

2.0 Assessment

Each scenario previously assessed by SLR (2020, 2021, 2022) assumed the same emissions will occur for the remainder of the currently approved mine life (i.e. 2022-2026 or approximately 5 years). Soil metal concentrations from deposition onto existing soil were estimated using standard equations from the United States Environmental Protection Agency (US EPA) which incorporate physical loss of metal from soil due to surface water runoff. Other loss processes (soil erosion, leaching) were not included.

Since the air quality predictions for MOD13 show cumulative annual lead concentrations and annual lead deposition are anticipated to decrease slightly from the existing situation (see **Table 1**), this would not impact the HHRA conclusions with respect to the blood lead modelling undertaken for the currently approved mine life (i.e. till December 2026).

However, MOD13 also proposes to extend the life of PA07_0018 for five years, until 31 December 2031. To investigate whether the proposed extended mine life may change the HHRA conclusions, the potential cumulative soil lead (and associated total dust lead) concentrations were estimated as follows.

- Using the lead deposition rates modelled by Zephyr (2025a, c), the same equation and approach outlined in the 2020 HHRA was used to estimate the additional soil lead concentrations at each receptor location after 10 years of mine life. Ten years was used instead of the five years previously used to cater for the period covered by the 2020 HHRA (approximately 2022-2026 plus an additional five years 2026-2031).
- The existing soil lead concentrations sourced from the literature and used in the 2020 HHRA were also retained, except that soil loss was incorporated over a 10-year period rather than a 5-year period.
- The resulting existing soil lead concentrations (incorporating soil loss from runoff over a 10-year period) were added to the potential additional soil lead concentrations at each receptor location after 10 years of mine life, consistent with the methodology in the 2020 HHRA.
- Total indoor dust lead concentrations after 10 years of mine life were then estimated from total soil lead concentrations by multiplying soil lead concentrations by a factor of 1.5, consistent with the methodology in the 2020 HHRA.

The above was done for both Scenario 1 (the existing cumulative situation) and Scenario 2 (the proposed cumulative situation which includes MOD13).

The results, compared with the concentrations used in the 2020 HHRA, are presented in **Table 2**.

Table 2: Summary of estimated soil lead and indoor dust lead concentrations (1) used in the 2020 HHRA (assumes 5-year mine life) compared with those estimated for the proposed extended mine life (MOD13)

Parameter	2020 HHRA (2)	MOD13 Proposal (3)
Scenario 1 (existing situation) additional soil lead concentration (mg/kg)	0.2 – 11.3	0.6 – 21.9

Parameter	2020 HHRA (2)	MOD13 Proposal (3)
Scenario 2 (proposed situation) additional soil lead concentration (mg/kg)	0.2 – 11.1	0.6 – 20.5
Existing soil lead concentration incorporating loss	78.2 – 2,394.5	76.4 – 2,340.3
Scenario 1 (existing situation) total soil lead concentration after remaining mine life	78.6 – 2,395.2	77.5 – 2,341.6
Scenario 2 (proposed situation) total soil lead concentration after remaining mine life	78.6 – 2,395.2	77.4 – 2,341.6
Scenario 1 (existing situation) total indoor dust lead concentration after remaining mine life	117.9 – 3,592.8	116.3 – 3,512.4
Scenario 2 (proposed situation) total indoor dust lead concentration after remaining mine life	117.9 – 3,592.8	116.1 – 3,512.3
(1) Concentration ranges in this table represent the range for the 70 receptors included in the 2020 HHRA and the Zephyr Environmental (2025a, c) modelling. (2) In the 2020 HHRA, the remaining mine life modelled was assumed to be 5 years (from 2022-2026). (3) The MOD13 proposal proposes to extend the mine life to December 2031 (i.e. a total of approximately 10 years from 2022).		

From **Table 2**, the following can be concluded.

- As would be predicted, the proposed 5-year extension to the mine life is predicted to result in an approximate 2- to 3-fold change of the 'additional' soil lead concentration contributed by the mine over this time (i.e. 0.6 – 20.5 mg/kg for MOD13 vs. 0.2 – 11.1 mg/kg in 2020 HHRA).
- However, due to:
    - the much larger contribution of existing soil lead concentrations to total soil lead concentrations[2]; and
    - the larger proportional predicted loss of lead from existing soils over a 10-year period than a 5-year period[3];

  the total soil lead concentration estimated at the end of 10 years of remaining operation (i.e. 77.4 – 2,341.6 mg/kg for MOD13) is lower than that predicted in the 2020 HHRA at the end of 5 years of remaining operation (i.e. 78.6 – 2,395.2 mg/kg).

[2] The 'additional' soil lead contributed by the MOD13 Proposal makes up a very small fraction of the total soil lead, i.e. 0.8 to 0.9% of total soil lead. Soil lead (and therefore dust lead) exposure is dominated by the existing soil lead present in Broken Hill from the natural mineralogy of the area and historical mining practices. The 2020 HHRA (Figure 3-10) showed clearly that the 'additional' soil and dust lead from MOD6 contributes less than 0.5% to the IEUBK modelled geometric mean blood lead in children. A similar proportionality would also apply to MOD13. The source of lead exposure (and therefore the source of modelled blood lead) is markedly dominated by the contributions from exposure to existing soil and dust lead (i.e. 28 to 92% according to the 2020 HHRA, depending on the receptor location) and dietary exposure (i.e. 7 to 67%, depending on the receptor location). It therefore follows that even a 2- to 3-fold change in 'additional' soil lead as a result of MOD13 will make very little difference to blood lead levels since a doubling or a tripling of a very small number is still a very small number.

[3] Due to the concentration of existing soil lead being much larger than any 'additional' soil lead predicted to result from MOD13, the loss of lead from existing soil over the 10-year period outweighs the added soil lead predicted from MOD13 over the 10-year period.

