BROKEN HILL OPERATIONS PTY LTD ABN 58 054 920 893

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26 October 2023

Mandana Mazaheri
Principal Planning Officer
Resource Assessments
Department of Planning Industry and Environment
GPO Box 39
Sydney NSW 2001

Re: 07_0018-Mod 11 Rasp Mine Modification11 - Submissions Report

Dear Mandana,

1. Introduction

I refer to your letter to CBH Resources (Broken Hill Operations – or BHO) dated 28 September 2023 requesting responses to issues raised in advice from NSW Government agencies. Notably there was one specific request for further information from the Department's Water Division (DPE Water).

This report summarises the issues raised, provides a commensurate response and has been prepared in accordance with State significant development guidelines – preparing a submissions report (DPIE 2022).

2. Summary of MOD11 proposal

On 28 July 2023 BHO submitted a modification application 07_0018 MOD11 under Section 4.55(1A) of the Environmental Planning & Assessment Act 1979. The proposed modification involves;

- extending mining development activities into the northern section of CML7 (Main Lode Blocks 13, 14 and 15) and
- installing a new ventilation intake to provide suitable ventilation to workers in the northern areas of the mine.

3. Submission analysis

Advice was received from four NSW Government agencies and one local government authority. Notably there was one specific request for further information from the Department's Water Division (DPE Water).

The advice and submissions received have been placed on the DPIE Major Projects Portal at: https://www.planningportal.nsw.gov.au/major-projects/projects/mod-11-ventilation-intake-and-underground-exploration

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4. Summary of submissions and responses

4.1. Resources Regulator

Comment: Resources Regulator advises that it has no specific comments regarding mine safety or mine rehabilitation matters in relation to the proposals.

Regulatory requirements if approved:

The proponent will be required to comply with rehabilitation requirements under the mining authorisations prior to the commencement of the works associated with the proposal.

Response: BHO will comply with rehabilitation requirements.

4.2. NSW EPA

Comment: Based on the information received, we do not object to the proposed modification.

Where approval is granted, an application to vary the EPL will be required to be submitted by the proponent to the EPA prior to the commencement of any activities associated with the modification.

Response: BHO notes and agrees to submit a variation to the EPL prior to the commencement of any activities associated with the modification.

4.3. Broken Hill City Council

Comment: Council understands the need for the modification and proposed works, and does not have any objection to proposed MOD 11.

Response: BHO acknowledges and appreciates the support from BHCC.

4.4. Department of Planning and Environment (DPE) Water

Prior to project determination

Issue 1 Water Take: The proponent should quantify the maximum annual volume of water take required for the project due to aquifer interference activities, including;

- provide the maximum potential inflows for the current mine and modification and
- compare the maximum potential inflow to the held entitlement to demonstrate that sufficient entitlement is held to account for take.

Response: EMM Consulting was engaged to conduct an independent review of the Rasp mine water balance, including the maximum potential inflows from the current mine and modification and determining whether the current entitlement is sufficient for these maximum inflows.

The review stated that maximum potential inflows at current/approved mining rates are expected to be 250ML/year (based on average climatic conditions, including rainfall) which is well within the current licence to extract up to 370ML/year groundwater. The full review and report can be found in Appendix A

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The mine will regularly review its water extraction rates in line with its Water Access Licence and where required take necessary steps to ensure sufficient water entitlement is held. This may (if required) include increasing its water allocation through purchasing another licence holders allocation on the water market.

Issue 2 Ground Water Impact Assessment: The proponent should provide a statement of impact against the minimal impact considerations of the NSW Aquifer Interference Policy (2012).

Response: EMM consulting was engaged to conduct an independent review of the potential impacts of modification activities against the minimal impact considerations of the NSW Aquifer Interference Policy (2012).

The proposed modification is not expected to exceed the minimal impact criteria. It is considered unlikely that the proposed modification would impact high priority groundwater dependent ecosystems (GDEs) or water supply works, due to the ongoing significant localised depressurisation of the regional fractured bedrock aquifer caused by the current approved mining activities. It is probable that the GDEs or water supply works access a separate, and likely perched, aquifer system to that impacted by the ongoing mining activity. The full review and report can be found in Appendix A

If you have any questions or would like to discuss the matter further, please contact Joel Sulicich HSET Manager on 0427 610 774 or joelsulicich@cbhresources.com.au.

Yours sincerely

Giorgio Dall'Armi

General Manager

Broken Hill Operations Pty. Ltd.

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Appendix A – EMM Consulting review of Rasp Mine Water Take and Groundwater impact assessment

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26 October 2023

Joel Sulicich
Health, Safety, Environment and Training Manager
CBH Resources
130 Eyre Street
Broken Hill
NSW 2880

Re: DPE Water - Mod 11 Request for Additional Information

Dear Joel,

EMM has prepared the following response to the DPE Water Request for Additional Information.

1 Water take

The proponent should quantify the maximum annual volume of water take required for the project due to aquifer interference activities.

1.1 Historical water balance

In 2021, EMM's hydrologists undertook a review of the Rasp Mine's water metering data and used that data to develop a historical water balance (Appendix A). Through that work, it was determined that the groundwater take at the site is proportional to the mining rate. The reason for this relationship is thought to be as follows:

- The rock matrix is relatively tight and does not permit groundwater to flow easily towards the dewatered mine excavations.
- Groundwater encountered underground is primarily due to mining activity, due to interception of water held in small fractures near the mining face and local dewatering around the worked area.

The rate identified was 0.5–0.6 megalitres (ML) of water per kilotonne (kt) of ore mined.

It is expected that this relationship represents the upper limit of inflows from the proposed extension of development workings, as the extension is a continuation of existing mining activities in the vicinity of the existing workings and within the same rock mass/aquifer but located at a higher elevation than the current mining front. Dewatering activities at the current mining front are expected to reduce the volumes of water encountered at the proposed extension.

1.2 Maximum annual water take

Operations are undertaken in accordance with Project Approval PA07_0018 (as modified) (PA), which allows mining operations at the Rasp Mine until 31 December 2026, including extraction of up to 500 kt of ore per annum. At that mining rate (which occurred in 2020), approximately 250 ML/year groundwater flows into the underground workings.

The maximum potential inflows for the mine is thus expected to be 250 ML/year, based on average climatic conditions, including rainfall. These inflows would be lower if mining occurs at a slower rate. The mine currently has a license to take up to 370 ML/year groundwater.

In 2022, the site was subject to significant rainfall events. During these events, it was necessary to transfer water from the surface storages to underground workings to maintain integrity and capacity of surface water storage areas. The transfer of this water was unmetered. The total water extracted from the underground workings in 2022 was 373 ML, however the mine had an available water balance of 407 ML, following a carryover balance from the previous year of 37 ML.

CBH Resources will continue to operate within its licence limit and will obtain additional licence entitlement if water pumped from the mine is anticipated beyond the current licence amount.

2 Groundwater impact assessment

The proponent should provide a statement of impact against the minimal impact considerations of the NSW Aquifer Interference Policy (2012).

