Broken Hill Operations Pty Ltd **ABN 95 103 555 862**

Rasp Mine

Annual Environmental Management Report

REPORTING PERIOD

1 January 2019 - 31 December 2019

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Title Block

Name of Operation:	Rasp Mine
Name of Operator:	Broken Hill Operations Pty Ltd
Development consent / project approval:	PA 07_0018 (MOD1, MOD2, MOD3, MOD4, MOD5, MOD7)
Name of holder of development consent / project approval:	Broken Hill Operations Pty Ltd
Mining Titles / Leases:	Consolidated Mining Lease 7 Mining Purpose Leases 183, 184, 185, 186
Name of holder of mining lease:	Broken Hill Operations Pty Ltd
Water licence:	85WA752823
Name of holder of water licence:	Broken Hill Operations Pty Ltd
MOP Commencement Date: 1 October 2017	**MOP Completion Date:** 30 September 2020
AEMR Commencement Date: 01/01/2019	**AEMR End Date:** 31/12/2019
I, Devon Roberts, certify that this audit report is a true and accurate record of the compliance status of the Rasp Mine for the period 1 January 2019 to 31 December 2019 (Reporting Period) and that I am authorised to make this statement on behalf of Broken Hill Operations Pty Ltd.	
Name of authorised reporting officer:	Devon Roberts
Title of authorised reporting officer:	Senior Environmental Advisor
Signature of authorised reporting officer:	
Date: 31 March 2020	

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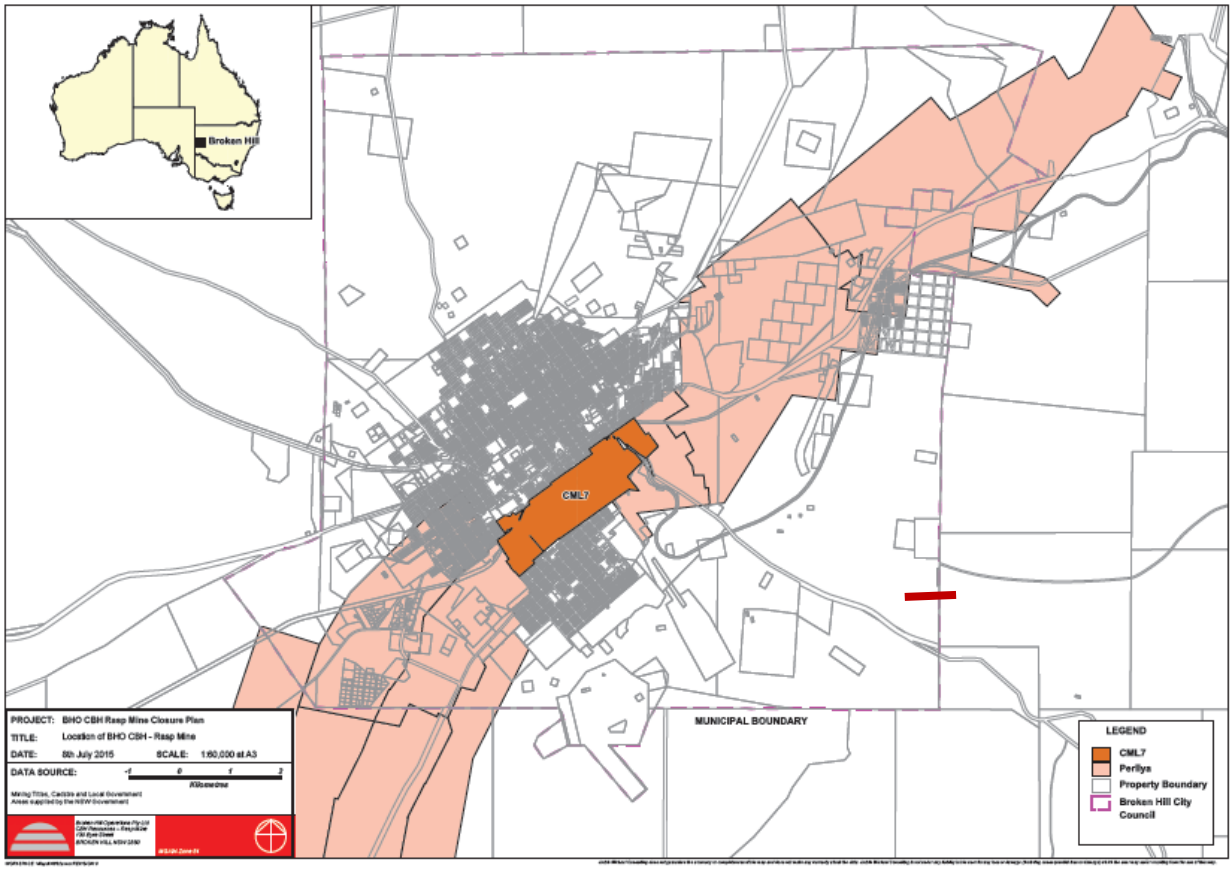
1. INTRODUCTION

The Annual Environment Management Report (AEMR) documents the environmental performance of the Rasp Mine for the reporting period 1 January 2019 to 31 December 2019. It has been prepared in accordance with the NSW Government *EDG03 – Guidelines to the Mining, Environmental, Rehabilitation and Environmental Management Process*.

Figure 1-1 Location Map – Plan 1



2.2 Location

The Rasp Mine is owned and operated by Broken Hill Operations Pty Ltd (BHOP), a wholly owned subsidiary of CBH Resources Ltd (CBH). The Mine is located on Consolidated Mine Lease 7 (CML7) within the City of Broken Hill and includes several Mining Purposes Leases (183,184,185 and 186) with the entire Project extending over Western Land Leases and freehold properties.

The Rasp Mine consists of underground mining operations, a processing plant producing zinc and lead concentrates, a rail siding for concentrate dispatch to shipping facilities within Australia as well as other mining ancillary facilities. In the reporting period all concentrate product was placed in sealed containers and transported by rail to either the Port of Newcastle NSW or smelter operations in Port Pirie SA. Rasp Mine is approved to produce 750,000 tpa of ore and 8,450,000 tonnes of ore over the life of the Project to December 2026.

The Mine is located centrally within the City of Broken Hill (Figure 1-1) and is surrounded by transport infrastructure, areas of commercial and industrial development and some residential housing. The Mine is bounded by Eyre Street to the southeast, Perilya Broken Hill Operations Pty Ltd (Perilya) North Mine to the east and Perilya's South Mine to the west, and the commercial centre of Broken Hill to the north. Two major State roads dissect CML7 - South Road (Silver City Highway SH22) to the southwest and Menindee Road (MR66) to the northeast. These roads form part of the existing road

train and B-double routes through Broken Hill. Mawson's Quarry lies to the east of the existing processing plant. The Broken Hill railway station is located within CML7 on a surface exclusion with the main Sydney – Perth railway line also located within the Lease on various surface exclusions. Residential and commercial areas surround the mine with pastureland to the southeast. An aerial view of CML7 is provided in **Plan 1, Figure 1-1**.

The mining leases occupy a central region of the historic Broken Hill Line of Lode ore body incorporating the original mine areas that commenced operations in the 1880s including a substantial amount of mining infrastructure from various mining phases. The Mine was the birthplace of Broken Hill Pty Ltd (BHP) in 1885. Subsequently several mining companies, including Broken Hill South and Minerals Mining and Metallurgy Ltd (MMM), have operated the mine. This past mining has left the mining lease highly modified and disturbed. The original landform has been significantly altered; the majority of native vegetation removed and soils have been degraded and covered with waste rock.

There are a number of heritage items on the site relating to historic mining activities and the site is recorded on the Register of National Estate for its heritage values. The people of Broken Hill consider the mine as an important historic site for its role in Broken Hill's history. The Broken Hill Miners Memorial and Broken Earth Café are located centrally within CML7.

The CML7 boundary is shown in Plan 2**,** which also indicates surface exclusion areas and MPLs. The Project Area includes additional areas to the southeast located on Western Land leases or freehold properties owned or leased by BHOP (highlighted in orange). Located in this area are the current Rasp Mine administration offices and stores.

The AEMR is distributed to a range of stakeholders that include government authorities and is available on the CBH website at: www.cbhresources.com.au.

1.1 Mine Level

The Rasp Mine is classified as a Level 1 Mine and in 2018 it was transitioned to a State Significant Development under the *EP&A Act* with development consent determined and authorised by the Minister for the Department of Planning and Environment.

1.2 Approvals

Error! Reference source not found. provides a list of all current development consents, mining leases and licences held by the Rasp Mine.

Table 1-1 Rasp Mine - Current Approvals

Approval Number	Date Issued	Expiry	Purpose
Project Approval 07_0018 (Part 3A)	31 Jan 2011	31 Dec 2026	Mining production of 750,000 tpa from Western Mineralisation, Centenary Mineralisation and Main Lode Pillars. Construction and operation of minerals processing plant and rail load out facility. Supported by an EAR and PPR. MOD1 – relocation of primary ventilation shaft MOD2 – 24 hour operation of crusher MOD3 – Mining of Block 14 (Zinc & Main Lodes) MOD 4 – Installation of Concrete Batching Plant and Extension to TSF2 MOD5 – Warehouse Extension, Cement Silo and adjustment of air quality monitoring MOD7 – Utilise, crush and screen waste rock in BHP Pit for Embankments construction.
CML7	17 Jan 2007	31 Dec 2026	Granted 8 Oct 1987. As per Schedule 2 of the Lease - Open cutting, shaft sinking, stoping, tunnelling, building of dams, extraction and obtaining minerals, generation of electricity, erecting dwellings, storage of fuels, dumping of ore, treatment and dumping of tailing, development of roads

Approval Number	Date Issued	Expiry	Purpose
MPL 183	24 Apr 2007	31 Dec 2026	Granted 4 Feb 1981. Dumping of ore and mine residues, treatment of tailing
MPL 184	24 Apr 2007	31 Dec 2026	Granted 4 Feb 1981. Dumping of ore and mine residues, treatment of tailing
MPL 185	24 Apr 2007	31 Dec 2026	Granted 4 Feb 1981. Dumping of ore and mine residues, treatment of tailing
MPL 186	24 Apr 2007	31 Dec 2026	Granted 4 Feb 1981. Dumping of ore and mine residues, treatment of tailing
EPL 12559	EPA	Upon surrender, suspension or revocation.	Authorises the carrying out of scheduled activities: Crushing , grinding or separating >500,000 – 2,000,000T processed. Mining for minerals >500,000 – 2,000,000T produced.
Dangerous Goods Explosives	Work Cover	24 Oct 2022	Store Manufacture
Refrigerant	Refrigerant Trading Council	27 Mar 2022	Use of refrigerant
Water extraction 85WA752823	NOW	29 Mar 2027	To extract 370 ML for use on site or to send to Perilya Broken Hill Operations Pty Ltd.
Radiation #5063802	EPA	26 July 2020	Sell and/or possess radiation apparatus. Sell and/or possess radioactive or items containing radioactive substances.

The Rasp Mine has an approved Mining Operations Plan (MOP) currently in place for the period 1 October 2017 to 30 September 2020. An extension of the MOP for 12 months was granted on 25 September 2019 as updated guidelines on MOP preparation are expected to be finalised in 2020 and the revised MOP can be submitted in the updated format. The AEMR, as required by the mining leases, incorporates reporting against this MOP.

The Rasp Mine has developed a number of environmental management plans as required by PA07_0018. **Error! Reference source not found.**2 provides a list of these Plans together with the approval dates for each.

Table 1-2 Status of Environmental Management Plans

Environmental Management Plan	Condition	Approved
Environment Management Strategy	Sched 4 Cond 1	Jun-19
Air Quality Management Plan	Sched 3 Cond 11	Jun-19
Community Lead Management Plan	Sched 3 Cond 13	Mar-16
Noise and Blast Management Plan:	Sched 3 Cond 20	
- Noise Management Plan		Jun-19
- Technical Blasting and Vibration Management Plan		Jun-19
Site Water Management Plan	Sched 3 Cond 23	Jun-19

1.3 Mine Contacts

Table 1-3 outlines the contacts for the Rasp Mine.

Table 1-3 Mine Contacts

Name	Title	Contact Details
Visko Sulicich	BHOP Director CBH Chief Operating Officer	T: 08 8088 9106 viskosulicich@cbhresources.com.au
Gwen Wilson	CBH Group Manager – Safety Health Environment Community	M: 0431 483 825 gwenwilson@cbhresources.com.au
Giorgio Dall'Armi	BHOP General Manager	T: 08 8088 9102 giorgiodallarmi@cbhresources.com.au
Joel Sulicich	BHOP Health Safety Environmental and Training Manager	T 08 8088 9125 joelsulicich@cbhresources.com.au
Devon Roberts	BHOP Senior Environmental Advisor	T 08 8088 9126 devonroberts@cbhresources.com.au
Complaints Line	Health, Safety and Environment Office	T: 08 8088 1211

1.4 Actions required from previous AEMR

Item	Action	Status
1	Development of the rehabilitation strategy through evidence-based studies containing options analysis, involving use of innovative rehabilitation or best practice, to demonstrate the feasibility or not, of rehabilitation options for areas classed as 'non-vegetative outcomes.'	Incomplete

A rehabilitation strategy has not been finalised although an Options Study for rehabilitation at Rasp Mine was begun in 2018 by Mine Earth. The draft report included a revegetation assessment (with a review of previous revegetation programs) and recommendations for rehabilitation trials. BHOP is considering expanding the Options Study as a project with the Centre for Mined Land Rehabilitation, University of Queensland. Guidance from the Resources Regulator following the Department of Premier & Cabinet Broken Hill Post Mining Interagency meeting held in Broken Hill on 13 and 14 August 2019 is still forthcoming. During the Interagency meeting there was agreement that paddock dumping of waste rock on free areas may be a suitable method of capping them.

Following the AEMR site visit in 2019, BHOP have developed a procedure for field-testing of waste rock samples using a hand-held XRF device and have employed it to classify waste materials used in the TSF2 Embankment works. Material to be tested is no more than 3m in depth and is marked up into 4m x 4 m areas. Three XRF samples are taken at six locations in the 4 x 4m area. A sample of at least 0.2kg is taken from each of the six samples locations to form a composite sample which is sent to a lab for analysis. By having samples analysed at a lab the material can be identified as suitable for use, but most importantly to generate a model of XRF accuracy. A consulting Geo-Technical firm will be conducting an analysis of the XRF accuracy with lab analyses of the tested samples in 2020.

2. OPERATIONS SUMMARY

During the 2019 reporting period, the Project Approval was modified (MOD7) to permit the crushing of waste rock in the BHP Pit for the purposes of providing suitable fill material for TSF2 Embankment construction.

Table 2-1 outlines the production summary for the reporting period. Predictions for the next reporting period are taken from the planned 2020 budget.

Table 2-1 Production Summary – Cumulative

Material	Approved Limit	Start of reporting period	At end of reporting period	End of next reporting period
Waste rock	NA	2,446,539	2,601,599	2,873,599
Ore	750,000	4,294,551	4,944,453	5,603,718
Processing waste (Tailings)	NA	3,712,062	4,290,534	4,869,006
Product (Concentrates)	NA	503,541	576,375	659,263

2.1 Exploration

2.1.1 Surface exploration

Consistent with the drilling programs proposed in the MOP, the Rasp Mine completed a surface drilling program across CML7. The primary exploration focus remained on underground diamond drill testing for continuations/extensions of both the Western Mineralisation and the Main Lode remnant zones. Surface exploration programs targeting the characterisation of various Main Lode Remnant and Extensional Targets were also completed early in the reporting period.

The program was located on land already disturbed by historic mining and no vegetation was removed. Top soils had already been removed from the area by historic mining activities. The drill pads were installed off existing tracks with minimal earthworks required.

No surface rehabilitation activities were undertaken on CML7 during the reporting period as the drill pads were still operational, although drill holes have been capped.

In 2020, surface exploration will target the Western Mineralisation, No 2 and 3 Lens Main Lode remnants, McCulloch's, McBryde's, Blackwood's, and Zinc Lodes areas.

2.1.2 Underground exploration

During the reporting period, 51,557m of underground diamond drilling was completed:

- Underground Diamond Drilling Western Mineralisation – 318 holes and 44,256.9m
- Underground Diamond Drilling Main Lodes – 101 holes and 16,604.7m

The 2019 program will continue to focus on the Western Mineralisation and Main Lodes 2 Lens and 3 Lens including the Lower Harvey Shaft remnants.

2.2 Land Preparation

The access road to the south of TSF2 Embankment 1 was constructed in 2019.

Routine maintenance of roads was undertaken as required which includes the application of dust suppressant to infrequently used roads.

Boundary fencing was also inspected and repaired.