- As the indoor dust lead concentrations are linearly related to the soil lead concentrations, the same is also true for indoor dust lead (i.e. 116.1 – 3,512.3 mg/kg for MOD13 vs. 117.9 – 3,592.8 mg/kg in 2020 HHRA).

Since modelled blood lead is broadly linearly related to total lead exposure, MOD13 is therefore not anticipated to result in an increase of blood lead levels in Broken Hill children. Indeed, for MOD13, total lead exposures are predicted to decrease slightly over the course of the proposed extended mine life compared to those modelled in the 2020 HHRA.

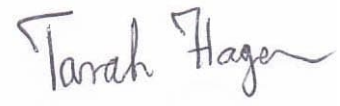
3.0 Overall Conclusion

The MOD13 proposal does not change the 2020 HHRA conclusions (SLR 2020) nor the conclusions in the HHRA addendum (SLR 2021) or the MOD10 letter (SLR 2022).

Closure

Regards,

SLR Consulting Australia Pty Ltd



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4.0 References

BH Mines (2025). Rasp Mine (PA07_0018) – Modification 13 (MOD13). Drat letter addressed to NSW Department of Planning, Housing and Infrastructure. 5 November 2025.

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SLR (2022). Letter entitled ‘Potential impact of MOD10 on MOD6 HHRA conclusions’. Prepared for Broken Hill Operations Pty Ltd. 29 September 2022.

Taylor MP, Isley CF, Lyle D, Cattle S, Dong C, Juhasz A, Morrison AL (2019). Environmental Lead Risks at Broken Hill, New South Wales, Australia: Sources, Exposures and Forward Solutions. Macquarie University, NSW, Australia. ISBN: 978-1-86408-844-1.

Zephyr Environmental (2025a). Rasp Mine Modification 13 Air Quality Assessment. Project Number 0370. Draft 01. Dated 26 September 2025.

Zephyr Environmental (2025b). Excel spreadsheet entitled “MOD13 Results Summary”. Received from BHOP 25/09/2025.

Zephyr Environmental (2025c). Excel spreadsheet entitled “Results for HHRA – 19.09.25”. Received from BHOP 19/09/2025.

Appendix M
Geochemical Assessment

EMM
creating opportunities

Brisbane

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Memorandum

To:	Joel Sulicich – Health, Safety, Environment and Training Manager, Broken Hill Mines
From:	James Tuff, Senior Lead - Geochemistry
Cc:	Devon Roberts – Broken Hill Mines
Document No:	B-1231-220_m01final
Date:	9 March 2026
Re:	**Rasp Tailings Geochemical Characterisation**

Broken Hill Mines operates and supports both the Rasp Mine and the Pinnacles Mine in New South Wales and as part of the MOD 13 application, is planning to transport ore from Pinnacles for processing at Rasp, followed by disposal of both the Pinnacles and Rasp tailings at the Rasp tailings storage facility (TSF). Both the historic Rasp Mine and the satellite Pinnacles Mine are silver-lead-zinc (Ag-Pb-Zn) deposits, with similar ore mineralogy, particularly with regards to sulfides in the form of galena (PbS) and sphalerite (ZnS). The mines are located only 10-15 km apart and belong to the same 'Broken Hill Type' deposit.

Given the geological and mineralogical similarities of the two deposits, it is already understood that processing Pinnacles ore at Rasp should not result in major impacts to either the current Rasp process methodology or the environment once placed in the TSF; however, to provide additional confidence that this would be the case, Broken Hill Mines commissioned additional geochemical test work on the tailings of each deposit to verity the geochemistry. This memorandum outlines the geochemical characterisation of the tailings samples commissioned by Broken Hill Mines and undertaken by Okane Consultants (Okane).

Tailings Samples and Testing

Five tailings samples were collected from both the Rasp and Pinnacles tailings streams. The samples were sent to ALS for testing, which included:

- Acid base accounting (ABA): total sulfur concentrations, acid neutralisation capacity (ANC), maximum potential acidity (MPA), net acid producing potential (NAPP), pH and electrical conductivity (EC).

- Total metal/metalloid contents: aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (B), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silver (Ag), strontium (Sr), thallium (Tl), thorium (Th), tin (Sn), titanium (Ti), uranium (U), vanadium (V), zinc (Zn), lanthanum (La).

- Australian Standard Leaching Procedure (ASLP) leachate under acetate leach: chromium (Cr), mercury (Hg), cyanide (CN), and fluoride (F).

Sample details and the results of some key parameters are shown in Table 1. Full laboratory test results are shown in Appendix A.

Table 1: Rasp and Pinnacles Tailings Geochemistry

Parameter	Unit	Rasp Tailings					Pinnacles Tailings				
		1	2	3	4	5	1	2	3	4	5
Total Sulfur	%	1.08	0.94	0.89	1.09	1.14	1.68	1.69	1.76	1.62	1.67
MPA	kg H_2SO_4/t	33.05	28.76	27.23	33.35	34.88	51.41	51.71	53.86	49.57	51.10
ANC	kg H_2SO_4/t	6.8	5.9	5.9	5.8	5.5	4.0	1.8	<0.5	0.6	1.6
NAPP	kg H_2SO_4/t	26.2	22.9	21.3	27.6	29.4	47.4	49.9	53.9	49.0	49.5
pH		7.7	8.0	8.5	7.8	7.7	5.0	5.0	5.0	5.0	5.0
EC	µS/cm	3,000	2,800	2,600	3,400	1,800	2,800	2,800	2,900	2,600	2,900
Aluminium	mg/kg	10,000	9,500	9,900	11,000	8,900	12,000	11,000	13,000	13,000	12,000
Arsenic	mg/kg	110	91	97	110	110	1,200	1,200	1,300	1,300	1,200
Cadmium	mg/kg	9	4.1	5.1	11	4.7	86	76	98	74	80
Chromium	mg/kg	21	18	18	21	17	16	15	17	17	16
Lead	mg/kg	1,100	790	640	910	910	2,900	2,800	3,200	3,100	3,100
Silver	mg/kg	<5	<5	<5	<5	<5	15	15	16	17	16
Zinc	mg/kg	2,000	910	1,100	1,700	1,100	8,500	10,000	12,000	10,000	11,000
Leached Fluoride	mg/L	5.5	2.1	1.8	1.9	7.5	<0.3	<0.3	<0.3	<0.3	<0.3
Leached Chromium	mg/L	0.02	0.03	0.02	0.02	0.03	<0.01	<0.01	<0.01	<0.01	<0.01

Data from Broken Hill Mines and ALS; all samples were collected on 30th December 2025; '<' denotes a value at or below the laboratory limit of reporting (LOR).