2.1 Assessment of impact against the AIP

The proposed modification is located within the Adelaide Fold Belt Murray-Darling Basin (MDB) Groundwater Source (Groundwater Source) managed under the Water Sharing Plan (WSP) for the NSW MDB Fractured Rock Groundwater Source 2020.

Within the regional fractured rock aquifer that underlies mining lease CML7 typical salinities range between 4,000–9,000 mg/L, and typical bore yields are less than 2 L/s[1]. Therefore, this fractured rock water source is defined as 'less productive' under the Aquifer Interference Policy (AIP) due to its poor quality and low yields.

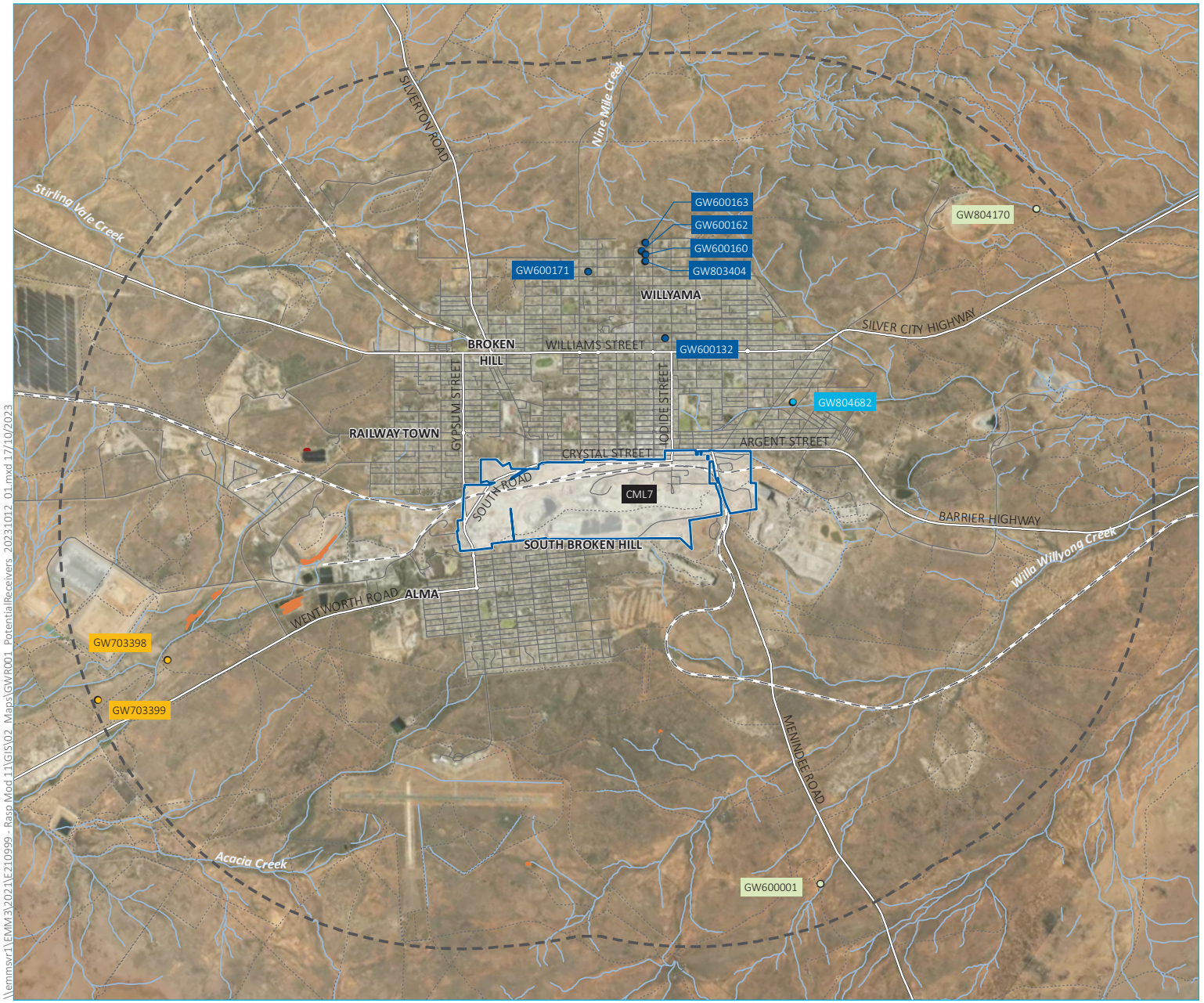
2.2 Sensitive receivers

2.2.1 High priority groundwater dependent ecosystems

Mapping provided in the NSW MDB Fractured Rock Groundwater Source 2020 WSP indicates that high priority groundwater dependent ecosystems (GDEs) are not found within the mining lease (CML7); however, there are some small pockets present within its vicinity. These are generally associated with ephemeral creek lines to the south-west within the Perilya Broken Hill Operations Pty Ltd South Mine lease areas.

Further assessment indicates the mapped high priority GDEs align with the terrestrial GDEs categorised as high–very high priority within the publicly available High Ecological Values Aquatic Ecosystems (HEVAE) GDE dataset (refer to Figure 2.1).

[1] Lewis, S.J., Roberts, J., Brodie, R.S., Gow, L., Kilgour, P., Ransley, T., Coram, J.E., and Sundaram, B., 2008, *Assessment of Groundwater Resources in the Broken Hill Region*, Geoscience Australia Professional Opinion 2008/05.



Source: EMM (2023); CBH (2021); DPIE (2020); DPE (2019); DFSI (2020); BoM (2021)

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Potential sensitive receivers

Rasp Mine Modification 11
Groundwater-related DPE Water Response
Figure 2.1

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2.2.2 High priority culturally significant sites

There are no high priority culturally significant sites listed in the schedule of the NSW MDB Fractured Rock Groundwater Source 2020 WSP.

2.2.3 Third-party bores

A total of 51 groundwater bores are registered within the BoM's National Groundwater Information System within a 5 km radius of the mining lease. Depths for the registered bores range significantly from 2 to 194 metres below ground level (mbgl) but are predominantly less than 40 m deep. Registered groundwater bores have only been constructed in the area since the mid-1990s, with the most recent bores installed in 2013. Only monitoring bores have been constructed since the Rasp Mine re-opened in 2012.

Most of the bores are monitoring bores, but 11 bores have the potential to be water supply bores (use categories = stock and domestic; water supply; commercial and industrial; or other). The existing registered uses of groundwater bores within the 5 km radius include:

- commercial and industrial – 2 bores
- monitoring – 40 bores
- other – 1 bore
- stock and domestic – 2 bores
- water supply – 6 bores.

Registered bores in the vicinity of the mining lease that have the potential to be water supply bores are shown on Figure 2.1. Further details of all the registered bores are provided in the bore summary table in Appendix B.

According to Golder (2008)[2], water supply bores in the Broken Hill area are mainly confined to known fault zones and ephemeral creeks. These two features provide the area's most effective groundwater recharge zones and highest groundwater storage capacity.