2.3 Construction

2.3.1 New buildings / structures

Construction woks for Stage 1 of the Blackwoods Pit TSF2 embankment raise commenced in June 2019 and practical completion was in December 2019. The works design was prepared and monitored by Golder Associates Pty Ltd (Golder). Golder are also the Geotechnical Inspection and Testing Authority overseeing quality assurance for the works. The Stage 1 works comprised of:

- Construction of the Embankment 1 starter bank
- Construction of Embankment 2
- Construction of the Stormwater Management System
- Construction of the emergence spillway.

Embankment 1 construction involved the construction of an access road from the waste stockpile to the South, excavation of existing fill mounds, rectification of cracks in the basement rock, and installation of a seepage outlet pipe.

Embankment 2 construction involved the excavation, conditioning and placement of the fill material from the Embankment 2 footprint. The embankment wall was constructed of rock fill, select rock fill and screened rock fill, as well as layer of filter sand with a seepage collection system and the installation of a HDPE liner on the upstream side of the embankment.

The Emergency Spillway consists of a subgrade drain, sill beam, spillway chute, seepage sump, and concrete access road across the spillway.

The Stormwater Management System for Embankment 2 consists of two drains feeding to a stormwater pond. A spillway was installed at the northern end of the stormwater pond.

Figure 2-1 Aerial view of Embankment 2, Stormwater Pond and Emergency Spillway

2.4 Mining

2.4.1 Mine access

All mining is undertaken underground accessed via the existing portal located at the northern end of Kintore Pit. Mining activities included mining of the Western Mineralisation, Main Lode Pillars and Zinc Lode.

Mining activities were undertaken as follows and met the requirements of the Project Approval:

- Underground operations, 24 hours per day, 7 days per week;
- Truck haulage of ore from underground to ROM Pad 24 hours per day, 7 days per week;
- Production rock blasting between 6.45 am to 7.15 pm, 7 days per week;
- Development blasting concurrently with production blasting where practicable;
- Ventilation fans, 24 hours per day, 7 days per week;

2.4.2 Mining method and sequence

A variety of production methods are utilised, including open stoping (OS), uphole benching, room and pillar and uphole pillar retreat mining. OS is the most prevalent method used in the Western Mineralisation, uphole stoping (with room and pillar) and uphole pillar retreat in the Main Lode Pillars.

The ore was blasted using a bulk emulsion explosive and extracted using load haul dump vehicles (LHD's) either conventionally or under remote control and transported to loading points where mine trucks transported ore to the ROM pad.

A total 649,902 t of ore from 139 stopes was mined during the reporting period. This resulted in approximately 14,500 truck movements to the ROM pad. **Figure 2-2** (**Plan 3)** provides a long section indicating location of the stopes mined. A vertical distance of 64 m was maintained (in the Zinc Lodes) from South Rd/Bonanza Street.

Figure 4-2 provides a long section for planned stopes in 2019.

2.4.3 Void backfilling

Waste rock was used to backfill mined out stopes with a total of 332,702 t placed during the reporting period. The backfill plant did not operate during the reporting period and no tailings were placed underground.

2.4.4 Waste rock and void backfilling

Waste rock is generated from underground mining operations and is predominantly used underground for backfilling stopes and maintenance of underground roads. During the reporting period 492,498 t was extracted as waste, 357,792 t of waste rock was returned underground as void fill, 29,392 t stockpiled in Kintore Pit, and 105,314 t to BHP Pit. At the end of the reporting period, the waste stockpile in Kintore Pit held approximately 981,834 t.

Waste rock is also used for road making and repairs underground.

Block modelling is used to identify underground waste material sources. Underground diamond drilling results and assays assist the geological technicians to identify waste materials earmarked for surface.

2.4.5 Underground decline development

The Rasp Decline provides access to stopes for mining. During the reporting period, the Decline was extended by 304.6 m providing access to the Western Mineralisation below the 19 Level.

2.4.6 Ore and waste stockpiles

Ore (649,902 t) was transported by truck and stored on the ROM Pad before being processed. The ROM Pad is 32 m by 80 m and is surrounded by 5 m windbreaks. Water application was used to control dust. No more than a week's processing was stored on the ROM stockpile at any one time. Mined ore was below the approved maximum rate of 750,000 tpa. Closing ore stockpiles on the ROM pad at the end of the reporting period totalled 1,732 t.

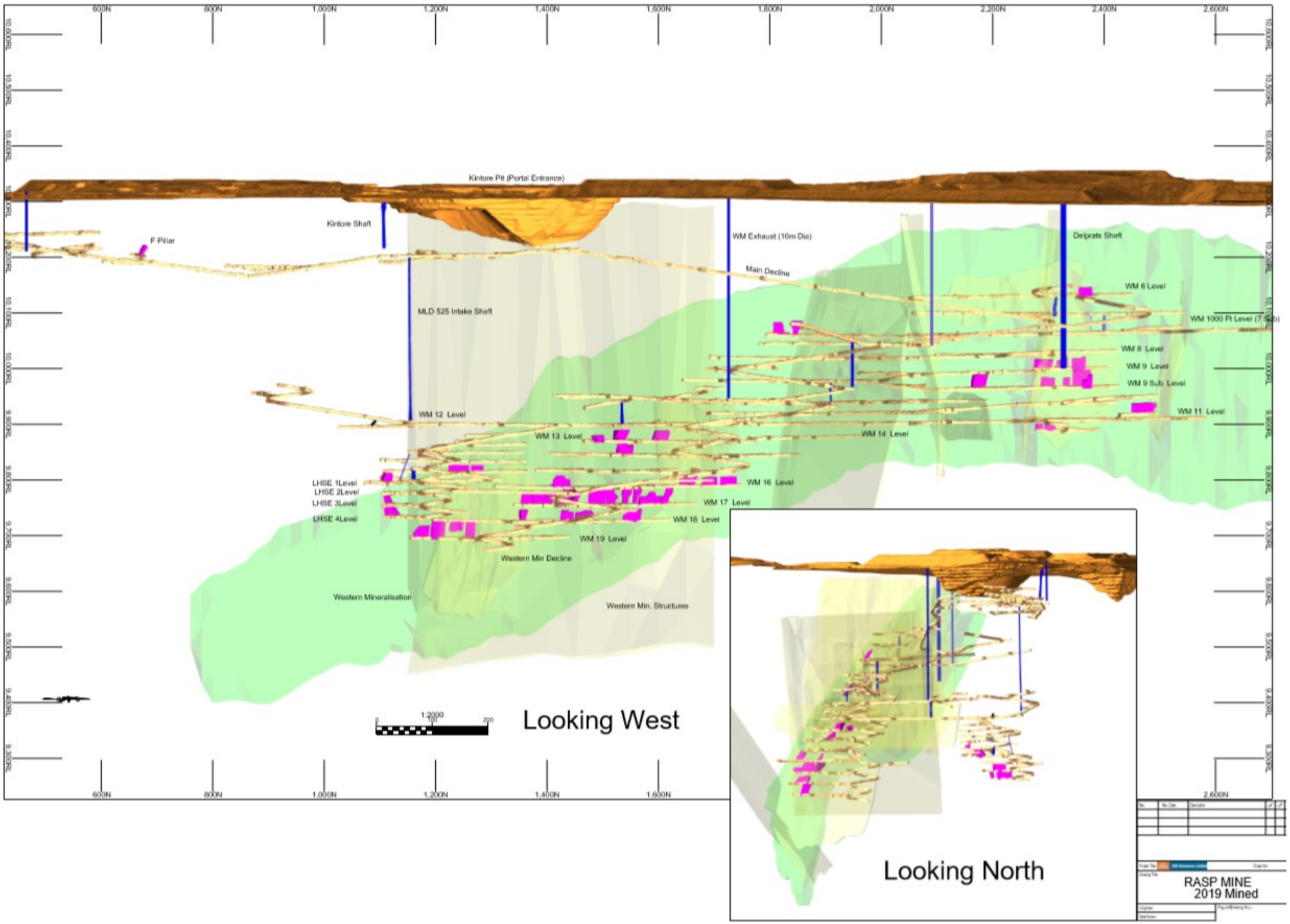
A total of 134,706 t of waste was hauled to the surface from underground during the reporting period and stored in Kintore Pit totalling 981,834 t stored.

Ore and waste production for the reporting period is summarised in **Table 2-2** Ore and Waste Summary for the Reporting Period (2019).

Table 2-2 Ore and Waste Summary for the Reporting Period (2019)

Item	Total Production Tonnes
Topsoil Stripped	N/A
Topsoil Spread	N/A
Ore Tonnes Mined: Dry Tonnes	649,902
Waste Backfill (UG voids): Tonnes	357,792
Waste Trucked to Kintore Pit	29,392

Figure 2-2 Plan 3 Mining Activities in the Reporting Period (2019)



2.5 Mineral Processing

2.5.1 Processing methods and rates

All mined ore is processed on site in the processing plant. This consists of a single stage crushing circuit with a two stage Semi-Autogenous Grind (SAG) – Ball milling circuit capable of processing ore at the required rate and to the required grind size. Material then passes through differential flotation, which incorporates conventional roughing, scavenging and multi-stage cleaning and includes concentrate regrind, to separate lead and zinc concentrates. Concentrates are dewatered using thickeners and pressure filtration. The filtered concentrates are conveyed directly into containers and sealed. The concentrate is stored in these sealed containers in readiness for loading onto rail wagons for transport to the CBH ship loader in Newcastle, NSW or to the Nyrstar Pty Ltd smelter at Port Pirie, SA. In 2019 all zinc concentrate was sent via rail to the ship loader, and all lead concentrate was sent via rail to the smelter.

Reagents used in the process included pulp pH modifier, flotation frothers, collectors, activators and depressants, used in various combinations in the lead and zinc flotation circuits. Flocculants are used in concentrate and tailing dewatering.

A summary of mineral processing production rates for the reporting period is presented in **Table 2-3.**

Table 2-3 Mineral Processing Summary for the Reporting Period (2019)

Activity	Total 2019 (t)
Milled	651,305
Lead concentrate	25,242
Zinc concentrate	47,592
Tailings deposited	578,472
Tailings Storage Facility (TSF2) storage capacity as at end of period	October 2020

2.5.2 Mill operating hours

The processing plant operates 24 hours per day in accordance with the Project Approval. Schedule 3 Condition 16 places a restriction on milling activities - (b) *shunting of concentrate wagons shall only occur between 7:00am and 6:00pm on any day*. No shunting of concentrate wagons occurs during the loading or unloading of concentrate containers. Concentrate trains are moved into and out of the loading area by Pacific National operators as one unit and no reordering of wagons occurs. Pacific National conducts this activity twice per week taking 10 to 15 minutes, following inspection of the connection and state of the wagons. Once loaded, the train departs in the same direction as arrival. During the reporting period, there were no community complaints related to this activity.

2.5.3 Mineral waste - tailings

All tailings generated from the processing plant are deposited into Blackwood Pit (TSF2). Tailings from the flotation process are pumped to and deposited at the southwestern end of TSF2 via a duty/standby configuration of centrifugal pumps. Particle solids settle out of the slurry stream along the length of TSF2 in a north-easterly direction. Any excess water collects at the northeast end of the facility and is pumped back into the process water tank via a mobile diesel water pump.

During the reporting period, 578,472 t of tailings were pumped to TSF2, on average the tailings contained zinc (0.35%), lead (0.21%) and copper (0.01%), Ag (8g/t), Fe (2.97%).

In the initial Project Approval, BHOP underestimated the amount of mine development that was required to access the Main Lode and Western Mineralisation ore bodies. The need to undertake more underground mining development than anticipated has reduced the capacity of underground voids to accept both waste rock and tailings material from the Backfill Plant. In the original EA, it was predicted that approximately 250,000 t of waste rock would be produced each year for a production rate of 750,000 t of ore. In 2019 with 649,902 t mined, waste rock produced was 492,498 t. BHOP has chosen to place the additional waste rock underground to fill voids and stopes, as it is more economical to dispose waste rock underground if possible rather than transporting waste to the surface. Hence, there is no void space underground for the backfill of tailings.

BHOP also opted to only deposit tailings in TSF2 as this facility had greater capacity and was economically more viable.

Table 2-4 shows past and proposed tailings deposition and waste rock production rates.

Table 2-4 Summary of Proposed (EA) and Actual Placement of Waste Rock and Tailings

Year (to 30 June)	EA Tailings in Underground back fill per year (t)	EA Tailings deposited in TSF1 (t)	EA Tailings deposited in TSF2 (t)	EA Waste Rock U/G (t)	Actual[1]/ Predicted[2] Tailings in TSF2 (t)	Actual waste rock placed underground (t)	Actual waste rock stored Kintore Pit (t)	Actual Total waste rock (t)
2012	97,969	273,281	0	250,000	322,111[1]	47,527	150,000[3]	197,527
2013	195,938	195,138	0	250,000	574,833[1]	230,607	150,000[3]	380,607
2014	195,938	195,138	0	250,000	486,749[1]	223,473	163,304	386,777
2015	216,563	216,563	0	250,000	499,598[1]	223,611	228,942	452,553
2016[1]	247,500	88,281	159,219	250,000	555,837[1]	265,369	96,888	362,257
2017[1]	292,475	0	278,438	250,000	622,161[1]	215,897	76,578	292,475
2018[1]	309,375	0	309,375	250,000	644,828[1]	332,702	121,864	444,566
2019[1]	309,375	0	309,375	250,000	578,472[1]	357,792[2]	134,706[1]	492,792[1]
2020[1]	309,375	0	309,375	250,000	530,000[2]	-	-	-
TOTALS	**2,174,508**	**968,401**	**1,365,782**	**2,250,000**	**4,651,289**	**2.202.465**	**1,206,896**	**3,409,361**

Note[1]: Actual tailings deposited.
Note[2]: Predicted .
Note[3]: Estimated from visual inspection at the time.

2.6 Mining Fleet

There were minor changes to the mining fleet during the reporting period with some trucks and light vehicles replaced and/or scrapped. In 2019, a haul truck was obtained from the CBH Endeavour site, an underground loader, three new Jumbo Drill rigs and a second-hand water cart were purchased. **Table 2-5** lists the mining fleet as at the end of the reporting period.

Table 2-5 Mining Fleet 2019

Vehicle Category	Number	Vehicle Category	Number
Jumbo drill	4	Grader	1
Production Drill	2	Excavator	1
Haul Truck	6	Service Vehicle	6
Load Haul Dump	5	Wheel Loader	2
Explosive Charger	2	Prime Mover	2
Forklift IT	7	Light Vehicle	30

2.7 Next Reporting Period

2.7.1 Construction

Construction of Stage 2 works for the TSF2 Embankments will be undertaken in 2020.These works will include construction of Stage 2 of Embankment 1 and construction of Embankment 3. A spray system will also be installed around the perimeter of the TSF2.

2.7.1.1 Construction of the Stage 2 TSF2 Embankment Works

Development consent (PA07_0018) MOD4 was granted to construct three embankments and a retaining wall at low points around the perimeter of the Blackwood Pit TSF (TSF2) in September 2017. The preliminary design was endorsed by the NSW Dam Safety Committee in December 2016. The EA and associated studies are available on the CBH website.

Stage 2 TSF2 Embankment works will be completed in 2020 with construction planned to commence mid-May and be completed in November. These works consist of:

- Completion of Embankment 1
- Construction of Embankment 3
- Water spray system

Construction of Embankment 3 will be undertaken when the tailings reach the required level and have settled sufficiently for installation.

The embankments will be formed from compacted waste rock excavated during mining operations and currently stored in Kintore Pit. The rock fill would also be used to form a pioneering layer for raise construction on potentially soft tailing. The testing procedure for lead content of the waste rock will be the same as used for the noise bund constructed at the CBP.

The embankments will be lined and seepage collection systems installed. Rainwater from embankments 1 and 2 directed to the current stormwater management system.

Golder Associates have been engaged to design the extensions to TSF2 and associated infrastructure are currently completing the detailed design. With the completion of the detailed design, the Site Water Management Plan and Air Quality Management Plan were updated and submitted to the DPE, EPA and DRG for review and approval.

In 2018, BHOP held discussions with the EPA in regards to an air quality monitoring program for the construction period and operations. BHOP updated the Air Quality Management Plan and Monitoring Program, Noise Management Plan, Site Water Management Plan, and Environmental Management Strategy, with the agreed requirements and they have been submitted to the DPE, EPA and DRG for review and approval. No works will commence for the construction of the embankments until these have been approved by the DPE.