Results and Interpretation

Acid-Base Accounting

Figure 1 compares the MPA (where MPA = 30.6 x total sulfur) and ANC of the Rasp and Pinnacles tailings samples.

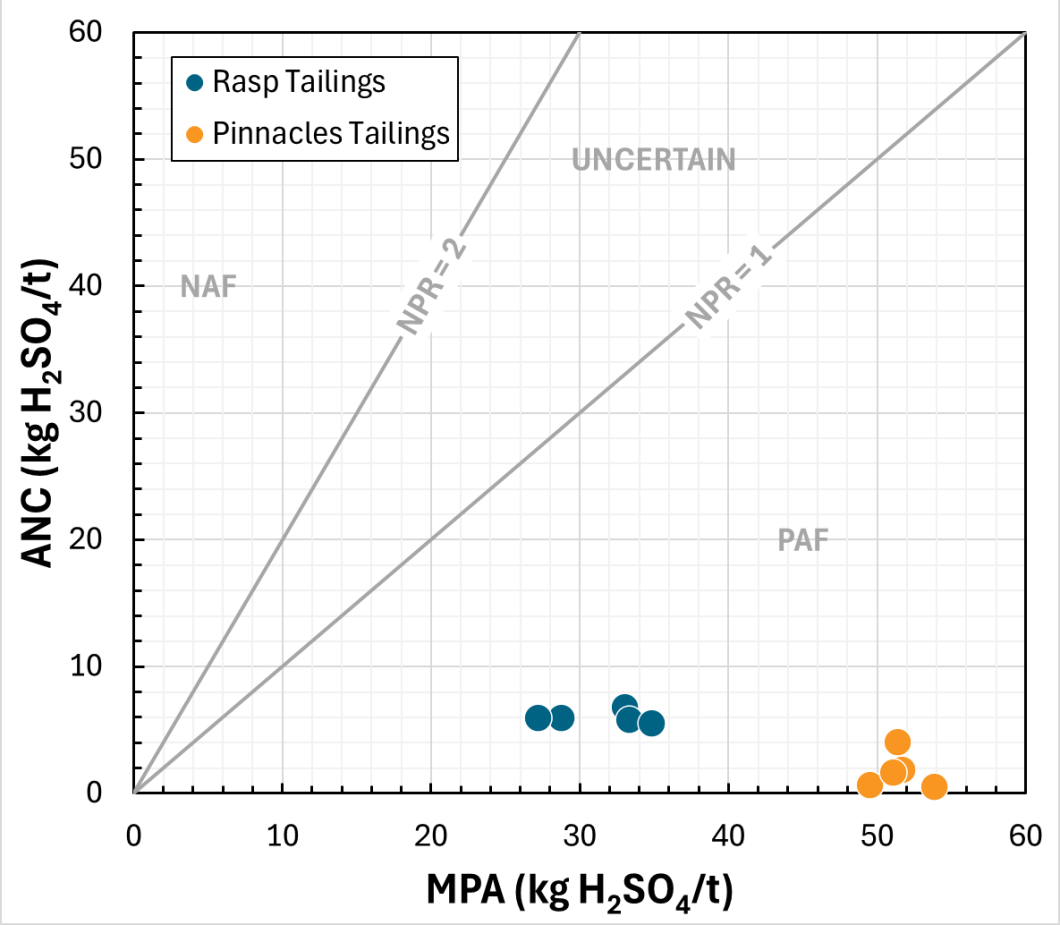

Figure 1: Maximum Potential Acidity (MPA) versus Acid Neutralisation Capacity (ANC) for the Rasp and Pinnacles tailings samples

Data from Broken Hill Mines and ALS. NPR refers to Neutralisation Potential Ratio and is calculated by dividing the ANC by the MPA. A value of NPR less than 1 indicates that the material is potentially acid forming (PAF); values of NPR greater than 2 are designated as non-acid forming (NAF); NPR values between 1 and 2 are classed as Uncertain (Price, 2009).

The Pinnacles tailings report higher MPA values than those from Rasp, although both sets of tailings samples are classified as potentially acid forming (PAF). However, pH values in both the Rasp and Pinnacles tailings samples are near-neutral to moderately alkaline (Table 1), indicating that there is limited readily oxidisable and leachable acidity in the tailings. The MPA values calculated here assume that all sulfur in each sample is present as acid-contributing iron sulfide (pyrite, FeS_2), and overestimate the maximum potential acidity, particularly (as is the case for both the Rasp and

Pinnacles samples) when the sample contains significant proportions of sulfur species that do not contribute to acid generation. Table 2 shows an estimate of the proportions of galena and sphalerite, which have limited impact on acid generation, in the Rasp and Pinnacles tailings, based on the concentrations of lead, zinc and sulfur. Using the stoichiometry of galena (PbS) and sphalerite (ZnS), and assuming that all lead and zinc is hosted in these sulfides, Table 2 shows that these minerals may represent up to 40% of the sulfur-hosted species in the ore, significantly reducing the acid potential of the samples, and indicating that the Pinnacles tailings samples are unlikely to represent any additional acid generation risk when disposed with the Rasp tailings.