Private bores in the vicinity of Broken Hill generally utilise groundwater for livestock water supply. This groundwater appears to be of better quality than that extracted within and adjacent to the major mining lease areas, suggesting that the bores access a separate, and likely perched, aquifer system (Golder 2008).

2.3 Local hydrogeological setting

The mining lease sits within a fractured rock aquifer associated with the Willyama Supergroup[3]. Groundwater within the aquifer is limited to fractures and faults within the surrounding rock formation. Such fracture-hosted aquifers are typically "tight" and low yielding (Corkery, 2017[4]).

[2] Golder, 2008, *Hydrogeological Assessment for Proposed Mine Expansion, Rasp Mine – Broken Hill NSW*. Prepared for Broken Hill Operations Pty Ltd.

[3] The Willyama Supergroup consists of highly deformed metasedimentary schists and gneisses with abundant quartzofeldspathic gneisses, lesser basic gneisses and minor 'lode' rocks. It has an estimated total thickness of 7–9 km, with neither top nor basement exposed. B.P.J. Stevens, R.G. Barnes, R.E. Brown, W.J. Stroud, I.L. Willis, (1988) *The Willyama Supergroup in the Broken Hill and Euriowie Blocks, New South Wales*. Precambrian Research, Volumes 40–41 (pages 297–327).

[4] Corkery, 2017, Broken Hill North Mine recommencement - Environmental Impact Statement. Prepared for Perilya Broken Hill Limited.

Perched aquifers may also be present in the thin veneer of Quaternary sediments overlying the bedrock formations. These may contain groundwater, primarily within alluvial deposits along water courses. There is unlikely to be significant interaction between groundwater present in bedrock structural features and perched groundwater in shallow Quaternary deposits (Caritat, 2002[5]).

Extensive long-term dewatering from historical and ongoing underground mines in the area has led to a significant cone of depression in the regional fractured bedrock aquifer in the vicinity of the mining lease (Golder 2008).

In 2008, Golder noted that water levels within the Rasp Mine lease workings had been maintained at approximately 500 mbgl for the previous 12 years as a safety measure for the Perilya Broken Hill Operations Pty Ltd South Mine. Similarly, the current Rasp Mine Site Water Management Plan (BHO, 2019[6]) states that groundwater continues to be extracted to maintain safety of personnel in the Rasp Mine and also the adjacent Perilya South Mine.

Golder (2008) stated the following:

> Previous experience with evaluation of aquifer depressurisation associated with mining in low permeability formations typically indicates that significant depressurisation is constrained to the immediate vicinity of the mining operations provided significant water-bearing structural features are not intercepted by the mine workings.

Due to the depth of the regional groundwater at the site, there is little interaction between the shallow perched groundwater and the regional groundwater (BHO 2019).

2.4 Assessment of impacts

According to the AIP, the aquifer within and surrounding the mine lease may be classified as a "less productive fractured rock aquifer." Under the AIP, thresholds for determining minimal impact have been determined and are presented in Table 2.1. This table also includes an assessment of the proposed modification against each of the identified criterion.

Table 2.1 Level 1 Minimal Impact Consideration (Fractured rock – less productive)

Aquifer Interference Policy consideration	Discussion and assessment
Water table	
Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, 40 m from any: • high priority groundwater dependent ecosystem, or • high priority culturally significant site listed in the schedule of the relevant water sharing plan.	High priority GDEs have been mapped (and could potentially be present) along creek lines within the vicinity of the mine. However, as stated in Section 2.3, extensive long-term dewatering, as well as numerous historical and underground mine workings and the cumulative influence of these mining operations, is likely to have resulted in significant localised depressurisation of the regional fractured bedrock aquifer. The additional influence of the proposed modification on the groundwater resource is likely to be indistinguishable relative to existing impacts of currently approved mining activities. Accordingly, it is considered unlikely to impact the drawdown cone near the surface or perched groundwater resources that may potentially sustain GDEs. There are no high priority culturally significant sites listed in the schedule of the NSW MDB Fractured Rock Groundwater Source 2020 WSP.

[5] Caritat, P. de, Kirste, D., Dann, R. and Hutcheon, I, 2002, *Groundwater composition in the Broken Hill area: salinity and mineral exploration applications*. In: Phillips, G.N., Ely, K.S. (Ed.s), Proceedings and Field Guide, Victoria Undercover (Benalla, VIC, 30 April – 2 May 2002). CSIRO Publishing, Collingwood, pp. 275 -278.

[6] BHO, 2019, *RASP Mine Site Water Management Plan 2019*, Broken Hill Operations Pty Ltd.

Table 2.1 Level 1 Minimal Impact Consideration (Fractured rock – less productive)

Aquifer Interference Policy consideration	Discussion and assessment
A maximum of a 2 m water table decline cumulatively at any water supply work.	There are 11 registered bores within 5 km of CML7 that have the potential to be water supply bores. They were all installed prior to 2012, when the current Rasp Mine re-opened for operation. If significant impacts to the groundwater resource being accessed by these bores were to occur, they would have already been realised, given the long-term dewatering programs onsite and in the vicinity of the mine. The dewatering programs would have, by now, influenced the groundwater levels in the bores if there was a direct hydraulic connection. Again, the additional influence of the proposed modification on the groundwater resource is likely to be indistinguishable, relative to existing impacts of currently approved mining activities. Accordingly, it is considered unlikely to affect the drawdown cone near the surface or perched groundwater resources and, therefore, is unlikely to impact on the groundwater levels in the water supply bores in the vicinity of the mine.
Water pressure	
A cumulative pressure head decline of not more than a 2 m decline, at any water supply work.	See previous comment.
Water quality	
Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.	The proposed modification would not result in a change to the quality of groundwater. As a result, there would be no change in the beneficial use category of the groundwater.

In summary, the proposed modification is not expected to exceed the minimal impact criteria. It is considered unlikely that the addition of the proposed modification would impact high priority GDEs or water supply works, due to the ongoing significant localised depressurisation of the regional fractured bedrock aquifer caused by the currently approved mining activities. It is probable that the GDEs or water supply works access a separate, and likely perched, aquifer system to that impacted by the ongoing mining activity.

Yours sincerely,

Katharine Bond
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Appendix A
Historic water balance

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23 November 2021

Joel Sulicich
Health Safety Environment and Training Manager
CBH Resources - Rasp Mine
130 Eyre St
Broken Hill NSW
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Re: J210513 - Rasp Mine water balance

Dear Joel

In October 2021, Broken Hill Operations Pty Ltd (BHO) engaged EMM Consulting Pty Ltd (EMM) to independently review the Rasp Mine site water balance. The engagement took place in the context of the proposed Mine Modification 9 submission and requests from the Department of Planning, Industry and Environment (DPIE) Water and the Natural Resources Access Regulator (NRAR) for further information regarding predicted groundwater take.

This letter describes the water balance review and findings.