Three portable PM10 monitors will be purchased in 2019, with two placed at the western and northern side of TSF2 and one held as a spare. The northern PM10 monitor was installed in Proprietary Square in place of the TEOM, High Volume Air Samplers and Dust Gauge currently situated at Blackwood Pit, which are required to be removed during the construction of Embankment 2. When the Blackwood Pit monitoring equipment is re-installed following the Embankment 2 construction, the PM10 at Proprietary Square will be moved to the TSF2 ramp to monitor in-pit dust levels. Video cameras will also be installed on the Mill Control Room and overlooking TSF2 before the embankment works start as a means of monitoring and recording dust generation. The other operational PM10 monitor was installed at the lookout above the western end of TSF2.

2.7.2 Exploration

During 2019-20, exploration on CML7 will continue to focus on:

(a) Western Mineralisation:

- Southern and down-plunge delineation.
- Northern plunge reversal.

(b) Number 2, 3 Lens Main Lode remnants including the Lower Harvey Shaft area and testing the Lower Harvey Shaft remnants to the south (toward Shaft 7).

(c) Surface Exploration:
- Western Mineralisation - Northern plunge reversal
- Blackwood's East
- British Shear
- Block 11 – 14

2.7.3 Operations

Table 2- outlines the planned production rates for 2020**. Plan 3** (**Figure 2-6**) shows the mining areas and stopes. Planned mine production is 725,970 t, tailings deposition is estimated at 623,884 t. It is also planned to commission the Backfill Plant in late 2019, which will result in future tailings placement in underground voids.

Table 2-6 Summary of Planned Production for 2020

Activity	January to December 2020 (t)
Ore Mined	665,698
Waste Backfill (UG Rock Places)	250,000
Waste Trucked to Surface	240,000
Milled	665,698
Lead concentrate	26,151
Zinc concentrate	56,737
Tailings deposited	600,453
TSF2 storage capacity as at end of period	2 years (with approved embankments)

2.7.4 Water structures - maintenance

Surveying of the water storage structures were conducted in 2018. The development of staged storage curves enabling more accurate capacities and volumes to be determined will be completed in 2020.

Inspections of storages for sediment build-up were conducted in 2018 and sediment removal was conducted in sediment pond 17A and Horwood's Dam in 2019.

2.7.5 Modification applications

In 2020, BHOP will apply for modification (MOD6) of the project approval to deposit tailings into Kintore Pit, relocate the mine portal, and provide for future waste rock storage.

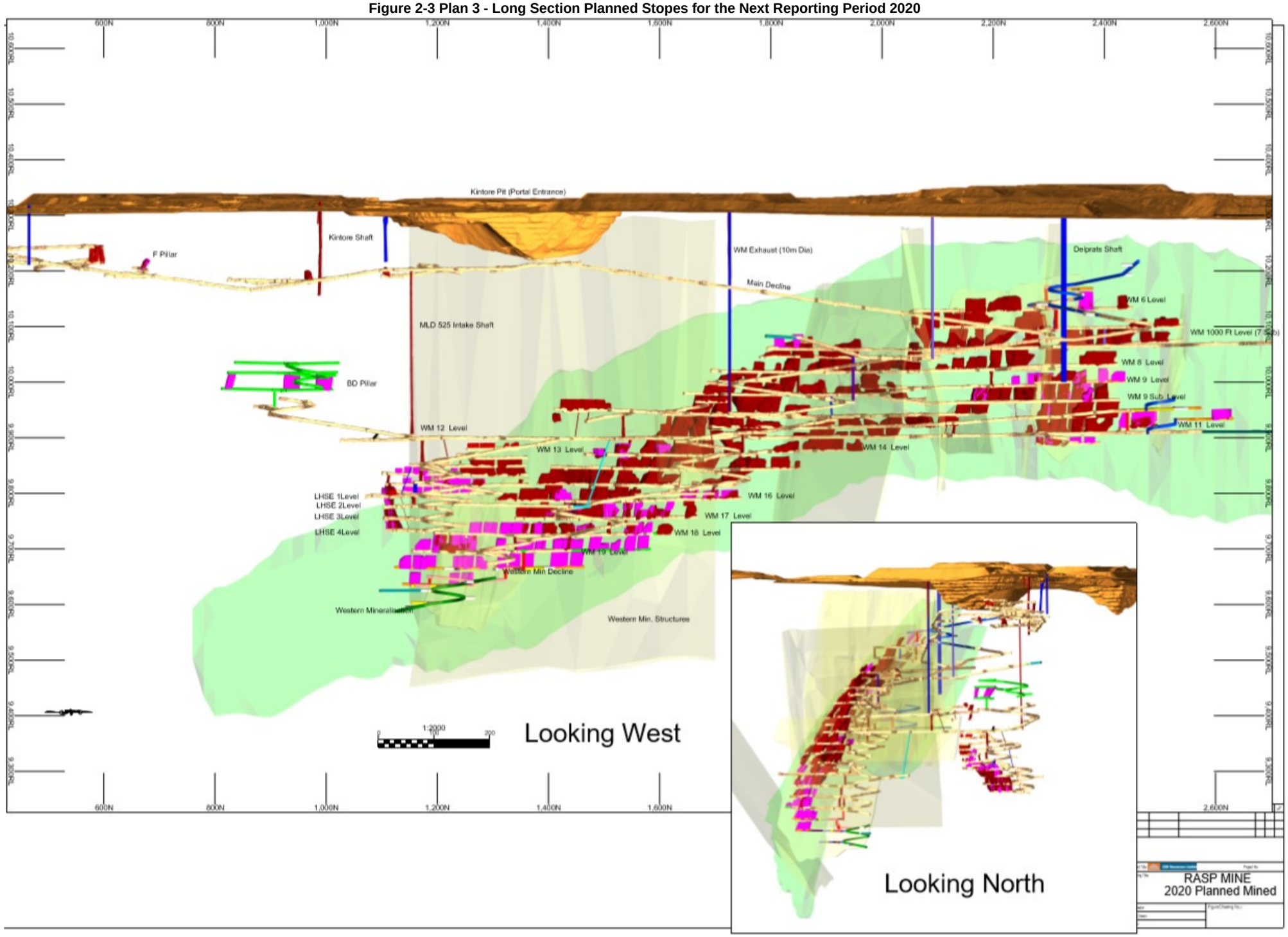
In the original Environment Assessment (EA) for the Project it was planned for tailing to be placed both in an above ground tailing storage facility and underground, via the Backfill Plant, to fill mining voids. The tailing waste stream from ore processing has been approved to be deposited in the historic tailing facility (TSF1) and in the disused Blackwood Pit (TSF2). BHOP chose to deposit tailing in TSF2 and not use TSF1. This decision was based on the greater capacity of TSF2 (3.1 Mt) compared to the capacity of TSF1 (970,000 t).

In the initial EA BHOP underestimated the amount of mine development that was required to access the Main Lode and Western Mineralisation ore bodies. The need to undertake more underground mining development has impacted the amount of waste generated. In the original EA it was predicted that approximately 250,000 t of waste rock would be produced each year for a production rate of 750,000 t of ore. Actual total waste rock produced has averaged 361,000 t per year since

commencement of operations peaking in 2015 and 2018 with 452,000 t. BHOP has chosen to place the additional waste rock underground to fill voids and stopes, as it is more economic to dispose of waste rock underground where possible rather than transporting waste to the surface. Thus there has been no requirement to fill any underground void with tailings. **Table 2-4** summarises tailing and waste rock placement as predicted in the original EA (at a production rate of 750,000 t) and what has actually been placed since commencement of operations.

Meetings have been held with the relevant regulators to discuss the proposed modification - Department of Planning and Environment (DPE), the Broken Hill City Council (BHCC), Division of Resources and Geoscience (DRG) and the Environment Protection Authority (EPA).

Figure 2-3 Plan 3 - Long Section Planned Stopes for the Next Reporting Period 2020



3. ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

3.1 Meteorological

Figure 3-1 and **Table** 3-1 provide summary weather data. This data is a combination of information from the Rasp Mine weather station and the Bureau of Meteorology station (for rain days and rainfall).

While temperatures in 2019 remained consistent with historical records, rainfall (34.76 mm) for the period was significantly lower than the BoM's long-term annual average of 259 mm. There were only 18 rain days for the period (35 in previous period) with most rain falling in Autumn (20.6 mm). Winds were predominantly from the south with high winds experienced during July to November.

Figure 3-1 Weather Data for the Reporting Period (2019)

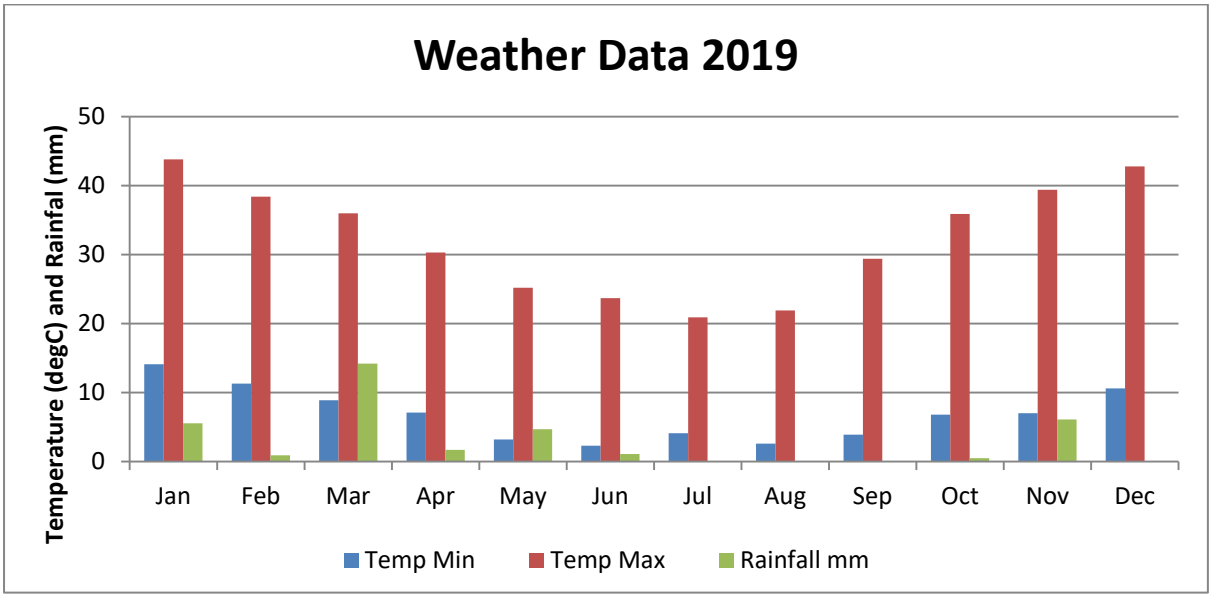


Table 3-1 Summary of Wind and Rain Days in Reporting Period (2019)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Predominant Wind Direction	S	S	S	S	SW	S	NW	S	S	S	S	S
Max wind speed (km/hr)	43.8	41.4	40.8	39.9	42.6	50.8	41.8	47.9	50.3	42.8	53.3	43.7
Days rained in month	3	2	1	1	1	2	0	0	2	1	3	0

3.2 Environmental Monitoring Locations

The BHOP site environmental monitoring program is summarised in **Table 3-2**, locations for sampling/monitoring points are shown in **Figure -3-2**. Shaft 6 was removed as an air quality monitoring location in MOD5, approved in November 2018, as Shaft 6 became an air intake point in April 2018. In April, blast monitor V4 at 123 Eyre St was removed at the residents request and placed at the Eyre St Bowls Club. The site weather station is due for replacement in early 2019 as the current weather station cannot calculate Sigma Theta, a requirement of EPL 12559.

Table 3-2 Summary of BHOP Environmental Monitoring Program

EPA ID	BHOP ID	Parameter	Frequency
AIR QUALITY			
1 & 56	Primary Vent Shaft and Shaft 6	- Oxides of Nitrogen (as NO_2) -Total solid particles (TSP) - Volatile organic compounds - Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V	Quarterly (at blasting event)
2	Crusher Baghouse Stack	- Total solid particles (TSP) - Total - Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V	Quarterly
3 - 9	D1 – D7	Insoluble solids, Lead	Monthly
10	TSP-HVAS	Total Suspended Particulate, Lead on filter paper	Every 6 days
11 & 12[1]	HVAS1 & 2	PM10, Lead on filter paper	Every 6 days
13 & 14	TEOM 1 & 2	PM10, Wind Speed/Direction	Continuous
SURFACE WATER			
29 - 36	S31-1, 44, 49, 1A, 9B-2, Horwood Dam, Upstream and Downstream	pH, EC, TDS, SO4, Cl, Na, Cd, Pb, Mn, Zn	When contain water (at least 2 per 12 months) April & October
GROUNDWATER			
37 - 52	GW01 – GW16	pH, EC, TDS, SO4, Cl, Ca, Mg, Na, Fe, Cd, Pb, Mn, Zn	Quarterly
53 & 54	Shaft 7 & Kintore Pit extraction	pH, EC, TDS, SO4, Cl, Ca, Mg, Na, Fe, Cd, Pb, Mn, Zn	Quarterly
NOISE & BLASTING VIBRATION			
15 - 28	A1 – A14	Leq, 15min/Day Leq, 15min/Evening Leq, 15min/Night	Annually
V1 – V5	V1 – V5	dB mm/ second	Continuous (when blasting)
-	V6	dB mm/ second	Continuous (when blasting)
-			
WEATHER			
55	Meteorological Station	Temperature, wind speed & direction, rainfall	Continuous (15 minute intervals)

Note 1 = EPL 12559 lists TSP and TSP Lead to be sampling from these units, however, these units can only monitor one type of parameter. BHOP are in discussion with the EPA to resolve this.

The following sections provide a summary of these monitoring requirements together with the results for the reporting period. A discussion of any identified trends and a comparison with predictions in the original EA/PPR are also provided where available.

3.3 Air Quality

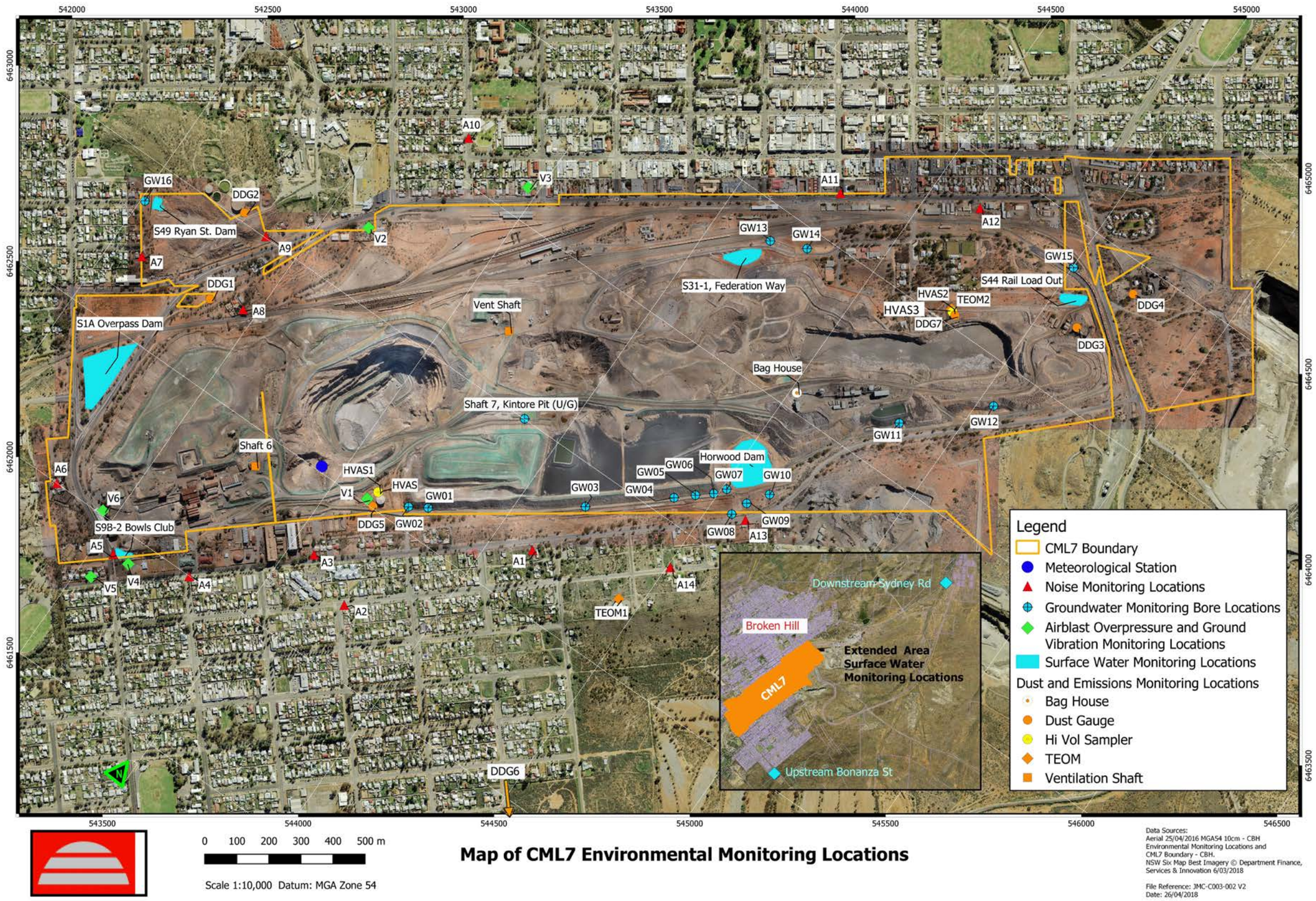
In accordance with the conditions of PA07_0018 and EPL12259 air quality is monitored:

- Air emissions from in-stack mine exhaust ventilation and the crusher baghouse are tested quarterly by an external contractor with specialised equipment;
- Ambient air quality is monitored by BHOP personnel via a combination of dust deposition gauges, high volumes air samplers (HVAS) and tapered element oscillating microbalance (TEOM) sampling units; and

Real-time information is downloaded and alerts automatically forwarded to assist in the day-to-day operational management of issues as well as long-term analysis of environmental data.