Table 2: Estimated MPA Using Galena and Sphalerite Stoichiometry

Parameter	Unit	Rasp Tailings					Pinnacles Tailings				
		1	2	3	4	5	1	2	3	4	5
Zinc	mg/kg	2,000	910	1,100	1,700	1,100	8,500	10,000	12,000	10,000	11,000
Lead	mg/kg	1,100	790	640	910	910	2,900	2,800	3,200	3,100	3,100
Sulfur in ZnS	mg/kg	984	448	542	837	542	4,185	4,923	5,908	4,923	5,415
Sulfur in PbS	mg/kg	170	122	99	140	141	448	432	494	479	479
Estimated ZnS	%	11	6	8	9	6	28	35	37	35	36
Estimated PbS	$	2	2	1	1	2	3	3	3	3	3

Stoichiometry based on ZnS and PbS with the relative atomic masses 65 $gmol^{-1}$ (Zn), 207 $gmol^{-1}$ (Pb) and 32 $gmol^{-1}$ (S).

Metals and Metalloids

Figure 2 compares the metal and metalloid contents of the Rasp and Pinnacles samples. Both sets of samples report similar concentrations for most elements, although the Pinnacles samples contain around ten times the concentrations of arsenic, cadmium, lead and zinc compared to the Rasp samples (Table 2). However, the overall dissolved load of both the Rasp and Pinnacles tailings samples is similar: Figure 3 shows that the electrical conductivity of the Pinnacles samples falls well within the range of the Rasp samples. This indicates that the leaching of readily mobile ions is similar in both sets of samples and that the Pinnacles tailings is unlikely to pose any greater risk than the Rasp tailings.

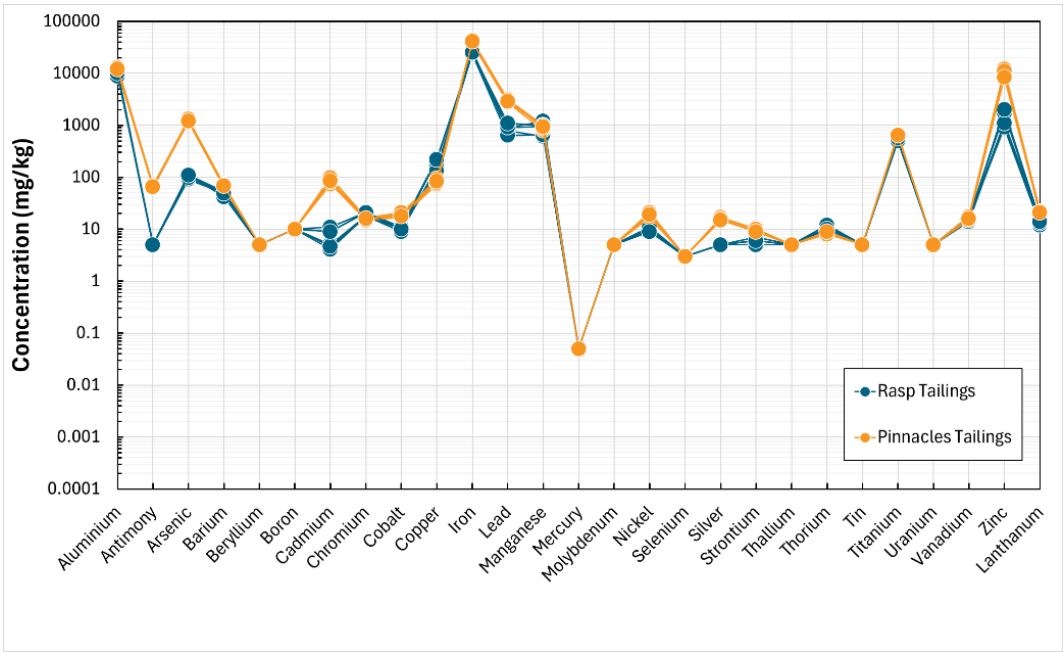

Figure 2: Comparison of metal and metalloid concentrations in Rasp and Pinnacles tailings samples

Data from Broken Hill Mines and ALS.