1 Overview of water movements

Rasp mine is located within the township Broken Hill, currently operating as an underground mine. Previous operations at the site included open cut mining, with pits now used for storing tails.

The main uses for water on site are ore processing, and operation of underground machinery. Minor uses of water include dust suppression, fire water, contractor facilities, evaporation, and vehicle washing.

Fresh water is supplied to the site from 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.

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 storm water management ponds, or in unlined depressions. Typically rainfall runoff evaporates, but it may be pumped into the mine water storage ponds when quantities are significant.

2 Data reviewed

The data described in Table 2.1 were provided to EMM for review.

Table 2.1 Data reviewed by EMM

File name	File type	Description
Rasp Water Schematic	PDF	Diagram of water storages and water movements. Included in Appendix A.
Rasp Mine Site Water Management Plan V2 June 2019	PDF	Site Water Management Plan June 2019 BHO-PLN-ENV-004
Ore Milled	Excel workbook	Daily milled tonnes from 1/1/2018 to 20/10/2021
Rasp concentrate water	Excel workbook	Tonnes of concentrate produced, and concentrate moisture content, in 2018, 2019, 2020, and first half of 2021, as totals for those periods.
Rasp site water balance v3	Excel workbook	Flow meter record summaries, including records of the actual flow meter readings, summed over the periods: 2015, 2016, 2018, 2019, 2020 first half, 2020 second half, 2021 first half
Site water flows	Excel workbook	Flow meter records, typically with daily frequency though in some cases weekly or monthly frequency for flow paths with low flow rates, for the period 2013-2021 for current and decommissioned flow paths. Records include notes describing meter maintenance, meter changes, observations to corroborate or explain the recorded data, and decommissioning dates of meters on currently unused flow paths.

3 Review process

EMM reviewed the supplied data by:

- Confirming that the recorded daily flows in the "Site water flows" workbook aligned with the flow summaries presented in "Rasp site water balance v3";
- Obtaining rainfall and evaporation data from SILO[1] for Broken Hill, to confirm the presented estimates of evaporation loss and potential rainfall runoff volumes;
- Developing a conceptual water balance diagram referencing the supplied summary data at each flow location, and using this new conceptual water balance diagram to:
  - confirm EMM's understanding of site processes with BHO staff;
  - identify balances and imbalances at storages;
  - estimate likely flow rates of unmetered flow paths by referencing upstream and downstream flows;
  - test the sensitivity of the water balance to tails seepage vs entrainment assumptions;
  - test the sensitivity of the water balance to evaporation from tails assumptions;

The conceptual water balance diagram developed during the review is presented in Appendix B with 2020 flow rates (in ML/year) recorded against each metered flow path.

[1] https://www.longpaddock.qld.gov.au/silo/

4 Water balance

4.1 Summary

A summary of the best estimate site water balance for 2020 is presented in Table 4.1. This best estimate is subject to uncertainty in some flows due to metering errors, discussed in section 4.3.

Table 4.1 Rasp mine 2020 water balance summary (ML)

Component	Source	Volume	Demand	Volume
Raw (town) water	Town water	98 (metered) *	Workshops and vehicle wash	96 (calculated from balance)
			Site services	2 (assumed)
		98		98
Process water	Town water	224 (metered) *	Entrainment - product	5 (measured)
	Groundwater	260 (calculated from balance)	Seepage and entrainment - tails	273 (calculated from balance)
	Rainfall – process ponds	0 (negligible volume)	Evaporation – process ponds	5 (calculated from climate records
	Rainfall - tails	16 (calculated from rainfall records)	Evaporation - tails	148 (calculated from climate records
			Dust suppression	69 (calculated from records of truck movements)
		500		500
Total In/Out		598		598
Underground supply recycling	Process water → S22 → Underground	236 (metered)		

Note: The total town water supply volume has been split across the process and non-process parts of this table based on meter records. The total town water supply take in 2020 was 322 ML.

4.2 Groundwater take

The groundwater take at Rasp Mine is estimated using the water balance as:

Groundwater take = Dewatering – Underground supply

In 2020, approximately half of the water removed from the underground workings via dewatering pumps was directly attributable to water taken underground for the purposes of operating underground machinery and ancillary uses such as fire water. This water was used in mining activities, collected in sumps within the excavated shafts and drives, and returned to the surface for settling in pond S22 before being recycled (Figure 4.1). The remainder of the water removed from the underground workings is attributed to groundwater inflows.

To allow the calculation of groundwater inflows, both the dewatering and underground supply pipes are metered.

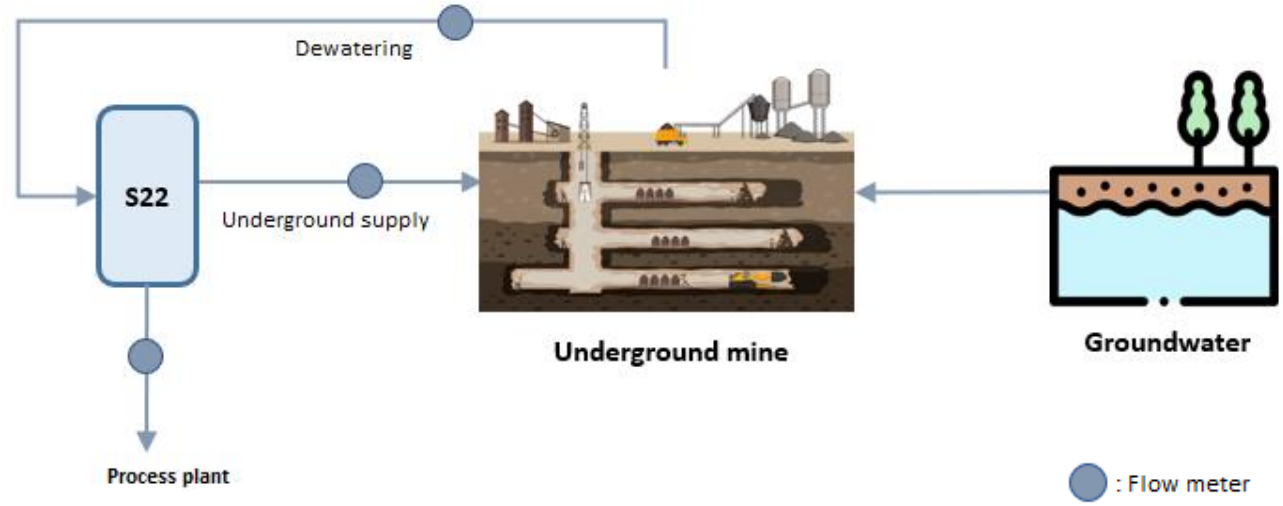


Figure 4.1 Schematic of underground water balance

The groundwater take has been trending down over the period of record analysed (2018-2021) (Figure 4.2), with volumes of water supply to underground workings and groundwater interception both reducing in proportion to the mining rate. Approximately 0.45 ML of water is supplied to the underground workings per 1 kt of ore extracted, and approximately 0.5 ML of groundwater is intercepted (Figure 4.3).