Figure 3-2 shows the sampling locations for all air quality monitoring units.

Figure 3-2 Location of Monitoring / Sampling Points



3.3.1 In-stack air quality

During the reporting period BHOP engaged Assured Monitoring Group (AMG) to conduct testing of the mine ventilation exhaust points and the crusher baghouse. Testing was performed each quarter in accordance with the EPL. AMG are NATA accredited to perform this testing. The EPL Condition L2.1 specifies the in-stack performance criteria for the two ventilation exhaust units - Primary Ventilation Shaft and Shaft 6 and the Crusher Baghouse. **Table 3-3** provides the results of the testing against the limits as set out in the EPL. All limits were met. Shaft 6 became an air intake in April 2018 but monitoring of emissions continued to the end of 2018. The EPA received a complaint in 2018 regarding the dust emanating from the Primary (Main) Vent. While sprays in the mouth of the Primary Vent are operated following blast, dust is still emitted from the vent and can be carried off the site. BHOP engaged the services of a ventilation specialist to review the effectiveness of the spray system and recommend alternative control measures if needed. A ring main has since been installed around the Vent mouth and fine particle sprays as recommended by Wet Earth are to be installed.

Table 3-3 Vent and Baghouse Testing Results During the Reporting Period

	Limit	Primary Vent (EPL1)				Crusher Baghouse (EPL2)			
Testing Date (2019)		12/3	28/5	8/10	10/12	13/3	29/5	9/10	11/12
Nitrogen Oxides (mg/m^3)	350	2.46	2.54	2.05	2.80	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Volatile Organic Compounds (mg/m^3)	40	0.194	0.486	0.009	0.181	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Total Suspended Particles (mg/m^3)	20	7.17	5.34	6.46	2.83	2.43	11.0	19.8	10.0
Type 1 and Type 2[2] (mg/m^3)	1	0.0441	0.119	0.0377	0.106	0.911	0.369	0.831	0.148

Note 1 = Not required to be tested.
Note 2 = Type 1 substance Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements. Type 2 substance means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements.

Air Quality Management Plan BHO-PLN-ENV-001 lists the controls that were in place during the reporting period. In summary, the major controls include:

- Automatic watering sprays on the ventilation shafts; and
- Fully enclosed primary crusher operating under negative pressure to a baghouse.

3.3.2 Dust deposition gauges

Dust deposition levels refer to the quantity of dust particles that settle out from the air as measured in grams per square metre per month (g/m^2/month) at a particular location. Total fallout dust (depositional dust) is continuously monitored from seven deposition gauges located on and around the Rasp Mine, as shown in **Figure 3-2**. D1 and D6 are located off-site, D1 near the St Johns training facility north of the Rasp Mine and D6 in Casuarina Avenue south of the Rasp Mine. D2 to D5 and D7 are located on the Mine lease in various locations. D7 was removed in June 2019 due to the construction of Embankment 2 at TSF2. It will be restored when the project engineer confirms the construction of Embankment 2 is complete.

Samples are collected monthly and are sent to ALS Laboratory (NATA accredited) in Newcastle and analysed for total deposited dust and deposited lead dust. Deposited dust is assessed as insoluble solids as defined by Standards Australia, 2003, AS 3580.10.1-2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited Matter - Gravimetric Method.

Dust deposition criteria are provided in terms of both an acceptable increase in dust deposition over the existing background levels and an absolute maximum value. These impact assessment criteria are summarised in **Table 3-4.**

Table 3-4 Dust Deposition Criteria

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Provided below is a discussion of results for dust deposition during the reporting period (2019) and trends over the operational life of the Rasp Mine. Dust deposition results are reported and reviewed internally on a monthly basis.

Figure 3-3 and **Figure 3-4** show the monthly dust deposition and total deposited lead results for the reporting period. Dust deposition results are higher for all gauges in 2019 when compared to the previous year. This may be the result of significantly lower rainfall (34.76 mm) than the BOM's long-term average of 259 mm, and less rainfall than the previous year (92.2 mm). Results at D2-Block 10 were elevated in November and December which may be due to the works occurring around the dust gauge on the Essential Water site.

There were fourteen occasions where the monitoring location exceeded the depositional dust level of 4 g/m^2/month limit (red figures in **Table 3-5**) compared to twenty the previous year, although this does not include six months of monitoring at D7-Blackwoods. Highest readings occurred in the spring and summer months when wind speeds are higher and dust storms more frequent despite the majority of the year's rainfall occurring in those months. D6-Casuarina Avenue is a control site which recorded more monthly results above the 4 g/m^2/month limit than any other location except for D4-Junction Mine.

Gauges which recorded levels greater than 2 g/m$^{2/}$month over background levels did so in the spring and summer months when wind speeds are higher and dust storms more frequent.

Lead results were consistently above baseline levels throughout the period except for October at D3-Thompsons Shaft, which is adjacent to the rail loading facility and access road, as well as exposed areas situated on the northern side of the site. D4-Junction Mine also recorded elevated lead levels throughout the year but this is surrounded by the Junction Mine reserve and other exposed areas to the northeast and northwest. The D5-Silver Tank gauge is situated on the southern boundary of the site and experienced high Dust and Lead results in July and August when winds were predominantly from the south. No works were taking place on site at that location in those months so the high levels were not likely to be caused by site activities.

There are no results for Dust and Lead for D1-St Johns as the dust gauge and stand were taken from the location by persons unknown and only discovered when BHOP staff went to the site to swap out gauges in October 2019. The replacement gauge is chained to a fence and the gauge is now inspected weekly.

Table 3-5 Dust Deposition Results for the Reporting Period (g/m$^{2/}$month)

	D1 EPL3 (off site)		D2 EPL4		D3 EPL5		D4 EPL6		D5 EPL7		D6 EPL8 (off site)		D7 EPL9	
2019	DD	LD	DD	LD	DD	LD	DD	LD	DD	LD	DD	LD	DD	LD
Jan	8.0	0.004	5.3	0.003	4.9	0.013	9.90	0.020	10.70	0.008	10.00	0.004	6.10	0.021
Feb	2.40	0.002	1.80	0.001	2.9	0.007	5.10	0.002	3.50	0.006	10.50	0.001	3.30	0.009
Mar	2.30	0.004	1.30	0.002	1.5	0.006	4.10	0.006	2.90	0.005	5.40	0.002	2.80	0.012
Apr	1.1	0.00323	0.9	0.0014	1.6	0.0112	1.80	0.008	1.7	0.0055	3.8	0.002	1.8	0.0137
May	1	0.0017	1.1	0.0009	1.5	0.0078	3.00	0.015	2.1	0.0095	1.4	0.0019	1.4	0.0067
Jun	0.7	0.00276	0.6	0.0007	0.8	0.0092	1.50	0.009	1.4	0.0063	1.8	0.0016	2.4	0.017
Jul	1.1	0.00152	0.9	0.001	2.5	0.011	2.60	0.009	17.2	0.1	2	0.0021	NS	NS
Aug	0.7	0.00633	0.7	0.0009	1.2	0.0104	1.80	0.015	2.6	0.0797	2.4	0.0074	NS	NS
Sep	NS	NS	2.9	0.0021	2.3	0.0141	6.50	0.022	4.6	0.0224	7.7	0.004	NS	NS
Oct	2.1	0.00212	1.8	0.002	1.2	0.00292	3.70	0.003	4	0.0068	4	0.0006	NS	NS
Nov	2.9	0.00129	7.6	0.0073	6.8	0.011	7.50	0.007	5	0.0054	13.3	0.0015	NS	NS
Dec	3.3	0.00019	5.2	0.0002	3.7	0.00653	6.60	0.000	4.9	0.0002	7	0.0024	NS	NS
2010	**4.0**	**0.0034**	**3.1**	**0.005**	**4.3**	**0.005**	**5.7**	**0.006**	**N/A[1]**	**N/A[1]**	**5.8**	**0.004**	**N/A[1]**	**N/A[1]**

Note 1 = Background is not available for these locations.