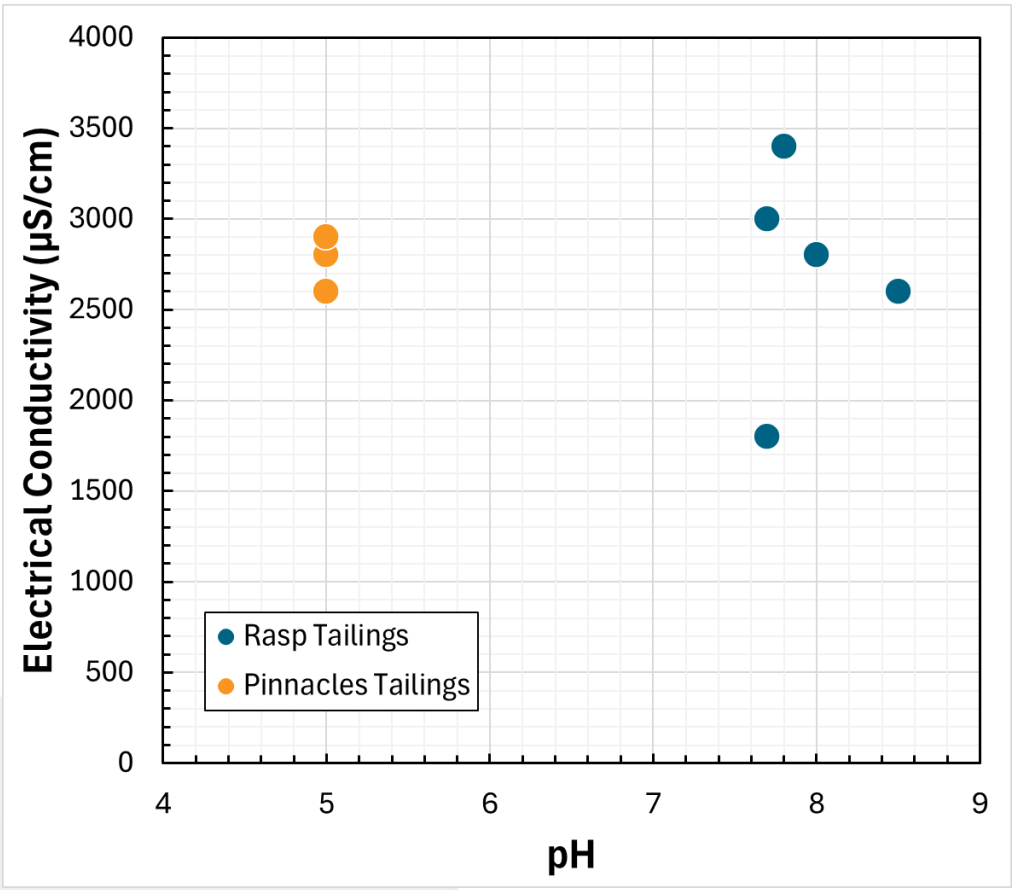

Figure 3: pH versus electrical conductivity in the Rasp and Pinnacles tailings samples

Data from Broken Hill Mines and ALS.

Tailings Leachate

In addition to similar electrical conductivities, the Rasp and Pinnacles tailings samples exhibit similar leaching characteristics: results from the ASLP tests (using an acetate solution buffered at pH 5) to simulate leaching shows that the Rasp samples record higher dissolved concentrations, and in particular fluoride concentrations are reported at least one order of magnitude higher than those from the Pinnacles samples. This further indicates that the leaching behaviour of the Pinnacles tailings once placed is unlikely to cause additional impact to the TSF.

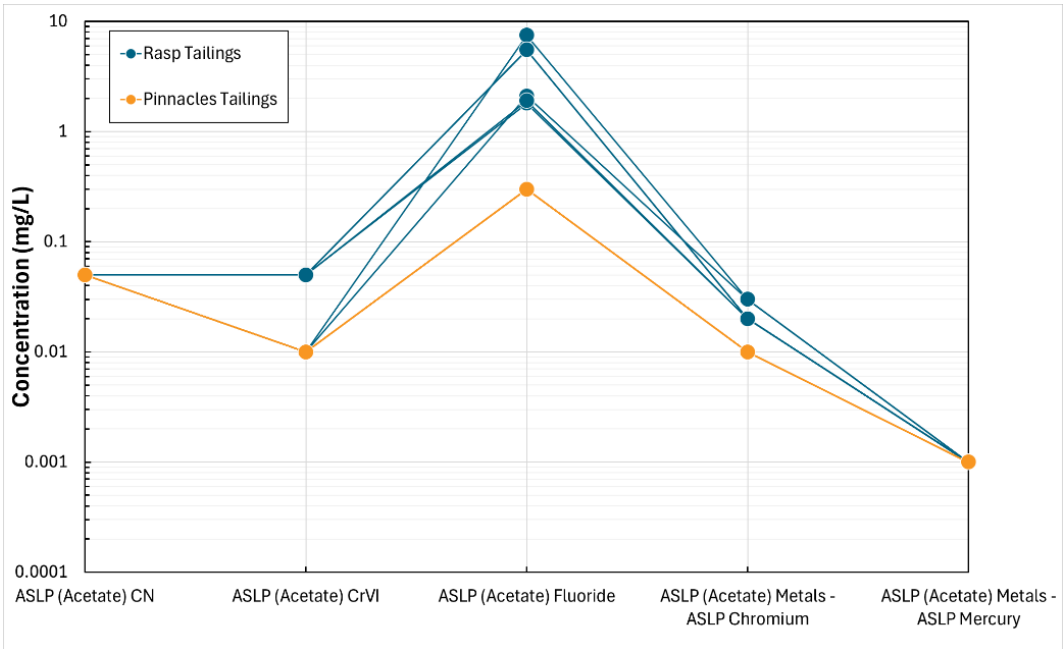

Figure 4: ASLP acetate leaching results for Rasp and Pinnacles tailings

Data from Broken Hill Mines and ALS.

Conclusions

Geochemical testing of five representative samples of Rasp tailings and five representative samples of Pinnacles tailings included acid-base accounting, metal and metalloid concentrations, and leach testing. The results and following characterisation indicate that the respective tailings deposits are expected to behave similarly geochemically and that placement of the Pinnacles tailings within the Rasp TSF is unlikely to cause additional impacts to the receiving environment.

Closing

We trust information provided in this memorandum is satisfactory for your requirements. Please do not hesitate to contact me at +61 450 340 432 or jtuff@ockanconsultants.com should you have any questions or comments.

References

Mindat. (2022). *Mineral Species from Broken Hill, NSW and its Outlying Regions.* Aricle 4285.

Price, B. (2009). *Prediction Manual for Drainage Chemistry from Sulfidic Geologic Materials.* MEND Report 1.20.1.

Appendix A: ALS Laboratory Test Results

CERTIFICATE OF ANALYSIS

Batch No:	**26-08080**		
Final Report	**332656**		
		Laboratory	Scoresby Laboratory
		Address	Caribbean Business Park, 22 Dalmore Drive, Scoresby, VIC 3179
Client:	**Onsite Laboratory Services Pty Ltd**		
Contact:	**Wendell Goyne**		
Address:	2 Abel Street BENDIGO VIC 3355 AUSTRALIA	*Phone* *Fax*	03 8756 8000 03 9763 1862
		Contact:	Brad Snibson Client Manager Brad.Snibson@alsglobal.com
PO No:	**Not Available**	Date Sampled:	**30-Dec-2025 - 14-Jan-2026**
Sampler Name:		Date Samples Received:	**14-Jan-2026**
ALS Program Ref:	**OSLS**	*Date Issued:*	**10-Feb-2026**
Program Description:	**Analysis for Onsite Laboratory Services**		
Client Ref:	**Analysis**		

The hash (#) below indicates methods not covered by NATA accreditation in the performance of this service .