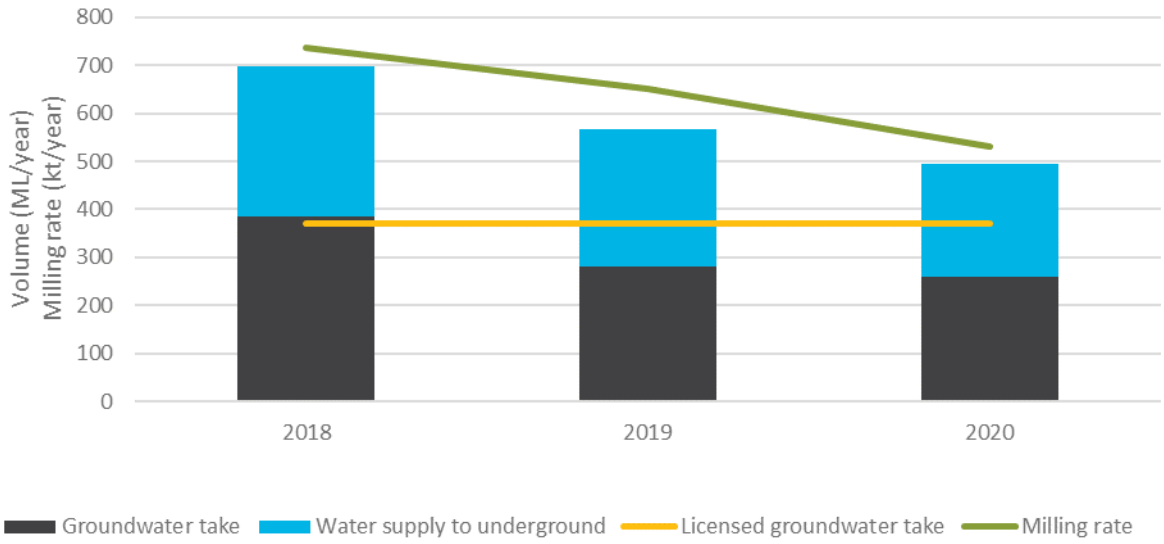


Figure 4.2 Underground dewatering

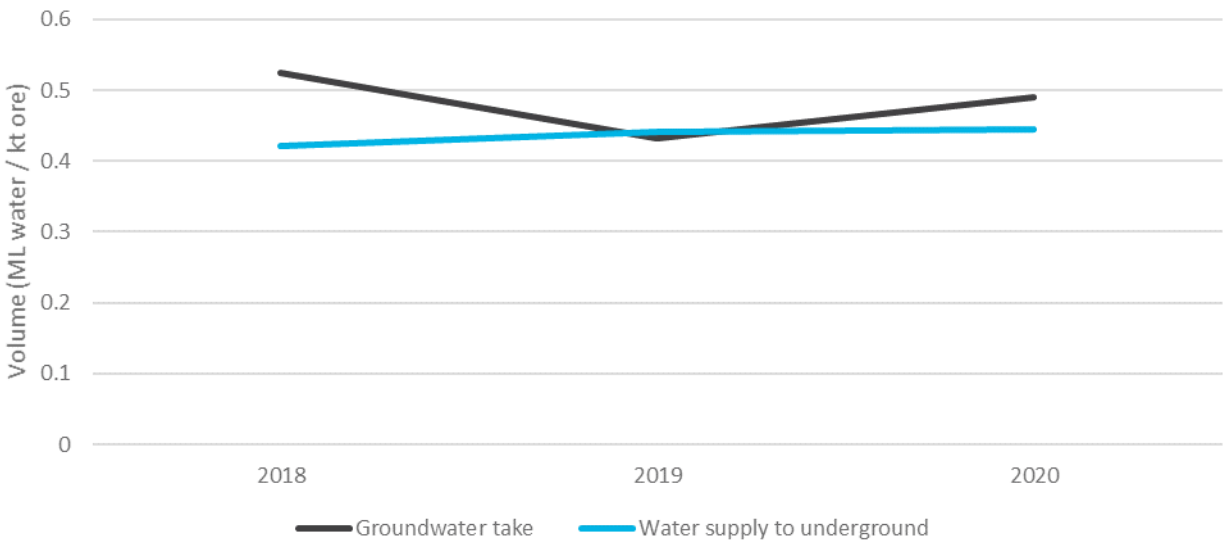


Figure 4.3 Dewatering relationship to mining rate

Data from the first half of 2021 indicate a continued trend of decreasing mining rate and reduced groundwater take. Data for 2021 were not presented in Figure 4.2 and Figure 4.3 as this review was published prior to the end of 2021, and because review of the flow in and flow out records for pond S22 revealed a volume imbalance signifying a significant metering error in the January – June 2021 data, discussed in section 4.3.1.

The proportionality of inferred groundwater inflow to mining rate could be due to interception of water-containing fractures during excavation, or due to seepage from tails which are stored in the completed Blackwoods pit which overlies the underground workings as these mechanisms for groundwater interception are each related to mining activity. Determining the exact mechanisms of groundwater inflows to the underground workings was not possible through review of site water movement records, but from the reviewed data it appears reasonable to assume that the total groundwater take will remain within the current groundwater take license limit of 370 ML/year if the mining rate remains at or below 700 kt/year.

4.3 Metering errors

Two periods with inconsistent flow data records were identified, likely caused by metering errors:

- First half of 2021: over estimation of dewatering volumes via the underground to S22 pipeline; and
- 2018 – 2021: over estimation of process water supply from S22.

Rasp mine has engaged Chris Clark of Millewa Pumping Company as a Duly Qualified Person to install and verify pattern approved flow meters. These installations will comply with the DPIE Non-urban water metering in NSW framework, and are expected to resolve metering errors from early 2022.

The identified metering errors and effects on the presented water balance data are discussed below.

4.3.1 Over estimation of dewatering volumes

As shown in Figure 4.2 and Figure 4.3, the mine dewatering rate is proportional to the mining rate. Over the assessed period the mining rate has decreased, with a proportional reduction to the rate of water supply to the underground workings (Figure 4.4). However, in the first half of 2021 flow records for dewatering via one of the two dewatering lines ('underground' dewatering) showed an unexpected flow rate increase (Figure 4.5). Flow record spreadsheets include notes which show that the flow meter was replaced at the end of 2020, and the new meter recorded higher flow rates from the time of installation (Figure 4.6).