Figure 3-3 Monthly Total Deposited Dust for 2019

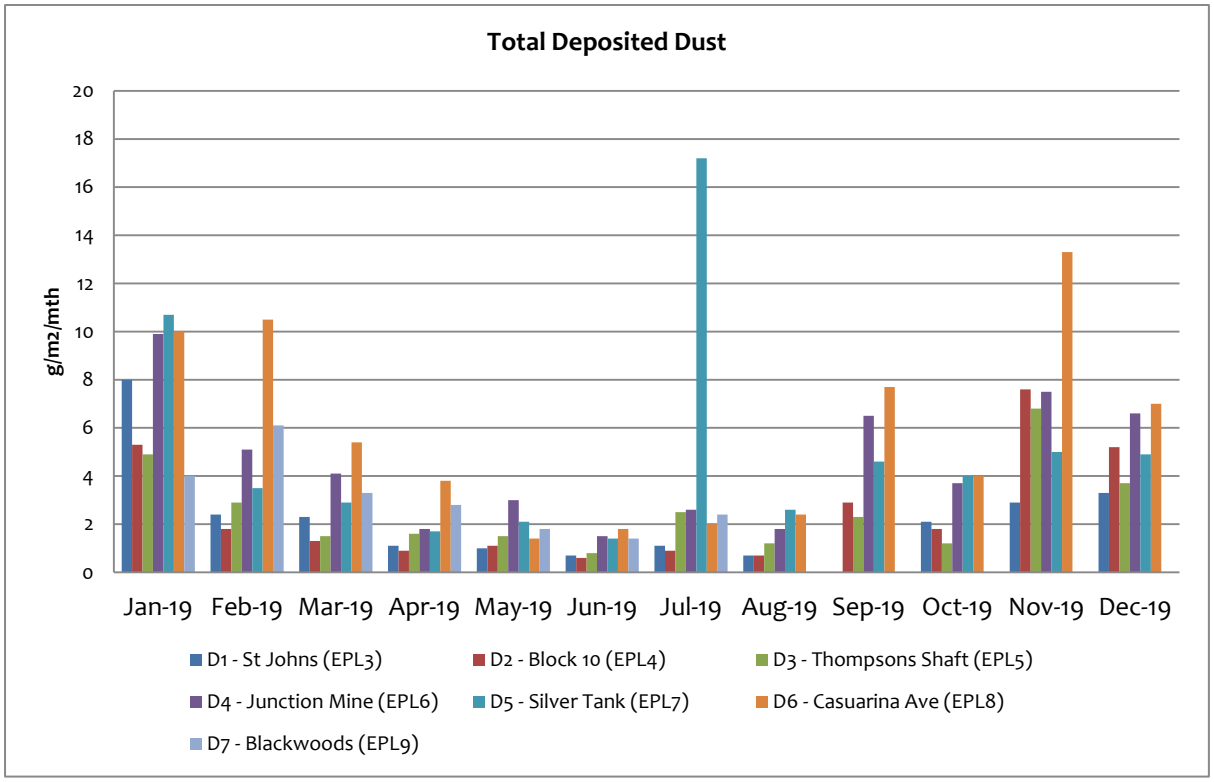


Figure 3-4 Monthly Lead Deposition for 2019

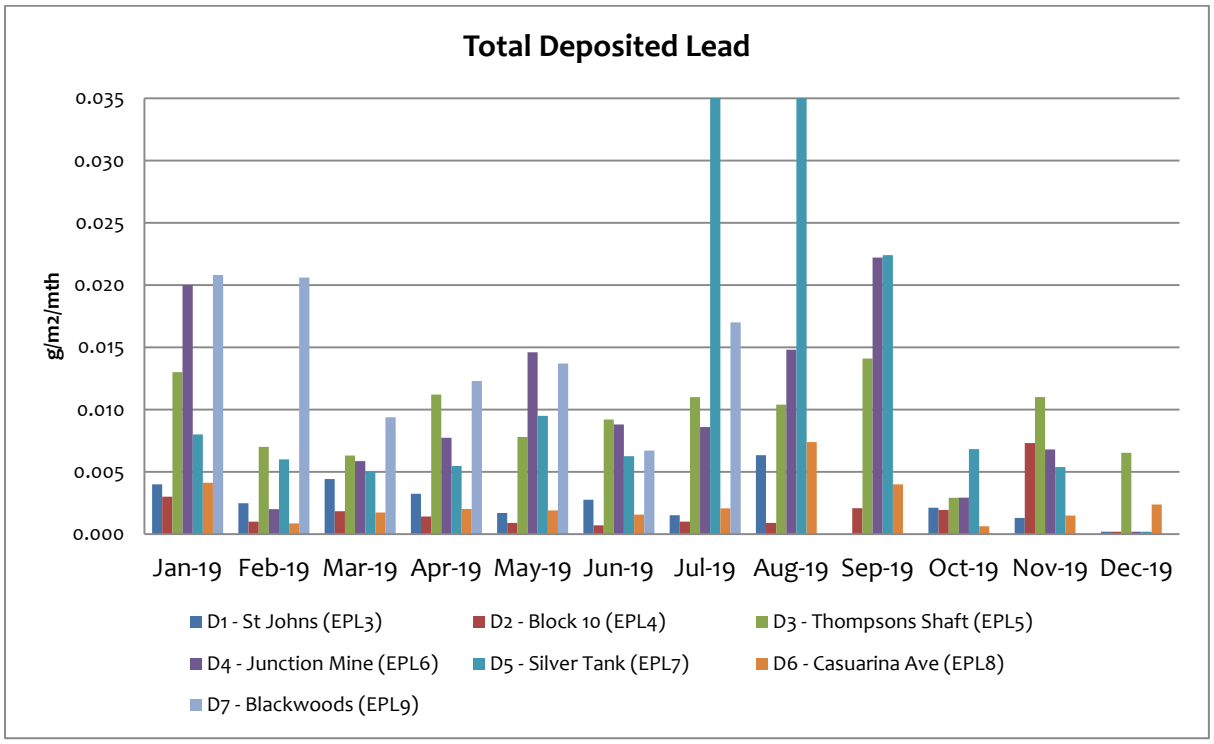


Figure 3-5 Total Deposited Dust 2007 – 2019

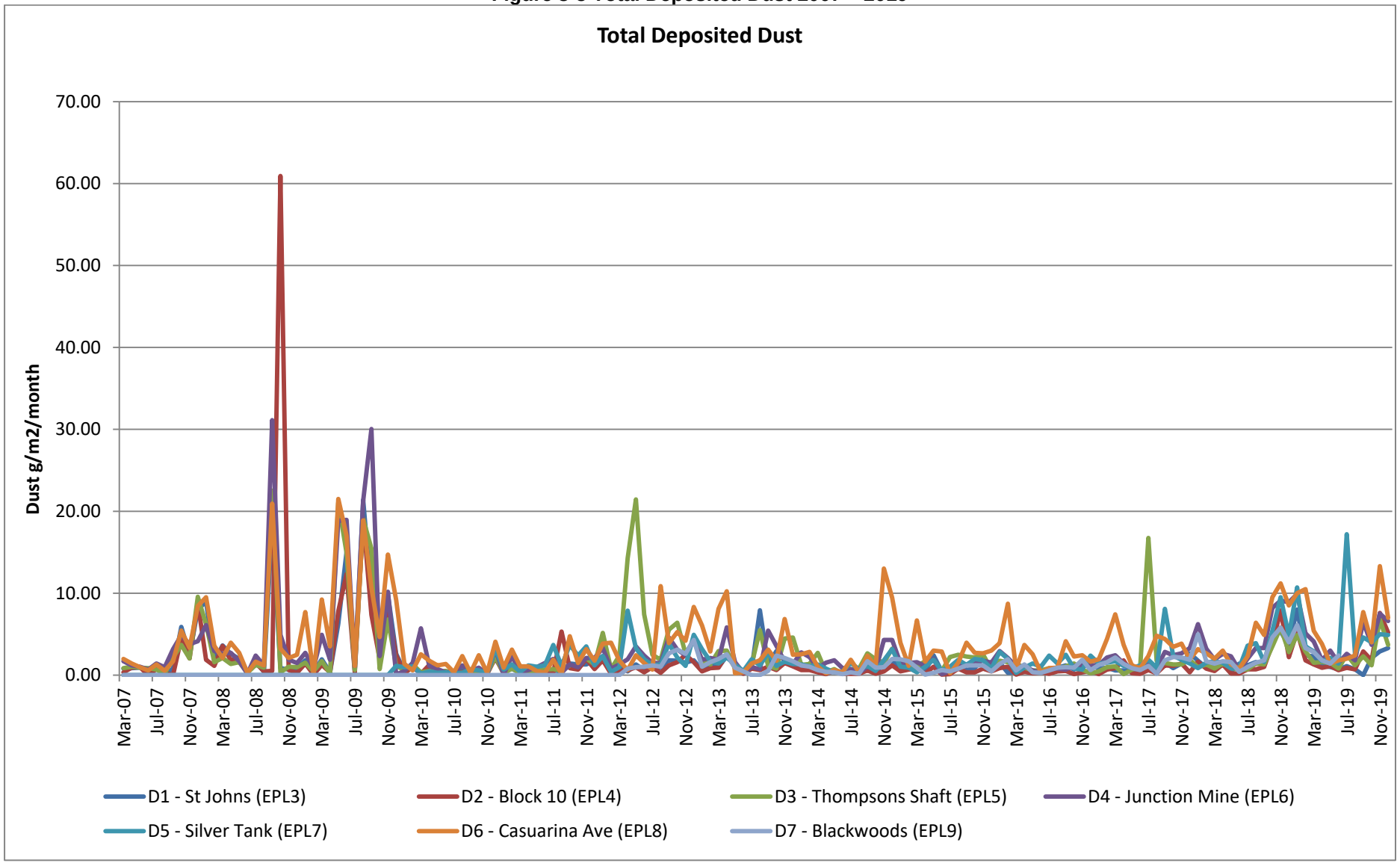
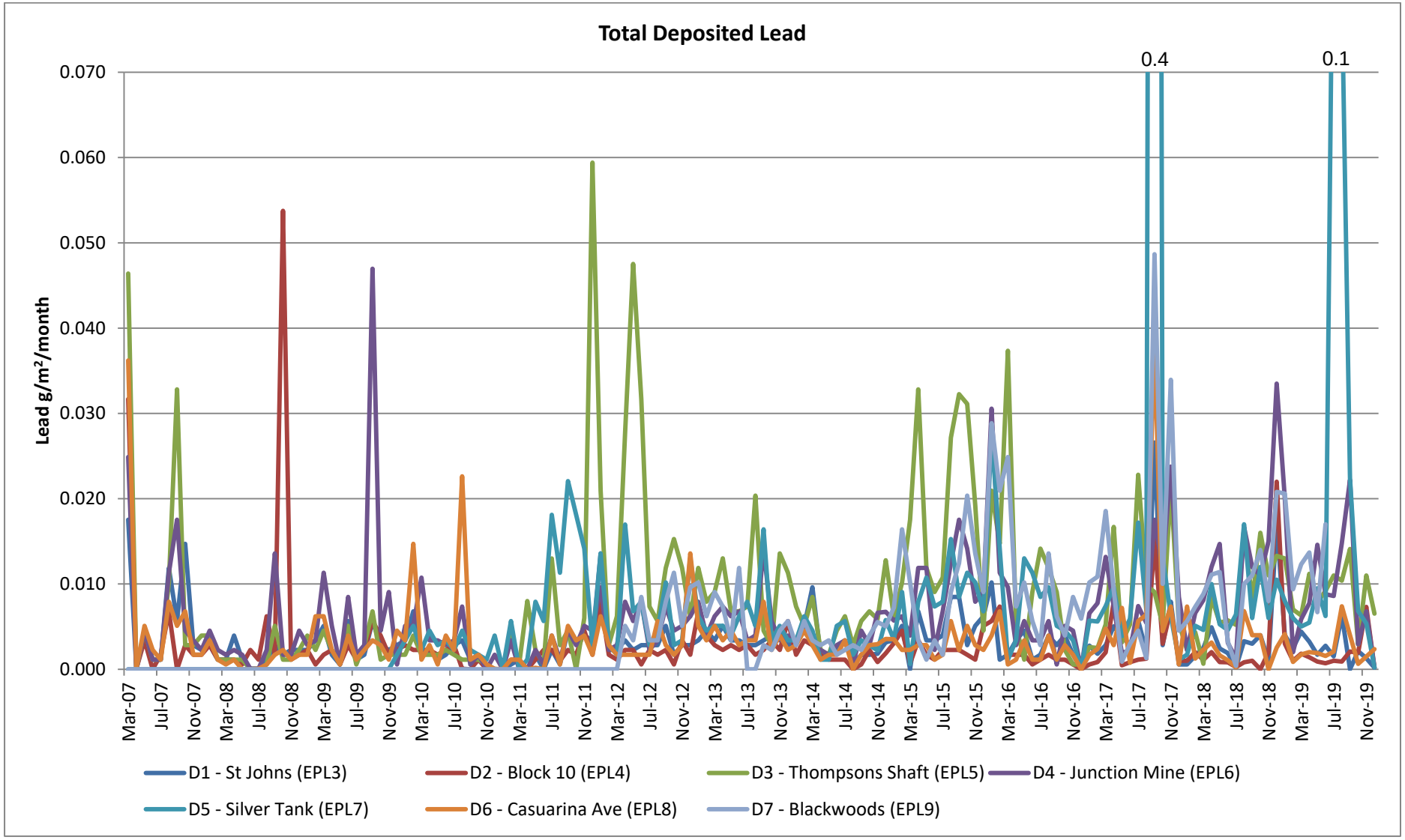


Figure 3-6 Total Deposited Lead 2007 to 2019



3.3.3 High volume air samplers

There are four high volume air samplers used to measure ambient air quality at the Rasp Mine – HVAS (EPL10) and HVAS1 (EPL11) are located at the Silver Tank, central and to the south of the mine lease, and HVAS2 (EPL12) and HVAS3 (EPL57) are located adjacent to and north of Blackwood Pit. Locations are shown in **Figure 3-2**. HVAS and HVAS3 sample for total suspended particulates (TSP) and lead dust, and HVAS1 and HVAS2 sample for particulate matter less than 10 microns (PM_{10}) and lead dust.

Samples are collected every six days and are sent to ALS Laboratory (NATA accredited) in Newcastle. **Table 3-6** outlines the impact assessment criteria as listed in PA07_0018.

In accordance with the PA07_0018 and the EPA air quality guidelines, from September 2017, the criteria for annual rolling average for PM_{10} criterion was reduced from 30 $\mu g/m^3$ to 25 $\mu g/m^3$. All other air quality criterion remains unchanged.

Table 3-6 Impact Assessment Criteria

Pollutant	Averaging Period	Criterion
Total suspended particulate (TSP) matter	Annual	90 $\mu g/m^3$
Particulate matter < 10 µm (PM_{10})	Annual	25 $\mu g/m^3$
Particulate matter < 10 µm (PM_{10})	24 hour	50 $\mu g/m^3$

Note: Criteria changed from 30 $\mu g/m^3$ to 25 $\mu g/m^3$ in September 2017

Provided below is a discussion of results for each HVAS unit during the reporting period (2019) and trends over the operational life of the Rasp Mine. HVAS unit results are reported and reviewed internally on a monthly basis.

There were no incidences of non-compliance for HVAS operations in 2019.

HVAS (EPL10)

TSP and TSP-lead results for 2019 recorded by HVAS are shown in **Figure 3-7** and **Figure 3-8.** These show the results have remained consistent over the reporting period.

The rolling annual average TSP at the HVAS unit recorded 80.17 $\mu g/m^3$ for the reporting period was a significant increase over the previous period rolling annual average of 62.89 $\mu g/m^3$. Drought conditions and frequent dust storms in Spring and Summer are responsible for the high dust levels.

As shown in the figures below, with the onset of warmer weather and high winds there is an increase in the TSP and TSP-Lead recorded. The rolling annual average TSP-lead at the HVAS unit has increased to 0.29 $\mu g/m^3$ from 0.28 $\mu g/m^3$ in the 2018 reporting period. The Rasp Mine PA07_0018 does not stipulate any criteria for lead; however the recorded annual average of TSP-lead remains below the NSW EPA guideline of 0.50 $\mu g/m^3$.

The highest TSP levels recorded were on 1 January (292 $\mu g/m^3$), 12 February (246 $\mu g/m^3$), 21 November (265 $\mu g/m^3$) and 21 December (253 $\mu g/m^3$). Winds were predominantly from the South (9.6 km/hr), SSW (39.2 km/hr), South (47.9 km/hr), and from the south (38.6 km/hr), respectively. High dust levels were also recorded on PM10 High Volume Air Samplers and TEOM units on these days indicating it was likely due to regional dust storms.

The highest TSP-Lead levels were on 12 February (0.9 $\mu g/m^3$), 2 March (0.9 $\mu g/m^3$), and 12 July (1.5 $\mu g/m^3$). Winds were predominantly from the SSW (39.2 km/hr), ENE (30.4 km/hr) and NW (41.8 km/hr), respectively. The results of 12 February and 12 July may have been a result of site activities although no specific activities could be identified as the cause.

Figure 3-9 provides a summary of TSP and TSP-lead results from 2008 to 2019. Results for TSP are well below the EPA threshold of 90 μg/m^3 and 0.5 μg/m^3 for TSP-lead.

Figure 3-7 HVAS TSP Results for the Reporting Period (2019)

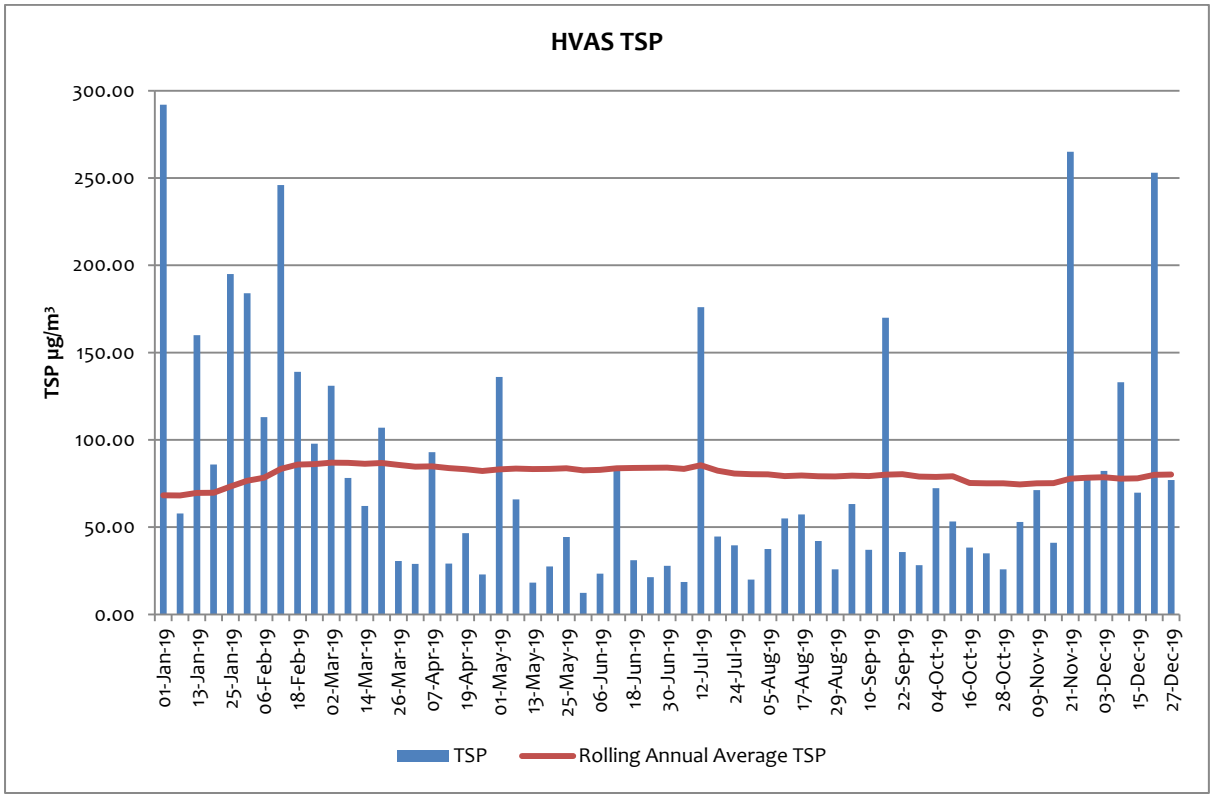
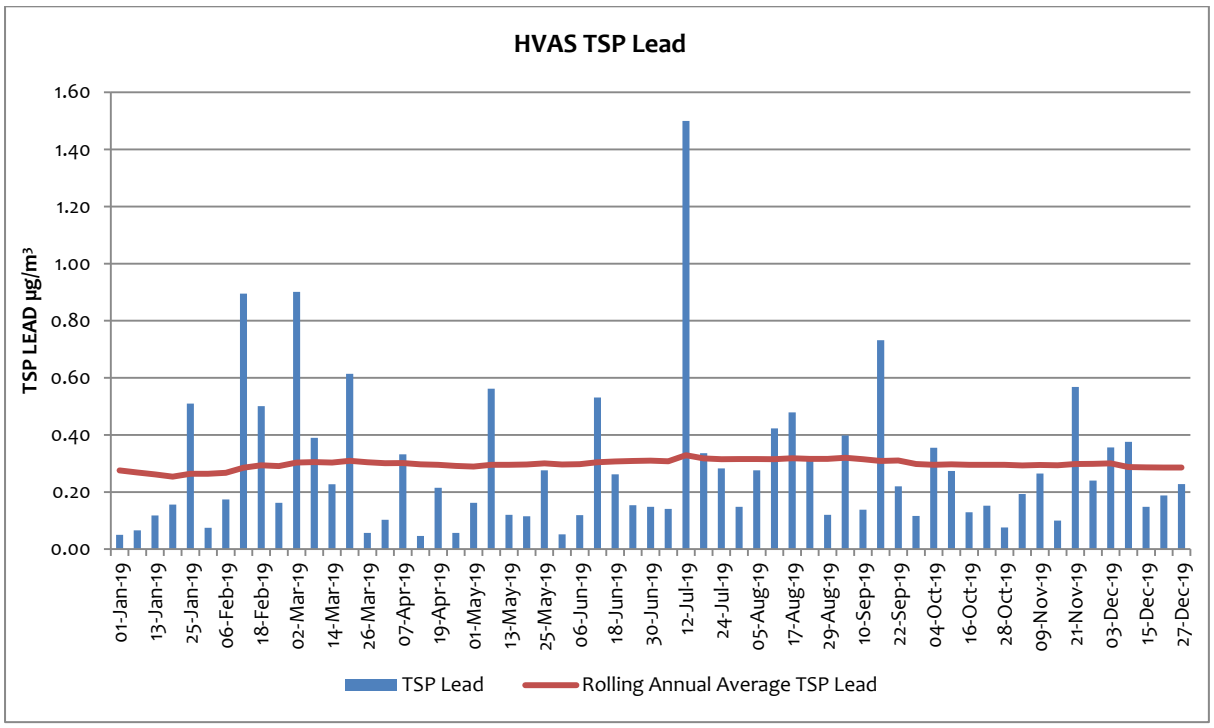


Figure 3-8 HVAS TSP-Lead Results for the Reporting Period (2019)



The original EA did not include a receptor close to HVAS in predictions for total suspended particles.

As can be seen in **Figure 3-9** there is an increase in dust levels recorded in HVAS since 2016 while Lead levels have remained stable, which suggests that much of the dust contributed is not from site and likely the result of drought conditions.