Analysis	*Method*	*Laboratory*	*Analysis*	*Method*	*Laboratory*
ASLP(Acetate) Prep	WN33SC	Scoresby	ASLP (Acetate) CN	WK026SF, WN33SC	Scoresby
ASLP (Acet.) Cr6+	WG050G, WN33SC	Scoresby	ASLP(Acet) F	WK040LL, WN33SC	Scoresby
EC	WA010	Scoresby	MS ASLP(Acet) Metals	WG020A; WN33SC	Scoresby
MS Total Metals	WG020B	Scoresby	OES Total	WG005B	Scoresby
pH	EA002	Scoresby	Cyanide	WK026SF	Scoresby
NAPP #	Outsourced	ALS Brisbane			

100 grams of sample was taken for ASLP determinations unless a lesser amount was submitted to this laboratory .

Signatories

Name	*Title*	*Name*	*Title*
Alan Chung	**Team Leader Metals**	**Brad Snibson**	**Client Manager**
Joseph De Alwis	**Analyst**	**Jessica Kelly**	**Chemist / Analyst**
Thanh U. Nguyen	**Analyst**		

Samples not collected by ALS and are tested as received.

Soil microb

Calculated results are based on raw data.

Samples are tested within holding time unless otherwise stated.

Results contained within this report relate only to the samples tested.
The report shall not be reproduced, except in full.

Batch No:	**26-08080**
Report Number:	**332656**
Client:	**Onsite Laboratory Services Pty Ltd**
ALS Program Ref:	**OSLS**
Program Description:	**Analysis for Onsite Laboratory Services**

For holding time compliance, method uncertainty, quality control and brief method summary, please refer to accompanying QC report.When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference. LOR = Limit of Reporting

Sample No	Site Code	Site Description	Sample Type	Sampled Date/Time
12104376	NONE	MH Cyanide	WATER	14/01/26
12104377	NONE	38 39 40 41	WATER	14/01/26
12104378	NONE	Pinnacles Tailings 1	SOIL	30/12/25

Analysis - Analyte	*Sample No. Site Code Units*	*LOR*	12104376 NONE	12104377 NONE	12104378 NONE
NAPP - Net Acid Production Potentia	kg H2SO4/t	0.5			47
Cyanide - Total Cyanide, as CN	mg/L	0.005	25000	230	
pH - pH, units	Units	0.1			5.0
EC - EC, uS/cm @ 25C	uS/cm	2			2800
ASLP (Acetate) CN - ASLP Cyanide	mg/L	0.005			<0.05
ASLP (Acet.) Cr6+ - ASLP Chromium 6+	mg/L	0.01			<0.01
ASLP(Acet) F - Leachate Fluoride	mg/L	0.3			<0.3
MS Total Metals - Aluminium	mg/kg	5			12000
MS Total Metals - Antimony	mg/kg	5			66
MS Total Metals - Arsenic	mg/kg	5			1200
MS Total Metals - Barium	mg/kg	5			68
MS Total Metals - Beryllium	mg/kg	5			<5
MS Total Metals - Boron	mg/kg	10			<10
MS Total Metals - Cadmium	mg/kg	0.2			86
MS Total Metals - Chromium	mg/kg	5			16
MS Total Metals - Cobalt	mg/kg	5			18
MS Total Metals - Copper	mg/kg	5			84
MS Total Metals - Iron	mg/kg	10			41000
MS Total Metals - Lead	mg/kg	5			2900
MS Total Metals - Manganese	mg/kg	5			940
MS Total Metals - Mercury	mg/kg	0.05			<0.05
MS Total Metals - Molybdenum	mg/kg	5			<5
MS Total Metals - Nickel	mg/kg	5			19
MS Total Metals - Selenium	mg/kg	3			<3
MS Total Metals - Silver	mg/kg	5			15
MS Total Metals - Strontium	mg/kg	5			9
MS Total Metals - Thallium	mg/kg	5			<5
MS Total Metals - Thorium	mg/kg	5			9
MS Total Metals - Tin	mg/kg	5			<5
MS Total Metals - Titanium	mg/kg	5			640
MS Total Metals - Uranium	mg/kg	5			<5
MS Total Metals - Vanadium	mg/kg	5			16
MS Total Metals - Zinc	mg/kg	5			8500
MS Total Metals - Lanthanum	mg/kg	5			21
MS ASLP(Acet) Metals - ASLP-Chromium	mg/L	0.01			<0.01
MS ASLP(Acet) Metals - ASLP-Mercury	mg/L	0.001			<0.001
OES Total - Sulphur	mg/kg	50			15000
ASLP(Acetate) Prep - Initial pH	pH units	-			>5.0
ASLP(Acetate) Prep - Leach Fluid pH	pH units	-			5.0
ASLP(Acetate) Prep - After HCL pH	pH units	-			<5.0
ASLP(Acetate) Prep - Solids Leachate pH (post rolling)	pH units	-			4.7

Batch No:	**26-08080**
Report Number:	**332656**
Client:	**Onsite Laboratory Services Pty Ltd**
ALS Program Ref:	**OSLS**
Program Description:	**Analysis for Onsite Laboratory Services**

For holding time compliance, method uncertainty, quality control and brief method summary, please refer to accompanying QC report.When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference. LOR = Limit of Reporting

Sample No	Site Code	Site Description	Sample Type	Sampled Date/Time
12104379	NONE	Rasp Tailings 1	SOIL	30/12/25
12108548	NONE	Pinnacle Tailing 2	SOIL	30/12/25
12108549	NONE	Pinnacle Tailing 3	SOIL	30/12/25