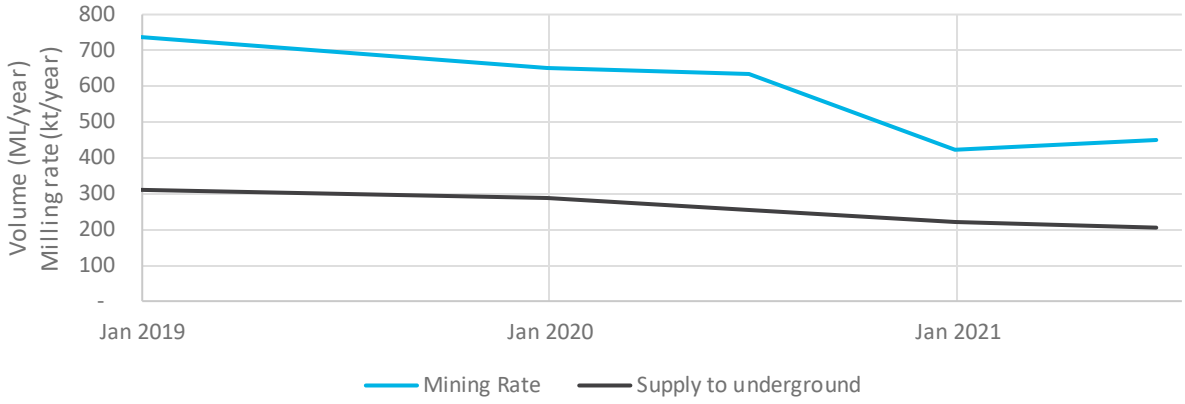
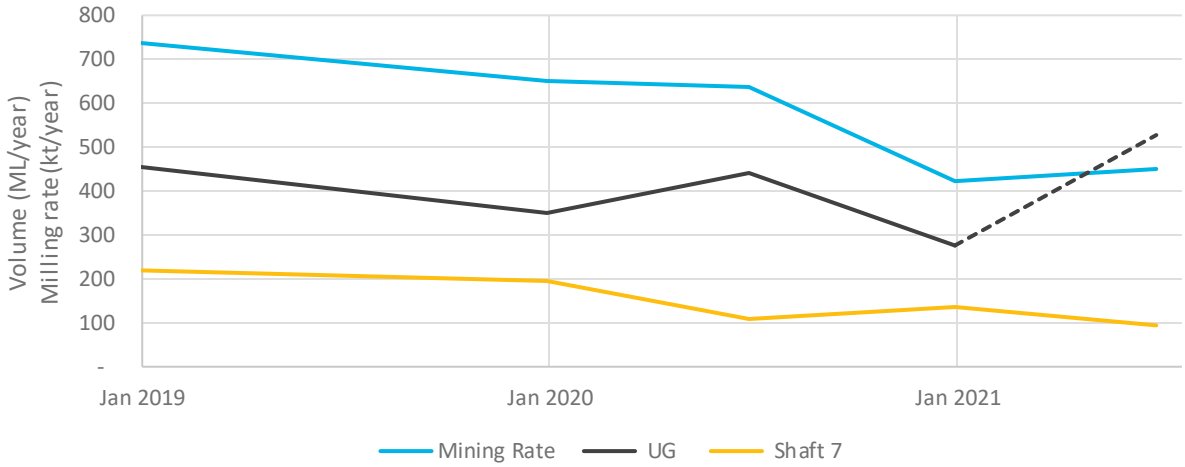
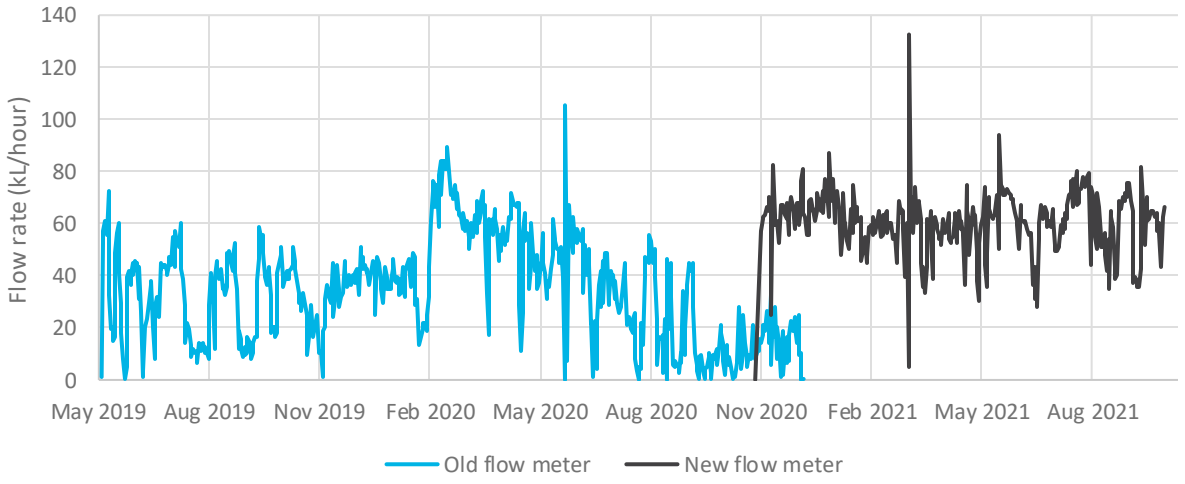


Figure 4.4 Recorded supply to underground workings



Note: Dashed line indicates data likely to be unreliable due to metering errors

Figure 4.5 Recorded dewatering rates



Note: Conflicting meter readings in November 2020 indicate a metering error

Figure 4.6 Underground dewatering meter records

The higher dewatering flow rates recorded by the new meter are not consistent with records of S22 volumes and S22 outflows; water taken from S22 to the process plant via 'Patto's' pond and for underground supply

did not increase in 2021 and so S22 would have overflowed if dewatering flow rates had increased as per the new flow meter. No overflows from S22 were observed by site operators.

The observed relationship between mining rate and dewatering over the period 2018-2020, the comparison of metering data for old and new meters, and the lack of S22 pond overflow during 2021 align with the proposition that the new flow meter for the underground dewatering was over-recording flow in 2021, and for this reason the 2021 underground dewatering and groundwater take data were not presented in section 4.2.

It would be reasonable to assume from the available data that and pre-2021 trends present in Figure 4.6 that the total dewatering for 2021 will be approximately 400 ML, and that the groundwater inflow component will be approximately 200 ML.

4.3.2 Over estimation of process water supply from S22

In each year of data assessed, the total metered volumes recorded entering pond S22 and the total metered volumes extracted from pond S22 did not balance (Table 4.2).

Table 4.2 Pond S22 water balance (ML/year)

Year	Total inflow	Total outflow	Imbalance
2018	675	745	70
2019	549	677	128
2020	480	517	37

It has been assumed that the imbalance recorded at S22 is due to metering errors on one or more inflows or outflows.

The estimate of groundwater inflow to the underground workings would not be affected if the metering error occurred when metering the offtake to the process plant via Patto's pond, or volumes used for dust suppression via water carts.

If the metering error was on the pipeline supplying water to the underground workings, the implication would be that volumes recorded as flowing through that pipeline were over-recorded. If the metering error occurred on either of the dewatering pipelines, the implication would be that recorded dewatering volumes were too low. In each of these cases, rectifying the metering would increase the estimate of groundwater take by the magnitude of the metering error.