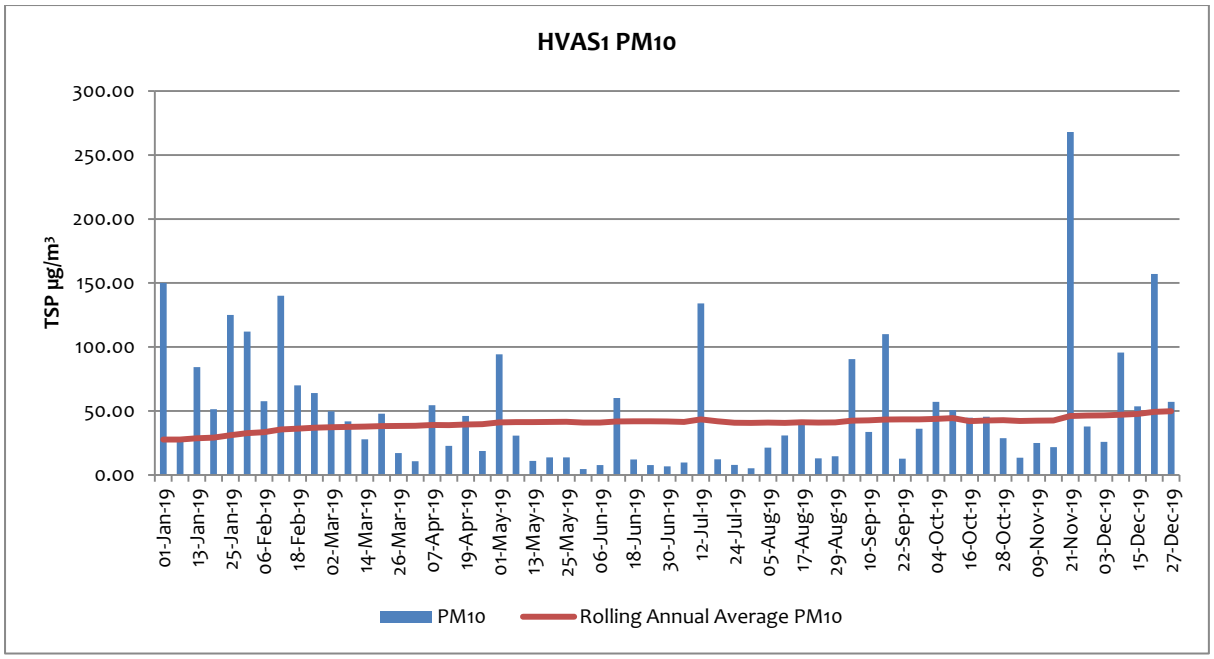
Figure 3-9 HVAS TSP and TSP-Lead Results for the Period 2008 to 2019

HVAS1 (EPL11)

HVAS1 is used for sampling PM_{10} and PM_{10}-lead. The average annual PM_{10} level recorded at this monitoring point at the end of the reporting period was 49.8 μg/m^3, which has increased from the previous reporting period of 25.4 μg/m^3 and is above the background level reported in the EA of 29.1 μg/m^3. Results for the reporting period are shown in **Figure 33-10** which indicates that the rolling annual average for PM_{10} is above the criteria of 25 μg/m^3. As expected there were elevated PM10 levels recorded in the summer and spring months. The elevated result of 134 μg/m^3 recorded on 12 July was due to an unexplained event which was also recorded in the co-located HVAS TSP (EPL 10).

Trends are discussed below and results for the period 2011 to 2019 are shown in **Figure 3-15**.

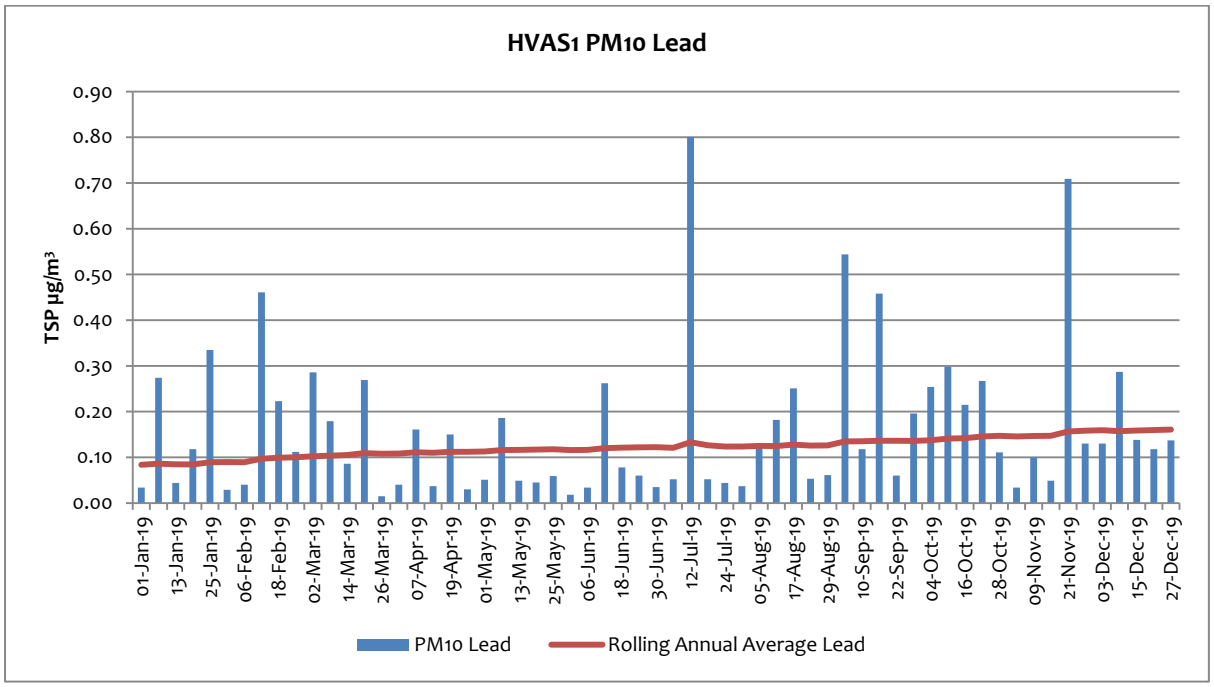
Figure 3-10 HVAS1 PM_{10} Results for the Reporting Period (2018)



The annual average PM_{10}-lead concentration has increased slightly from 0.08 μg/m^3 in the previous reporting period to 0.16 μg/m^3, **Figure 3-11.** The highest HVAS1-Lead levels were on 12 July (0.8 μg/m^3) and 21 November (0.71 μg/m^3). Winds were predominantly from the NW (41.8 km/hr) and the South (47.9 km/hr), respectively. Since May 2011 when HVAS1 started operating dust levels have fallen and then risen in the last year due to the drought and frequent dust storms.

There is no criterion for PM_{10}-lead. Trends are discussed below and results for the period 2011 to 2019 are shown in **Figure 3-16**.

Figure 3-11 HVAS1 PM_{10}-Lead Results for the Reporting period (2018)

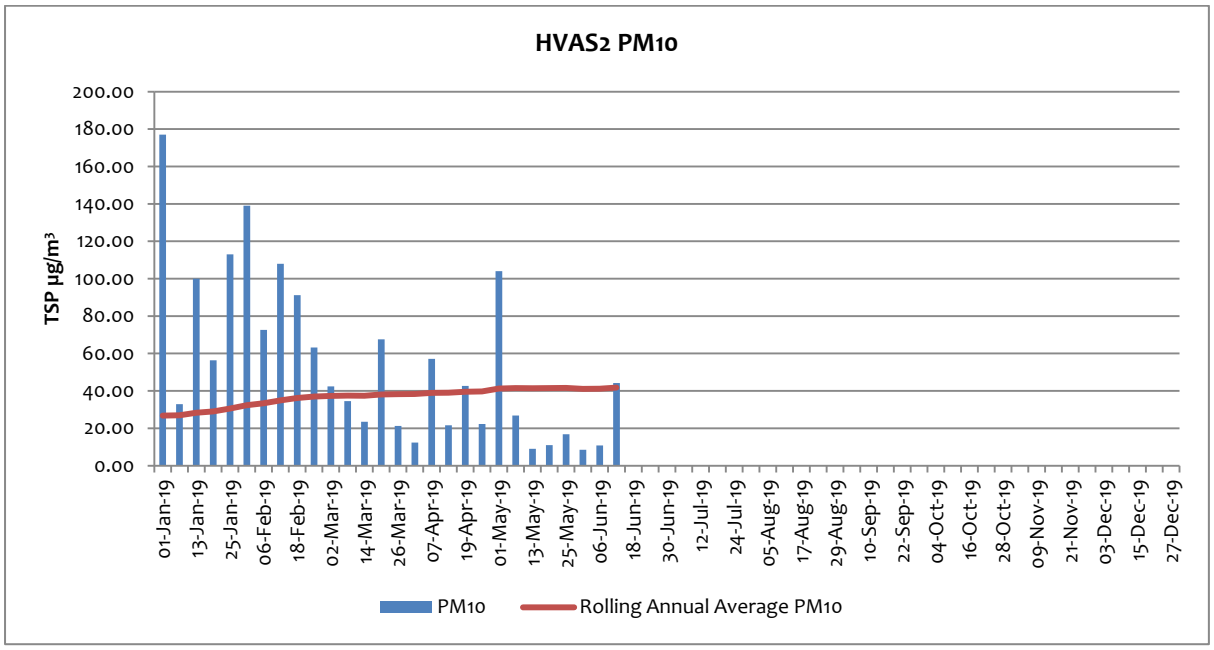


HVAS2 (EPL12)

HVAS2 was removed from Blackwoods Pit in June 2019 due to Embankment 2 construction works. To 12 June the average annual PM_{10} level recorded at this monitoring point was 41.74 µg/m^3, which has increased significantly from the previous reporting period (23.78 µg/m^3), above the background level reported in the EA of 29.1µg/m^3 and above the criteria of 25µg/m^3 (for off-site receptors), **Figure 3-12.** Data presented includes that which may be result of external events, particularly dust storms which are expected in the spring and summer months.

Trends are discussed below and results for the period 2011 to 2019 are shown in **Figure 3-15**. Since May 2011 when HVAS1 started operating dust levels have fallen and then risen in the last year due to the drought and frequent dust storms.

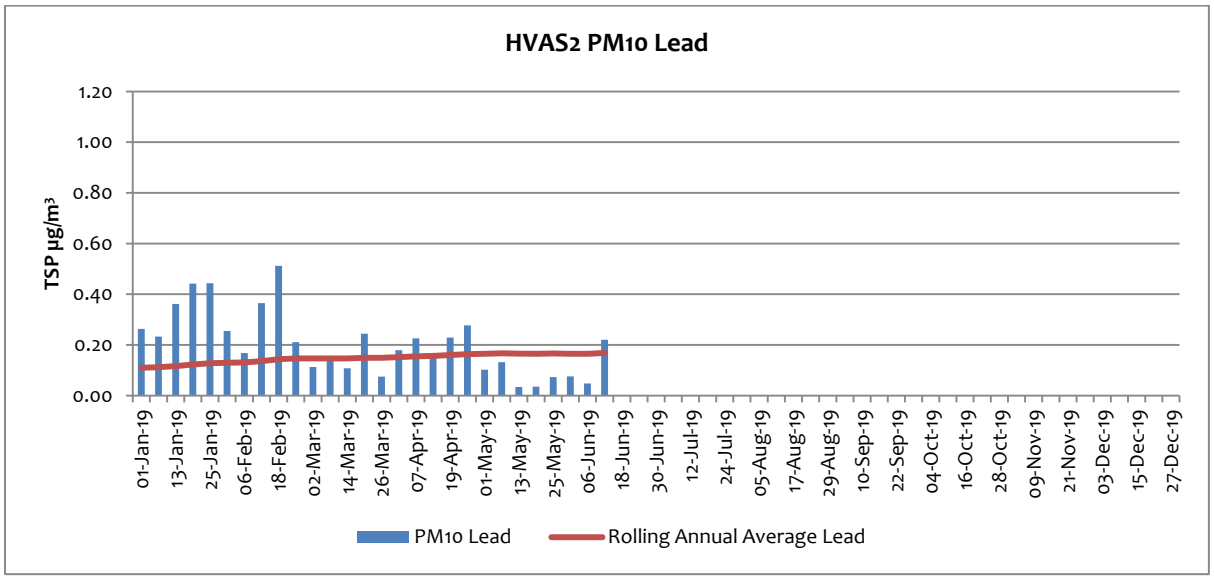
Figure 3-12 HVAS2 PM_{10} Annual Average Results for the Reporting Period (2019)



HVAS2 was removed from Blackwoods Pit in June 2019 due to Embankment 2 construction works. To 12 June the annual average PM_{10}-lead concentration recorded an increase from 0.11 µg/m^3 at the end of the previous period to 0.17 µg/m^3, **Figure 3-13**. The highest HVAS2-Lead levels were on 19 January (0.44 µg/m^3), 25 January (0.44 µg/m^3), and 18 February (0.51 µg/m^3). Winds were predominantly from the SSE (38.4 km/hr), South (38 km/hr), and South (41.4 km/hr) respectively. There are no criteria for PM_{10}-lead.

Trends are discussed below and results for the period 2011 to 2019 are shown in **Figure 3-17**. Since September 2013 when HVAS2 started operating dust levels have fallen and then risen in the last year due to the drought and frequent dust storms.

Figure 3-13 HVAS2 PM_{10}-Lead Results for the Reporting Period (2019)



HVAS3 (EPL57)

HVAS3 (EPL57) was included in EPL 12559 on 14 March 2019 to provide for monitoring of TSP Dust on the northern boundary of the site at Blackwoods Pit TSF2. HVAS3 has been decommissioned while Embankment 2 TSF2 construction works are undertaken. A real-time PM_{10} monitor is in place adjacent to the HVAS3 location.

To 12 June the rolling average annual TSP level recorded at this monitoring point was 56.05 $\mu g/m^3$ and while it appears it may be falling it is based on three months of data only as shown in **Figure 3-14.** Data in June suggests the dust collected may have been a result of activity in preparation for the construction of Embankment 2 as there was a corresponding increase in Lead recorded at HVAS3.

Figure 3-14 HVAS3 TSP Results for the Reporting Period (2019)

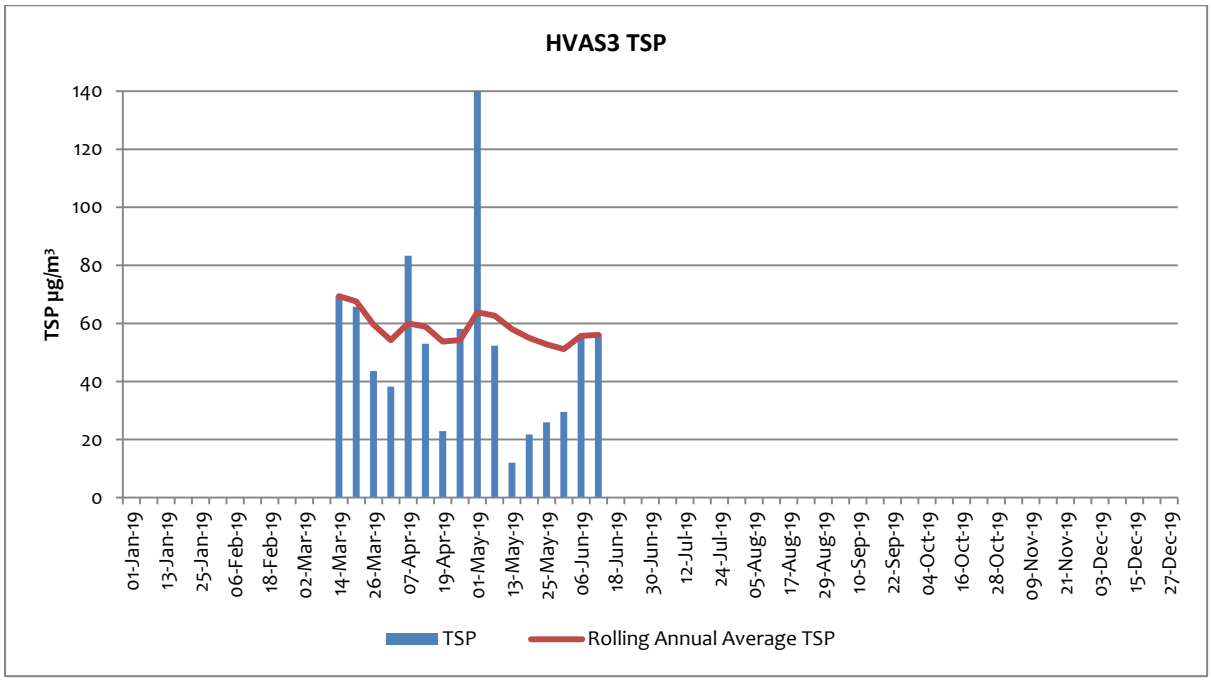


Figure 3-15 HVAS3 TSP-Lead Results for the Reporting Period (2019)