Analysis - Analyte	*Sample No. Site Code Units*	*LOR*	12104379 NONE	12108548 NONE	12108549 NONE
NAPP - Net Acid Production Potentia	kg H2SO4/t	0.5	26	50	54
pH - pH, units	Units	0.1	7.7	5.0	5.0
EC - EC, uS/cm @ 25C	uS/cm	2	3000	2800	2900
ASLP (Acetate) CN - ASLP Cyanide	mg/L	0.005	<0.05	<0.05	<0.05
ASLP (Acet.) Cr6+ - ASLP Chromium 6+	mg/L	0.01	<0.05 LINT	<0.01	<0.01
ASLP(Acet) F - Leachate Fluoride	mg/L	0.3	5.5	<0.3	<0.3
MS Total Metals - Aluminium	mg/kg	5	10000	11000	13000
MS Total Metals - Antimony	mg/kg	5	5	64	69
MS Total Metals - Arsenic	mg/kg	5	110	1200	1300
MS Total Metals - Barium	mg/kg	5	49	63	71
MS Total Metals - Beryllium	mg/kg	5	<5	<5	<5
MS Total Metals - Boron	mg/kg	10	<10	<10	<10
MS Total Metals - Cadmium	mg/kg	0.2	9.0	76	98
MS Total Metals - Chromium	mg/kg	5	21	15	17
MS Total Metals - Cobalt	mg/kg	5	10	17	20
MS Total Metals - Copper	mg/kg	5	220	74	93
MS Total Metals - Iron	mg/kg	10	25000	38000	44000
MS Total Metals - Lead	mg/kg	5	1100	2800	3200
MS Total Metals - Manganese	mg/kg	5	980	800	1000
MS Total Metals - Mercury	mg/kg	0.05	<0.05	<0.05	<0.05
MS Total Metals - Molybdenum	mg/kg	5	<5	<5	<5
MS Total Metals - Nickel	mg/kg	5	9	17	20
MS Total Metals - Selenium	mg/kg	3	<3	<3	<3
MS Total Metals - Silver	mg/kg	5	<5	15	16
MS Total Metals - Strontium	mg/kg	5	6	9	10
MS Total Metals - Thallium	mg/kg	5	<5	<5	<5
MS Total Metals - Thorium	mg/kg	5	10	8	9
MS Total Metals - Tin	mg/kg	5	<5	<5	<5
MS Total Metals - Titanium	mg/kg	5	560	600	690
MS Total Metals - Uranium	mg/kg	5	<5	<5	<5
MS Total Metals - Vanadium	mg/kg	5	16	15	18
MS Total Metals - Zinc	mg/kg	5	2000	10000	12000
MS Total Metals - Lanthanum	mg/kg	5	14	19	22
MS ASLP(Acet) Metals - ASLP-Chromium	mg/L	0.01	0.02	<0.01	<0.01
MS ASLP(Acet) Metals - ASLP-Mercury	mg/L	0.001	<0.001	<0.001	<0.001
OES Total - Sulphur	mg/kg	50	9200	14000	16000
ASLP(Acetate) Prep - Initial pH	pH units	-	>5.0	>5.0	>5.0
ASLP(Acetate) Prep - Leach Fluid pH	pH units	-	5.0	5.0	5.0
ASLP(Acetate) Prep - After HCL pH	pH units	-	<5.0	<5.0	<5.0
ASLP(Acetate) Prep - Solids Leachate pH (post rolling)	pH units	-	4.8	4.7	4.7

LINT Level of Reporting raised due to interferences in the sample matrix

Batch No: **26-08080**
Report Number: **332656**
Client: **Onsite Laboratory Services Pty Ltd**
ALS Program Ref: **OSLS**
Program Description: **Analysis for Onsite Laboratory Services**

For holding time compliance, method uncertainty, quality control and brief method summary, please refer to accompanying QC report.When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference. LOR = Limit of Reporting

Sample No	Site Code	Site Description	Sample Type	Sampled Date/Time
12108550	NONE	Pinnacle Tailing 4	SOIL	30/12/25
12108551	NONE	Pinnacle Tailing 5	SOIL	30/12/25
12108552	NONE	Rasp Tailing 2	SOIL	30/12/25

Analysis - Analyte	*Sample No. Site Code Units*	*LOR*	12108550 NONE	12108551 NONE	12108552 NONE
NAPP - Net Acid Production Potentia	kg H2SO4/t	0.5	49	50	23
pH - pH, units	Units	0.1	5.0	5.0	8.0
EC - EC, uS/cm @ 25C	uS/cm	2	2600	2900	2800
ASLP (Acetate) CN - ASLP Cyanide	mg/L	0.005	<0.05	<0.05	<0.05
ASLP (Acet.) Cr6+ - ASLP Chromium 6+	mg/L	0.01	<0.01	<0.01	<0.01
ASLP(Acet) F - Leachate Fluoride	mg/L	0.3	<0.3	<0.3	2.1
MS Total Metals - Aluminium	mg/kg	5	13000	12000	9500
MS Total Metals - Antimony	mg/kg	5	68	65	<5
MS Total Metals - Arsenic	mg/kg	5	1300	1200	91
MS Total Metals - Barium	mg/kg	5	70	69	49
MS Total Metals - Beryllium	mg/kg	5	<5	<5	<5
MS Total Metals - Boron	mg/kg	10	<10	<10	<10
MS Total Metals - Cadmium	mg/kg	0.2	74	80	4.1
MS Total Metals - Chromium	mg/kg	5	17	16	18
MS Total Metals - Cobalt	mg/kg	5	19	21	10
MS Total Metals - Copper	mg/kg	5	79	79	130
MS Total Metals - Iron	mg/kg	10	43000	41000	25000
MS Total Metals - Lead	mg/kg	5	3100	3100	790
MS Total Metals - Manganese	mg/kg	5	940	880	610
MS Total Metals - Mercury	mg/kg	0.05	<0.05	<0.05	<0.05
MS Total Metals - Molybdenum	mg/kg	5	<5	<5	<5
MS Total Metals - Nickel	mg/kg	5	19	21	10
MS Total Metals - Selenium	mg/kg	3	<3	<3	<3
MS Total Metals - Silver	mg/kg	5	17	16	<5
MS Total Metals - Strontium	mg/kg	5	10	9	<5
MS Total Metals - Thallium	mg/kg	5	<5	<5	<5
MS Total Metals - Thorium	mg/kg	5	9	9	9
MS Total Metals - Tin	mg/kg	5	<5	<5	<5
MS Total Metals - Titanium	mg/kg	5	670	660	560
MS Total Metals - Uranium	mg/kg	5	<5	<5	<5
MS Total Metals - Vanadium	mg/kg	5	17	17	16
MS Total Metals - Zinc	mg/kg	5	10000	11000	910
MS Total Metals - Lanthanum	mg/kg	5	21	21	12
MS ASLP(Acet) Metals - ASLP-Chromium	mg/L	0.01	<0.01	<0.01	0.03
MS ASLP(Acet) Metals - ASLP-Mercury	mg/L	0.001	<0.001	<0.001	<0.001
OES Total - Sulphur	mg/kg	50	14000	15000	8000
ASLP(Acetate) Prep - Initial pH	pH units	-	>5.0	>5.0	>5.0
ASLP(Acetate) Prep - Leach Fluid pH	pH units	-	5.0	5.0	5.0
ASLP(Acetate) Prep - After HCL pH	pH units	-	<5.0	<5.0	<5.0
ASLP(Acetate) Prep - Solids Leachate pH (post rolling)	pH units	-	4.8	4.8	4.8