The water balance data presented in Table 4.1 and Appendix B uses the assumption that the S22 imbalance metering error occurred on the pipe supplying water to the process plant via Patto's pond, as the volumes recorded as flowing through this pipe were in excess of plant requirements (calculated from the moisture content of tails and product leaving the plant).

If following meter verification it is found that rectifying the pond S22 imbalance results in an increased estimate of groundwater take, the revised groundwater take estimates could increase as presented in Table 4.3. The maximum estimates of groundwater take presented in Table 4.3 remain proportional to the mining rate, with an increased ratio of approximately 0.6 ML groundwater take per kt ore mined (cf Figure 4.3). At this rate, groundwater take would be expected to remain within the license limit of 370 ML/year for mining rates below 615 kt/year. The mining rate was below 615 kt/year in 2020 and is currently (November 2021) approximately 450 kt/year indicating that under the 'worst feasible case' the groundwater take is within the licence limit.

Table 4.3 Maximum effect of metering error on groundwater take estimate (ML/year)

Year	Current best estimate of groundwater take	Pond S22 imbalance	Maximum estimate of groundwater take
2018	386	70	456
2019	281	128	409
2020	260	37	297

5 Conclusion

EMM Consulting has undertaken an independent review of the Rasp mine site water balance with reference to flow meter data records and descriptions of day to day water movements provided by site operators. This review revealed that it is likely that one or more flow meters on the site are recording flows incorrectly. BHO has subsequently engaged a Duly Qualified Person to install and verify pattern approved flow meters. These installations will comply with the DPIE Non-urban water metering in NSW framework, and are expected to resolve metering errors from early 2022.

The available data indicate that the net groundwater take (calculated as 'Groundwater take = Total Dewatering – Underground supply') is proportional to the mining rate, with a best estimate of approximately 0.5 ML of groundwater taken per kt of ore mined. Metering errors introduce uncertainty to the estimate of groundwater take, with the 'worst feasible case' being 0.6 ML of groundwater taken per kt of ore mined.

The best estimate of groundwater take for 2020 is 260 ML, with an upper bound estimate of 297 ML. These rates are significantly below the current groundwater licence limit of 370 ML/year. Descriptions by the site operator of the proposed underground locations affected by Mod 9, and the probability of interception of groundwater at those locations indicates that future rates of groundwater take including Mod 9 activities are likely to be consistent with current rates of groundwater take. Future groundwater take is thus expected to remain within the license limit if the future mining rate remains similar to the current rate. It is noted that since 2018 the mining rate and groundwater take have been declining.

EMM Consulting recommends that the site water balance is revisited periodically (eg at 12 month intervals) following the installation of pattern approved flow meters to confirm that groundwater take rates follow historical trends as mine development continues.

Yours sincerely

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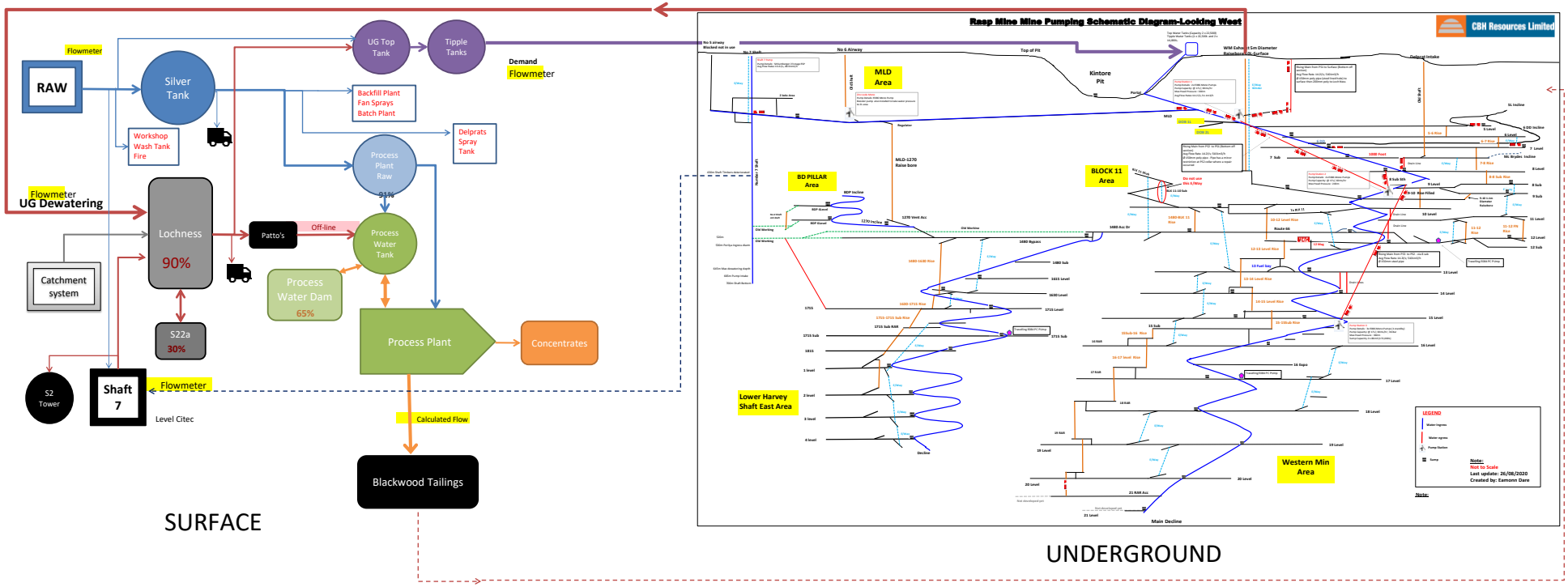
Appendix A

Rasp Water Flow Schematic (BHO)


Flowmeter
RAW
Silver Tank
UG Top Tank
Tipple Tanks
Demand
Flowmeter
Backfill Plant
Fan Sprays
Batch Plant
Delprats Spray Tank
Workshop
Wash Tank
Fire
Process Plant Raw
21%
Flowmeter
UG Dewatering
Lochness
90%
Patto's
Off-line
Process Water Tank
Catchment system
Process Water Dam
65%
S22a
30%
Process Plant
Concentrates
S2 Tower
Shaft 7
Flowmeter
Level Citec
Calculated Flow
Blackwood Tailings
SURFACE
Rasp Mine Mine Pumping Schematic Diagram-Looking West
CBH Resources Limited
MLD Area
Kintore Pit
BD PILLAR Area
BLOCK 11 Area
Lower Harvey Shaft East Area
Western Min Area
LEGEND
Note:
Not to Scale
Last update: 26/08/2020
Created by: Eamonn Dare
UNDERGROUND

Appendix B

Rasp Water Balance Schematic (EMM)

The conceptual water balance presented in this document was developed to illustrate a high level summary of flow meter records, with a focus on estimating the groundwater inflows to the underground workings from records of dewatering and water recycling.

As discussed in section 4.3, total flow into pond S22 and total flow out of pond S22 do not balance, presumed to be due to a metering error.