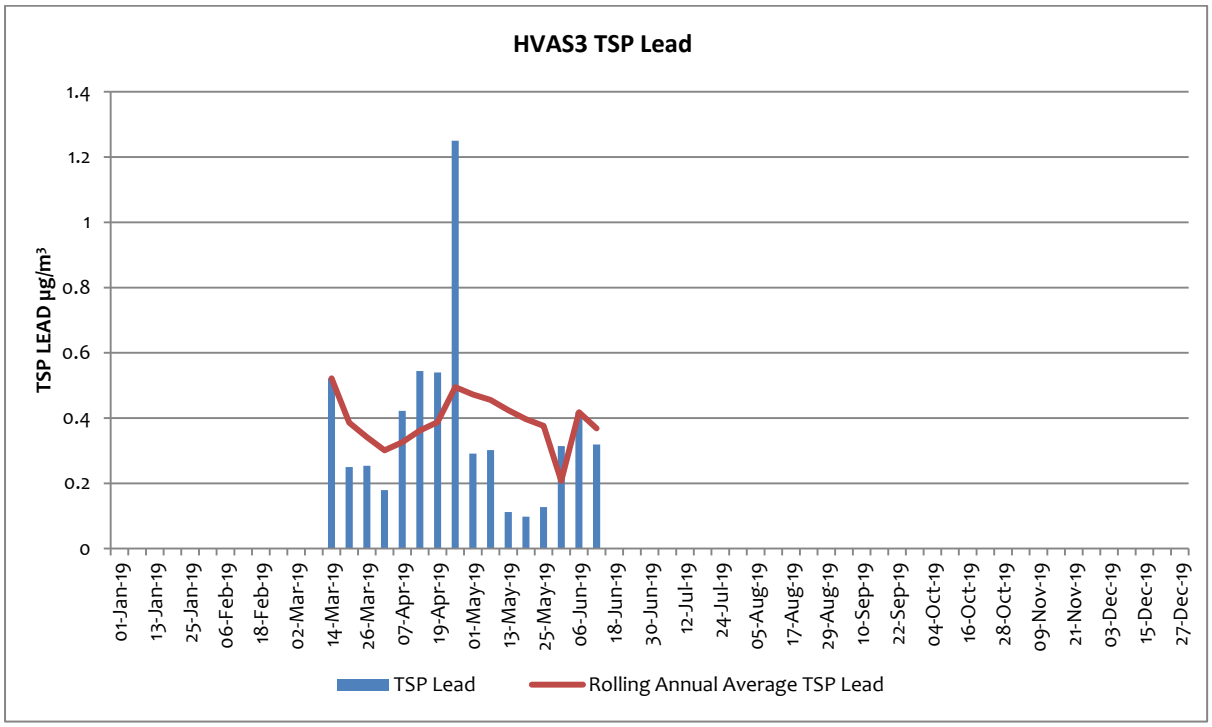


Figure 3-16 HVAS1 & HVAS2 PM10 Annual Average Results for the Period 2011 to 2019

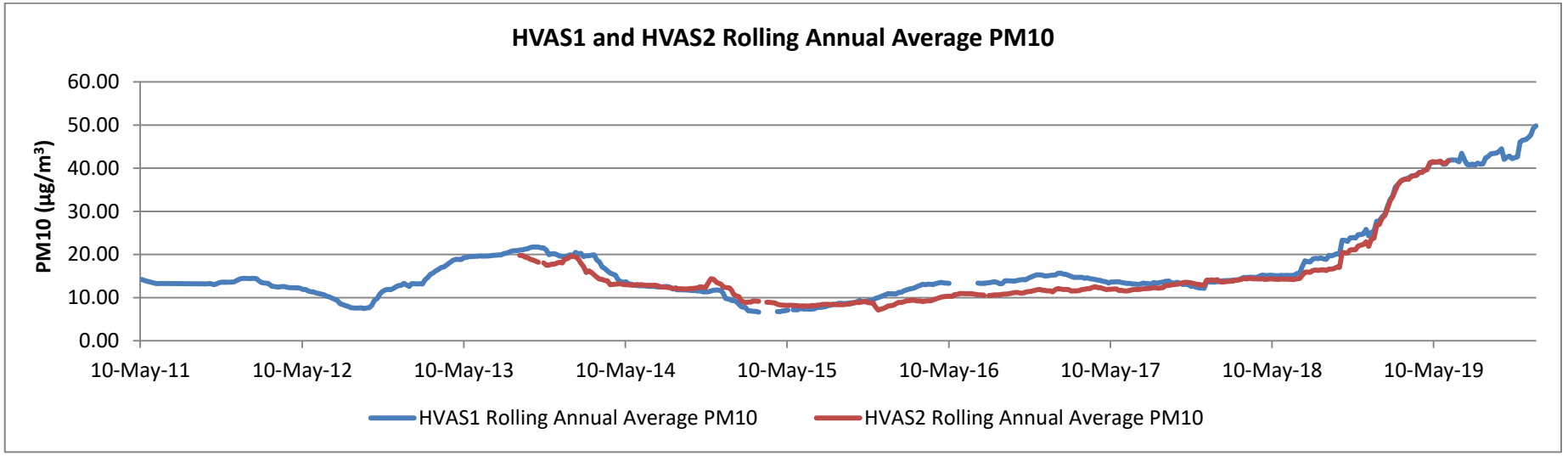
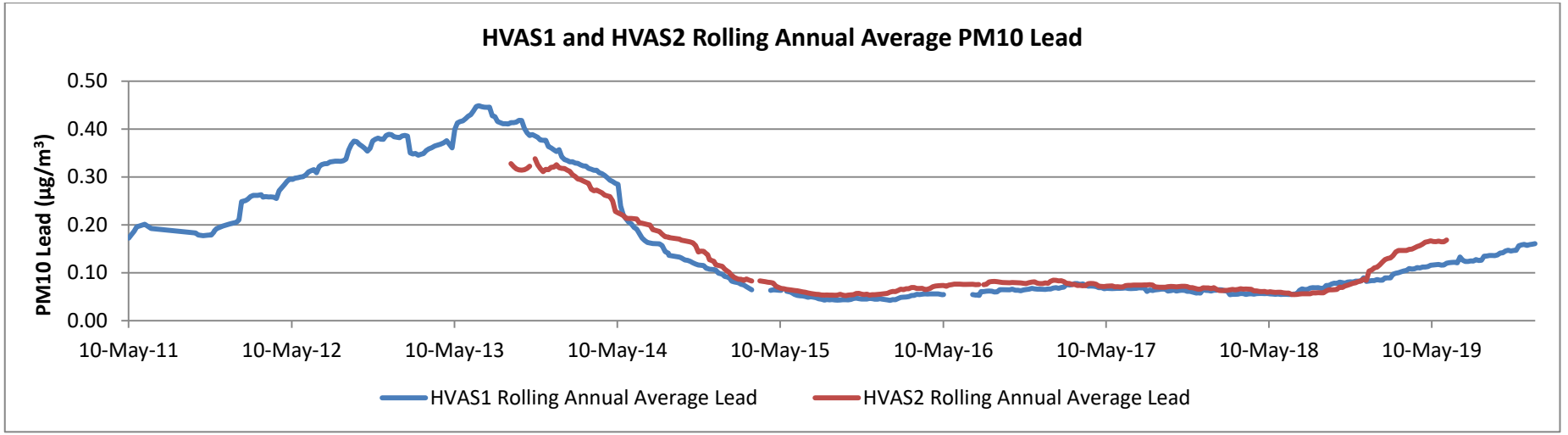


Figure 3-17 HVAS1 & HVAS2 PM10-Lead Annual Average Results for the Period 2011 to 2019



3.3.4 TEOM monitors

The Rasp Mine has two Tapered Element Oscillating Microbalance (TEOM) air quality monitors, which record real time PM10 data. **Figure 3-2** shows the location of these monitors.

Table 3-7 PM10 Assessment Criteria

Pollutant	Averaging Period	Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	25 µg/m^3

Note: Criteria changed from 30 µg/m^3 to 25 µg/m^3 in September 2017

The monitors operate continuously over a 24-hour period and provide a real time data read out on a kiosk computer in the HSE office. The monitors also provide auto-generated notifications when triggers are exceeded (when the level exceeds 100 ug/m3 expressed as a 1 hour rolling average) the cause is investigated and controlled by the use of the water truck or by modifying work methods.

TEOM2 was decommissioned on 15 June and removed due to Embankment 2 construction works on the northern side of Blackwoods Pit. During the reporting period both TEOM units were serviced by a technician on 9-10 April and TEOM1 was service by a technician on 9 October.

The un-validated results for TEOM1 PM_{10} 24-hour average for the reporting period are provided in **Figure 3-18**. A number of dust storm events were recorded on TEOM 1 and 2 during the period. As can be seen in the graphs in Figure 3-18and Figure 3-19, high-dust events are captured by both monitors so they are unlikely to be the result of site activities. Storm events are excluded from the application for criteria.

The un-validated results for TEOM2 PM10 24-hour average for the reporting period are provided in **Figure 3-19**. There were a number of occasions during the reporting period when TEOM2 (located adjacent Blackwood Pit) recorded above the criteria for a 24-hour average. The highest record of these events was on 18 January (326 µg/m3). Again, this was the result of dust storms across Broken Hill. Storm events are excluded from the application for criteria.

The PM10 annual average at the TEOM1 monitor at the end of the reporting period was 17.62 µg/m^3 (20.9 µg/m^3 in the previous year) and is below the listed criteria of 25 µg/m3. The annual average PM10 at TEOM2 in June was 20.52 µg/m^3 which is below the criterion 25 µg/m3 required at the nearest residential location. The results for TEOM1 and TEOM2 are provided in **Figure 3-20**.

The recorded annual average PM10 result at TEOM2 (20.52 µg/m3) is above the prediction for R28, the closest receptor to this monitoring point (30 m) reported in the EA for MOD4 at 17.54 µg/m^3.

Annual average PM10 results for 2019 results for TEOM1 and TEOM2 are higher over the long term after an increase in dust levels in early 2019, which is expected considering the severity of the drought over the past three years, **Figure 3-21**.

Air Quality Management Plan BHO-PLN-ENV-001 lists the controls that were in place during the reporting period. In summary, the major controls include:

- The use of chemical dust suppressant on non-active mining areas and roads;
- Sealing of all major roads and the use of a street sweeper and water truck;
- Wing walls and roof over the ROM Bin and water sprays on the apron feeder to the crusher;
- Fully enclosed conveyors and transfer points prior to the Sag Mill with installed dust collectors;

- Restricted access to non-active mining areas;
- Use of water sprays on the ROM Pad;
- Concentrate loading into containers occurs in an enclosed building and containers are covered prior to exiting the building; and
- All vehicles leaving site are washed, including trucks taking containers to the rail loadout area.
- Traffic light system informing all staff and contractors of wind speeds.
- Wind speed alerts from the onsite weather station notifying of wind speeds greater than 35 km/hr

Monitoring results indicate that controls have been adequate to manage dust levels during the reporting period.

Figure 3-18 TEOM1 PM10 24-hour Average Results for the Reporting Period (2019)

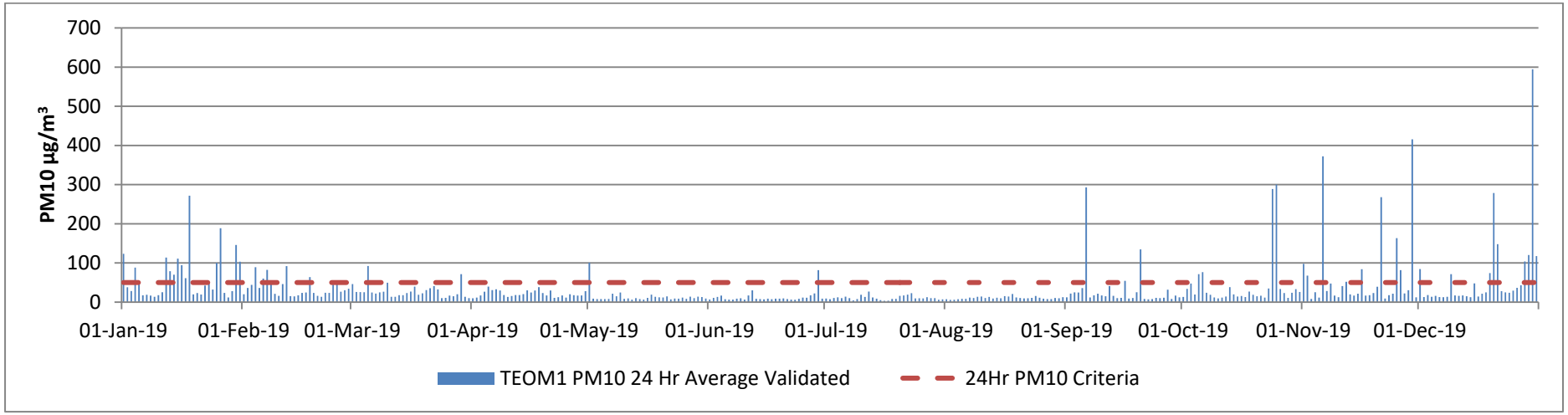


Figure3-19 TEOM2 PM10 24-Hour Average Results for the Reporting Period (2019)

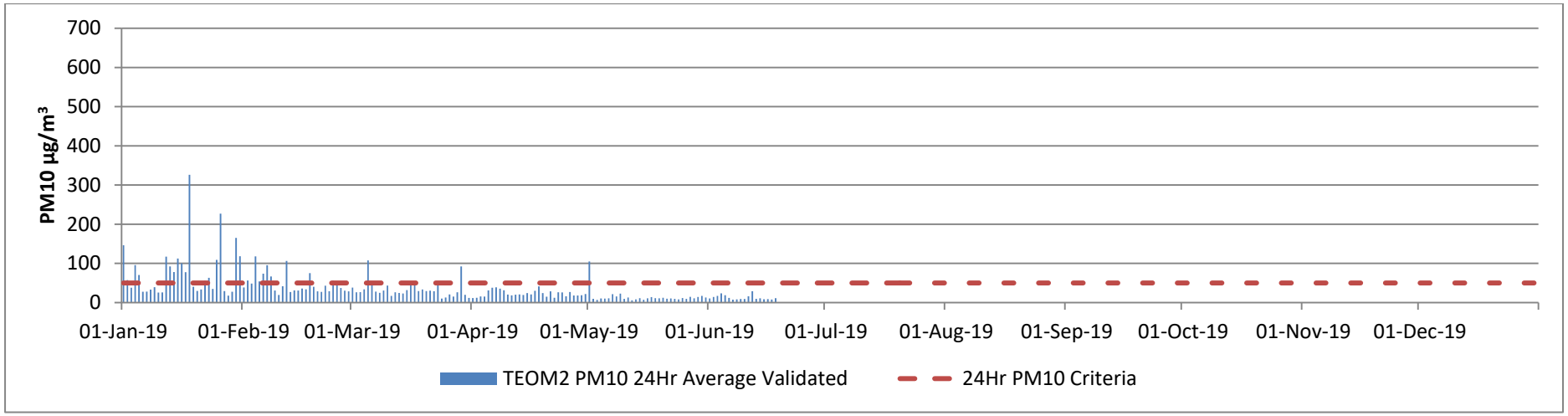


Figure 3-20 TEOM1 & TEOM2 PM10 Annual Rolling Average for the Reporting Period (2019)