Batch No:	**26-08080**
Report Number:	**332656**
Client:	**Onsite Laboratory Services Pty Ltd**
ALS Program Ref:	**OSLS**
Program Description:	**Analysis for Onsite Laboratory Services**

For holding time compliance, method uncertainty, quality control and brief method summary, please refer to accompanying QC report.When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference. LOR = Limit of Reporting

Sample No	Site Code	Site Description	Sample Type	Sampled Date/Time
12108553	NONE	Rasp Tailing 3	SOIL	30/12/25
12108554	NONE	Rasp Tailing 4	SOIL	30/12/25
12108555	NONE	Rasp Tailing 5	SOIL	30/12/25

Analysis - Analyte	*Sample No. Site Code Units*	*LOR*	12108553 NONE	12108554 NONE	12108555 NONE
NAPP - Net Acid Production Potentia	kg H2SO4/t	0.5	21	28	29
pH - pH, units	Units	0.1	8.5	7.8	7.7
EC - EC, uS/cm @ 25C	uS/cm	2	2600	3400	1800
ASLP (Acetate) CN - ASLP Cyanide	mg/L	0.005	<0.05	<0.05	<0.05
ASLP (Acet.) Cr6+ - ASLP Chromium 6+	mg/L	0.01	<0.05 LINT	<0.05 LINT	<0.01
ASLP(Acet) F - Leachate Fluoride	mg/L	0.3	1.8	1.9	7.5
MS Total Metals - Aluminium	mg/kg	5	9900	11000	8900
MS Total Metals - Antimony	mg/kg	5	<5	<5	<5
MS Total Metals - Arsenic	mg/kg	5	97	110	110
MS Total Metals - Barium	mg/kg	5	50	53	42
MS Total Metals - Beryllium	mg/kg	5	<5	<5	<5
MS Total Metals - Boron	mg/kg	10	<10	<10	<10
MS Total Metals - Cadmium	mg/kg	0.2	5.1	11	4.7
MS Total Metals - Chromium	mg/kg	5	18	21	17
MS Total Metals - Cobalt	mg/kg	5	9	11	11
MS Total Metals - Copper	mg/kg	5	160	230	130
MS Total Metals - Iron	mg/kg	10	24000	25000	27000
MS Total Metals - Lead	mg/kg	5	640	910	910
MS Total Metals - Manganese	mg/kg	5	660	1200	950
MS Total Metals - Mercury	mg/kg	0.05	<0.05	<0.05	<0.05
MS Total Metals - Molybdenum	mg/kg	5	<5	<5	<5
MS Total Metals - Nickel	mg/kg	5	9	10	11
MS Total Metals - Selenium	mg/kg	3	<3	<3	<3
MS Total Metals - Silver	mg/kg	5	<5	<5	<5
MS Total Metals - Strontium	mg/kg	5	<5	7	<5
MS Total Metals - Thallium	mg/kg	5	<5	<5	<5
MS Total Metals - Thorium	mg/kg	5	9	11	12
MS Total Metals - Tin	mg/kg	5	<5	<5	<5
MS Total Metals - Titanium	mg/kg	5	560	570	500
MS Total Metals - Uranium	mg/kg	5	<5	<5	<5
MS Total Metals - Vanadium	mg/kg	5	16	17	14
MS Total Metals - Zinc	mg/kg	5	1100	1700	1100
MS Total Metals - Lanthanum	mg/kg	5	13	15	16
MS ASLP(Acet) Metals - ASLP-Chromium	mg/L	0.01	0.02	0.02	0.03
MS ASLP(Acet) Metals - ASLP-Mercury	mg/L	0.001	<0.001	<0.001	<0.001
OES Total - Sulphur	mg/kg	50	7000	9700	8700
ASLP(Acetate) Prep - Initial pH	pH units	-	>5.0	>5.0	>5.0
ASLP(Acetate) Prep - Leach Fluid pH	pH units	-	5.0	5.0	5.0
ASLP(Acetate) Prep - After HCL pH	pH units	-	<5.0	<5.0	<5.0
ASLP(Acetate) Prep - Solids Leachate pH (post rolling)	pH units	-	4.8	4.8	4.8

LINT Level of Reporting raised due to interferences in the sample matrix

A blank space indicates no test performed.

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