The rate of seepage from tails illustrated in this appendix is considered to have low reliability as it is affected by:

- The estimate of unmetered overflow from Patto's pond, which is derived from the balance of water leaving S22 and water required by the process plant. The metering errors identified in section 4.3 could affect these flow rates.
- Estimates of evaporation from the surface of the tails.
- An assumption in this balance that no water evaporates within the process plant itself.
- The unmetered take of water for site services.
- A 'ball-park' estimate of water entrained in tails, based on professional experience without reference to in-situ testing.

Revision of any of these items would affect the presented water balance estimate of seepage, but would not affect the presented estimate of groundwater take other than as discussed in section 4.3.

The estimated rates of regional groundwater flow to the mine were not validated using groundwater modelling or by investigating aquifer properties.

: Flow meter

Start date **1/01/2020** End date 31/12/2020 366 days

Volumes in ML/year

Blue Water gains (rainfall, import)
Red Evaporative water loss
Black Water transfers

Shaft 7 121
UG Dewatering 359
Meter error adjust -
480

4.9 0.4

S22

S22a

69

Water carts

Underground supply
236

Underground mine

Ore

3% water
Solids: 530 kt
Water: **16**

Process supply 207
Meter error adjust - 37
170

Pattos

Process supply, from balance
41

Raw water supply
Silver Tank to mill

Raw water
322

Workshop - carwash
96

Silver Tank

Raw water
226

Site services
2.3

Operations

Operations

Process plant
Excess water applied as overflow from Pattos

Groundwater Inflows
260
From UG balance

0
Infiltration

Groundwater

Regional groundwater inflow
69
Estimate from balance

Seepage
190
From tails balance

148 15.7

Overflow, unmeterec **130**

63% solids
Solids: 468 kt
Water: **276**

Tails (Blackwood)

Entrainment
83
Estimate from assumed water content

Entrainment

7% water
Solids: 59 kt
Water: **5**

Concentrate

Appendix B
Registered bores

EMM
creating opportunities

Table B.1 Registered bores within 5 km of mining lease (CML7)

State bore ID	Bore depth (m)	Drilled depth (m)	Status	Drilled date	Easting	Northing	Reference elevation (mAHD)	Bore type
GW500071	7.5	7.5	Unknown	26/06/1995	543972	6464206	308.88	Monitoring
GW600001	44.3		Unknown	28/03/2000	549059	6460970	282.82	Stock and Domestic
GW600132	17.5	17.5	Functional	6/07/2006	543518	6465472	314.6	Water Supply
GW600144	19.8	19.8	Functional	23/05/2007	544316	6459543	288	Monitoring
GW600145	7.2	7.2	Use	14/05/2008	544315	6459557	288.64	Monitoring
GW600146	19	19	Use	21/07/2008	544306	6459556	288.64	Monitoring
GW600147	20	20	Use	21/07/2008	544339	6459547	288.54	Monitoring
GW600148	16.1	16.1	Use	21/07/2008	544333	6459529	287.88	Monitoring
GW600160	30	30	Use	12/01/2009	542712	6466192	322.72	Water Supply
GW600162	54	54	Use	12/01/2009	542645	6466200	321.56	Water Supply
GW600163	30	30	Use	12/01/2009	542626	6466311	320.8	Water Supply
GW600171	30	30	Use	5/05/2009	542242	6465603	333.12	Water Supply
GW600301	20.4	20.4	Functional	13/07/2011	542675	6463929		Monitoring
GW600302	20.54	20.54	Functional	10/07/2011	542668	6463901		Monitoring
GW600303	12	12	Functional	11/07/2011	542684	6463908		Monitoring
GW600304	16	16	Functional	13/07/2011	542702	6463920		Monitoring
GW600305	16	16	Functional	8/07/2011	542683	6463883		Monitoring
GW600306	23.2	23.2	Functional	7/07/2011	542701	6463890		Monitoring
GW600307	18.9	18.9	Functional	5/07/2011	542711	6463902		Monitoring
GW600308	12.8	12.8	Functional	13/07/2011	542656	6463865		Monitoring
GW600360	19	19	Use	1/07/2008	540916	6461332		Monitoring
GW600361	26	26	Functional	2/07/2008	540928	6461320		Monitoring
GW600362	17	17	Functional	2/07/2008	540900	6461331		Monitoring
GW600363	19	19	Functional	3/07/2008	540938	6461339		Monitoring
GW600364	22	22	Functional	4/07/2008	540956	6461314		Monitoring
GW600365	25	25	Functional	23/04/2010	540943	6461304		Monitoring
GW600366	16	16	Functional	23/04/2010	540928	6461288		Monitoring
GW600367	20	20	Functional	23/04/2010	540898	6461302		Monitoring
GW600368	20	20	Functional	23/04/2010	540907	6461344		Monitoring
GW600381	6	6	Unknown	29/05/2012	540815	6462058		Monitoring
GW600382	6	6	Unknown	29/05/2012	540845	6462044		Monitoring

Table B.1 Registered bores within 5 km of mining lease (CML7)

State bore ID	Bore depth (m)	Drilled depth (m)	Status	Drilled date	Easting	Northing	Reference elevation (mAHD)	Bore type
GW600383	6	4.2	Unknown	24/10/2012	540871	6462079		Monitoring
GW600384	6	6	Unknown	29/05/2012	540830	6462001		Monitoring
GW600385	6	6	Unknown	29/05/2012	540900	6461908		Monitoring
GW600386	6	6	Unknown	29/05/2012	540820	6461681		Monitoring
GW600433	17	17	Functional	5/06/2012	540887	6461254	282.37	Monitoring
GW600434	17.7	17.7	Functional	6/06/2012	540887	6461264	28.33	Monitoring
GW600435	20		Functional	6/06/2012	540894	6461258	281.9	Monitoring
GW600468	2	2	Proposed	15/08/2013	540593	6461771		Monitoring
GW600469	6	6	Use	16/10/2013	540906	6461757		Monitoring
GW600470	36	40	Use	17/10/2013	540655	6461588		Monitoring
GW600471	5	5.2	Use	17/10/2013	540658	6461589		Monitoring
GW600472	15	15	Use	13/08/2013	540716	6461975		Monitoring
GW600473	40	40	Use	15/08/2013	540974	6461933		Monitoring
GW600474	4	4.4	Use	14/08/2013	540974	6461930		Monitoring
GW600475	11	11	Use	13/08/2013	540849	6462121		Monitoring
GW703398	194		Unknown	10/02/2009	540711	6458564	273.68	Commercial and Industrial
GW703399	189		Unknown	10/02/2009	540278	6457652	269.9	Commercial and Industrial
GW803404	31	31	Use	6/10/2007	542756	6466123	325.44	Water Supply
GW804170	141.5	141.5	Use	1/07/1999	546410	6469485	271.76	Stock and Domestic
GW804682	38	38	Use	6/05/2010	545296	6465737	289.54	Other