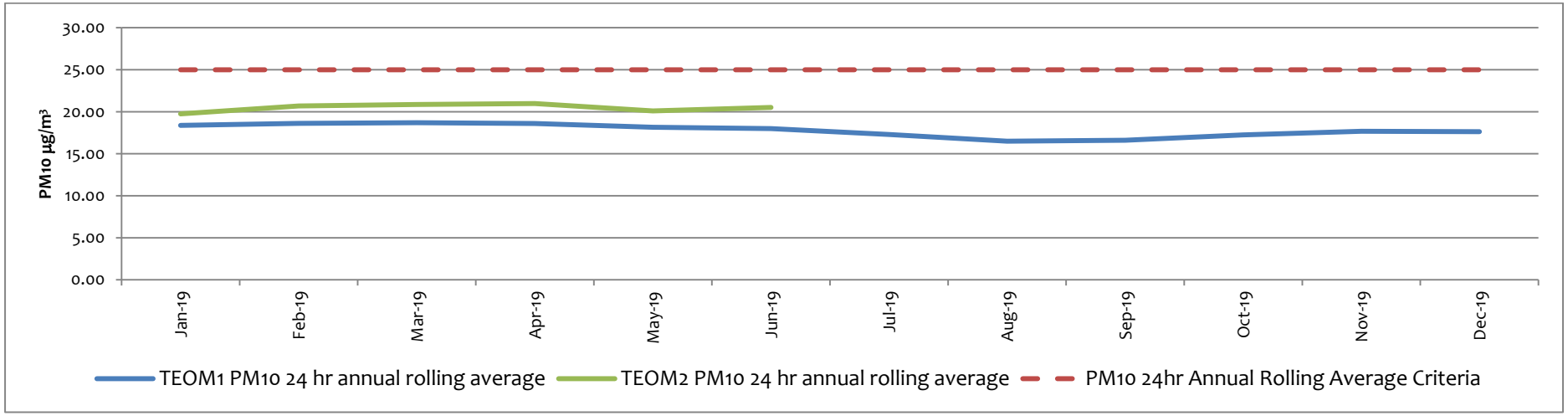
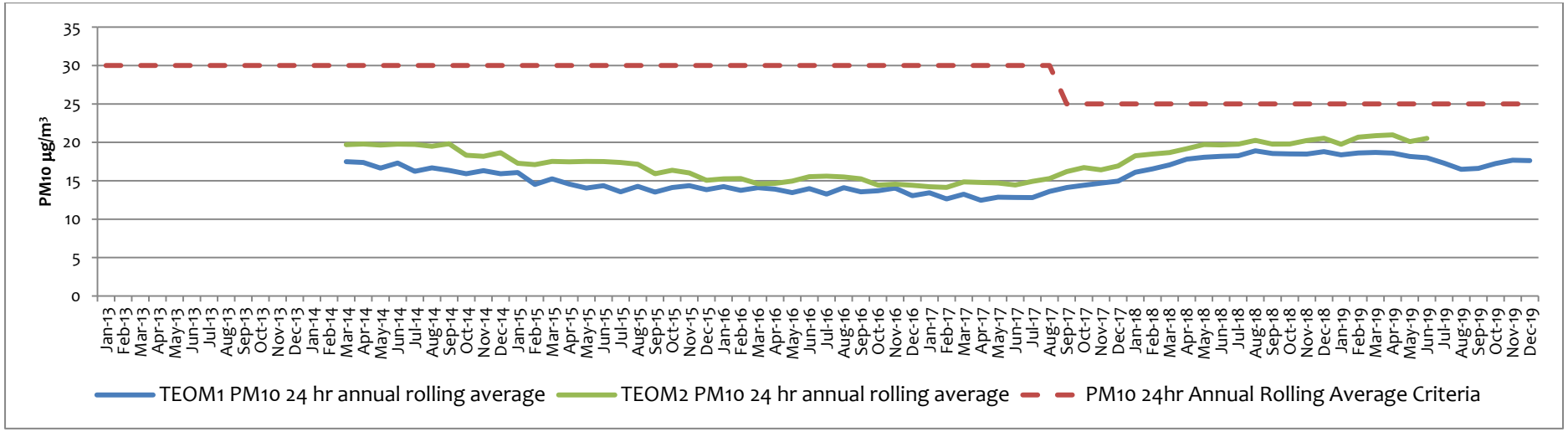


Figure 3-21 TEOM1 & TEOM2 PM10 Annual Rolling Average Results for the Period 2013 to 2019



3.4 Erosion and Sediment

The majority of the existing batters were constructed during former mining operations and consequently the surfaces of the batters consist predominantly of weathered rock. It is not practical to reshape the slopes, as most of the slopes are steep, on the mine lease boundary and predominantly comprise of large rock aggregate. The process of erosion over the years since the slopes were formed has removed most of the finer materials and the existing surface now comprises relatively large and coarse rock resulting in a self- armoured surface with limited erosion potential.

Inspections consist of a visual assessment for erosion, flooding, rubbish, algal growth or significant sediment build up. No major works were required as a result of these inspections.

3.5 Surface Water

There are no natural watercourses or creeks flowing through the site. The drainage network layout restricts runoff leaving active mine areas of the site for a 1 in 100-year 72-hour ARI rainfall event.

Surface water monitoring includes a weekly visual inspection of water storage facilities, freeboard and structural integrity. The tailings storage facility and the processing events dam are inspected and levels checked monthly. Quarterly water quality samples are taken from dams when the water levels are above 20% capacity. Samples are couriered to ALS, a NATA accredited laboratory for analysis.

There are seven sampling locations for surface water, these include surface water basins located on the mine lease to capture and retain rainfall and two locations up and down stream of an ephemeral creek located south of the mine lease boundary. Sampling requirements are provided in **Table 3-8** and locations of sampling points are shown in **Figure 3-2**.

Table 3-8 Surface Water Monitoring Requirements

Description	Frequency	Parameters to be Analysed
Federation Way Culvert EPL29/S31-1	2 x per year , six months apart	cadmium (Cd), chloride (Cl), electrical conductivity (EC), lead Pb), manganese (Mn), pH, sodium (Na), sulphate (SO4), total dissolved solids (TDS) and zinc (Zn)
Ryan Street Dam EPL31/S49	2 x per year , six months apart	
Adjacent Olive Grove EPL32/S1A	2 x per year , six months apart	
Adjacent Bowls Club EPL33 /S9-B2	2 x per year , six months apart	
Horwood Dam EPL34/Horwood Dam	2 x per year , six months apart	
Upstream Bonanza St EPL35	2 x per year , six months apart	
Downstream Sydney Rd EPL36	2 x per year , six months apart	

Ponds are sampled at least twice a year when the pond contains water for at least one week and the volume of stored water is at least 20% of the pond capacity. Sampling is expected to be undertaken in April and October, as these are the highest rainfall months as recorded by Bureau of Meteorology. Sufficient rain fell in March that sampling could be conducted from a few of the monitoring locations. Results of the surface water analysis for the reporting period are provided in **Table 3-9**.

No storage water overflowed from these ponds during the reporting period. Lead and Zinc levels were slightly elevated in S1-A which is the pond between the South Road overpass and Gypsum Street as this was a former mine water storage dam. Zinc was elevated in S31-1 as it is situated on Federation Way and receives water from the roadway and waste dumps along the northern side of the site.

Table 3-9 Stormwater Pond Water Quality Results for the Reporting Period (2019)

Site	Month Sampled	Cd	Cl	EC	Pb	Mn	pH	Na	SO4	TDS	Zn
		mg/L	mg/L	µs/cm^3	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L
EPL29 S31-1	Mar 2019	0.314	1	441	1.54	5.34	6.32	4	224	466	36.8
	Oct 2019	Dry									
EPL31 S49	Mar 2019	0.725	1	264	0.08	2.81	6.6	2	120	226	7.7
	Oct 2019	Dry									
EPL32 S1-A	Mar 2019	0.143	33	603	7.48	6.83	6.73	30	252	648	22.4
	Oct 2019	Dry									
EPL33 S9B-2	Mar 2019	Dry									
	Oct 2019	Dry									
EPL34 Horwoods Dam	Mar 2019	Dry									
	Oct 2019	Dry									
EPL35 Upstream Bonanza St	Mar 2019	0.002	9	124	0.15	0.188	7.03	8	5	153	0.467
	Oct 2019	Dry									
EPL36 Downstream Sydney Rd	Mar 2019	Dry									
	Oct 2019	Dry									

S49 Pump

S49 captures runoff from the Block 10 catchment contaminated by historic mining activities. In 2011 with the end of a long-term drought in Broken Hill, water escaped from this facility. A liner has since been installed on the upstream side of the levy bank and has not yet seen water levels high enough to test its effectiveness. In response to a seepage issue in 2016 a solar pump was installed within the Dam to remove water immediately from the dam to ensure a) water does not seep through the walls (which are lined), and b) to ensure capacity for catchment runoff is maintained. The solar pump was connected to a pipeline to sediment pond S31-1. The solar pump has since been removed as it is an electrical hazard and the BHOP Environment Department have purchased a dedicated mobile pump for use at S49.

It is difficult to undertake sampling of surface waters due to the low rainfall and high evaporation rates in Broken Hill. In particular, 2019 was a dry year (34.76 mm) with less than half the normal average rainfall (259 mm).

The quantity of water in the ponds at the time of sampling is unknown; this would have a major impact on the water quality results. All waters were contained within the containment structures with no off site discharges during the reporting period.

3.5.1 Water containment structures

All surface runoff on site is captured by diversion trenches or berms and channelled to site water storage structures. No changes were made to this system during the reporting period. **Plan 5** shows the water catchments and containment structures. **Table 3-10** provides the capacities and estimated stored water volumes at the end of the reporting period**.** Detailed surveying of the water storage

structures is planned for the next reporting period. Surveys will be used to develop staged storage curves that will enable more accurate capacities and volumes to be determined.

Sediment was removed from the S17 pond and Horwoods Dam in 2019. Sediment from S17 was disposed of in TSF2 and the sediment from Horwoods Dam was stockpiled on site to be disposed of in TSF2 when works on Embankments 1 and 3 resume in 2019 and equipment is available for carting the material.

Markers are placed in water ponds to indicate the maximum level to which water may be stored in the facilities to maintain sufficient free board to accommodate a 1:100 year 72 hour storm event.

Table 3-10 Water Containment Structures

	Pond Identification	Start of reporting period m^3 (1-Jan-2019)	At end of reporting period m^3 (31-Dec-2019)	Storage Capacity m^3
Potable and Raw Water	Workshop	9	9	14
	Boom Gate	22.5	22.5	22.5
	Mill	22.5	1400	1400
	Delprat's Shaft	22.5	22.5	22.5
	Kintore Pit	14	14	18
	Silver Tank	6500	6500	6500
Dirty Water (rain runoff)	S2	0	0	5003
	S14	0	0	7813
	S17	0	0	4265
	S31-2	0	0	225
	S49	0	0	1951
	S35	0	0	6092
Process, underground and used water	Horwood Dam	1000	100	7663
	Plant Water Pond	1000	1000	2000
	S22 Mine Settlement Ponds	3000	3000	20,489
	S22-A	2000	2000	2000
	Vehicle Wash	22.5	22.5	22.5

3.6 Groundwater

The regional groundwater near the site is depressed due to long term pumping from the underground mines in the area. This results in the depressed groundwater level below the site being more than 100m below the surface level, with a hydraulic gradient into the site at depth. The groundwater monitoring program is undertaken with the purpose of recording perched groundwater movement. Perched groundwater refers to surface water that has infiltrated into the near surface moderate to high permeability material generally comprising of granular soils and rock dill. The perched ground water exists for short periods of time after rainfall events and generally seeps laterally over the low permeability bedrock surface below the near surface permeable material. The rainfall events at Rasp mine site indicate that the perched groundwater has the potential to surface seep rather than seep into the regional groundwater. Considering the depth of the regional groundwater, it is concluded that there is little interaction between the shallow perched groundwater and the regional groundwater.

Rasp's groundwater monitoring plan is outlined in the Site Water Management Plan.

The monitoring program includes eighteen sampling locations for groundwater, GW01 (EPL37) to GW16 (EPL52) are installed piezometers 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 (EPL53) and Kintore Pit (EPL54), sampled monthly. The locations for these monitoring points are shown in **Figure 3-2**. Groundwater monitoring is scheduled for completion in March, June,

September and December. A number of parameters are required to be analysed including: alkalinity (calcium carbonate ($CaCO_3$)), cadmium (Cd), calcium (Ca), chloride (Cl), electrical conductivity (EC), iron (Fe), lead Pb), magnesium (Mg), manganese (Mn), pH, sodium (Na), sulphate (SO4), total dissolved solids (TDS) and zinc (Zn). **Table 3-11** lists the location and function of each borehole.

Table 3-11 Location and Function for Groundwater Monitoring Points

Bore ID	Location	Function
GW01, GW02	Southeast of Mt Hebbard	Monitor potential seepage from Mt Hebbard
GW03 – GW09	East of TSF1	Monitor potential seepage from TSF1 towards CML7 boundary
GW10	Downstream of Horwood Dam	Monitor potential seepage north of Eyre St Dam
GW11, GW12	East of Blackwood Pit	Monitor perched groundwater mounding from TSF
GW13-GW15	Adjacent to storage areas S44, S31-1 and S31-2	Monitor movement of perched groundwater occurring from the storages
GW16	West of S49	Monitor potential seepage from S49
Shaft 7	Shaft 7	To maintain safety for underground mining at both the Rasp and Perilya South Mines
Kintore Pit - Mine dewatering	Kintore Pit decline	To maintain safety for underground mining at the Rasp Mine

Groundwater quality monitoring was undertaken in May 2007 and August 2011 at Shaft 7 to establish an initial baseline for parameters and trigger levels for the monitoring program (30% above 2011 results).

The site's groundwater is deep and is extracted as part of mining. The underground extraction system results in inward flow of the groundwater into the mine. Hence, groundwater at the mine is likely to be impacted by off-site sources due to the inward hydraulic gradient into the mine.

As shown in **Table 3-12** the majority of piezometers showed a steady or decrease in water levels during the reporting period which can be attributed to the low rainfall. Even though GW13 and GW15 show increases, there is never enough water to sample. **Table 3-13** provides a summary of groundwater monitoring results for 2018, indicating highest in maroon and lowest in blue.

Table 3-14 provides a summary of water monitoring results for Shaft 7 and mine dewatering (Kintore Pit), indicating highest in maroon, lowest in blue and samples above baseline trigger in orange.

Figures 3-20 and **3-21** provide a summary of water monitoring results for the period 2012, commencement of operations, to 2019.

Table 3-12 Bore Piezometer Depths

Sample	Depth mbTOC						
	Ave 2019	Ave 2018	Ave 2017	Ave 2016	Ave 2015	Ave 2014	Trend
GW01	8.42	8.35	6.85	7.39	7.25	7.25	Potentially falling
GW02	Dry	Dry	3.33	Dry	Dry	Dry	Dry
GW03	3.83	3.6	3.58	3.64	3.62	3.61	Stable
GW04	2.99	2.73	2.87	2.94	2.9	2.83	Stable
GW05	3.76	3.65	3.49	3.53	3.5	3.4	Stable
GW06	3.16	3.10	2.96	2.85	2.76	2.66	Potentially falling
GW07	3.14	3.15	2.58	2.74	2.8	2.54	Potentially falling
GW08	2.53	2.36	1.88	1.81	1.87	2.11	Potentially falling
GW09	3.89	3.84	3.50	2.94	3.07	1.79	Potentially falling
GW10	4.20	3.46	1.90	1.49	1.725	0.83	Potentially falling
GW11	12.17	12.00	10.00	10.10	10.4	10.69	Potentially falling
GW12	21.53	20.47	19.19	34.49	37.1	21.6	Variable
GW13	Dry	Dry	Dry	Dry	Dry	Dry	Stable
GW14	Dry	Dry	1.3	Dry	Dry	Dry	Stable
GW15	Dry	Dry	2.8	Dry	Dry	Dry	Stable
GW16	Dry	Dry	Dry	1.55	Dry	Dry	Stable

Quarterly samples were obtained from 10 of the 16 bores, samples were obtained from ten bores, and no samples could be obtained from bores GW1, GW2, GW13, GW14, GW15, or GW16. This was due to dry conditions as a result of the low rainfall in Broken Hill for 2019.

Results remained within historic ranges and were consistent with the expectation of Golder as outlined in the Site Water Management Plan, that perched groundwater quality would contain significant concentrations of lead, manganese and zinc due to the seepage contact with the near surface materials on site and the surrounding areas.

The following provides a discussion of results.

GW01 and GW2 Located Downstream of Mt Hebbard

These water bores are intended to monitor the sub-surface water fluctuations south of Mt Hebbard. GW1 had sufficient water to monitor each quarter while GW2 was dry through the year. The ground water level decreased at GW1, probably due to low rainfall; water levels for GW2 were not recorded for previous years except for 2017 but this was at bore depth. **Figure 3-22** indicates that results remain within historic ranges.

GW03, GW04, GW05, GW06, GW07, GW08, GW09 and GW10 Located Adjacent to TSF1 and Horwood Dam

Groundwater bores are located near the eastern side of the unused historic TSF1 and extend to Horwood Dam. The intent of the monitoring bores is to monitor perched water in the area that may impact on Eyre Street Dam. The monitoring is in response to surface seepage noted in the area during intense 2011 rainfall events. All bores in the series were able to be monitored each quarter, except for GW7, which was dry in June. Water levels remained stable in GW3, GW4, GW5 with GW6, GW7, GW8, and GW9, and GW10 potentially falling. **Figure 3-22** indicates that results remain within historic ranges, with Alkalinity potentially falling at GW10 and variable results for Alkalinity at GW4, GW5 and GW9.

GW11 and GW12 located south east of Blackwood Pit

Blackwood Pit is used for the storage of tailings. It forms part of the mining area and is surrounded by historic mine workings. Due to these historic workings, any seepage from the Pit will be intercepted and collected by the underground mine water management system. Due to the north east and south west length of the pit there is a possibility for the formation of a perched aquifer as a result of groundwater mounding around the south east site of the pit once it receives tailings. If a perched water table is measured in the two bores, consideration will be given to the installation of additional bores to assess the local hydrogeological conditions and risk of migration of seepage. On the advice of Golder, bores were installed to the south east of the facility in order to detect any seepage.

The ground water level in GW11 was slightly lower than previous periods and the level of GW12 decreased but is higher than in 2015 and 2016. GW11 recorded elevated Cadmium, Manganese, Magnesium, Calcium, Total Alkalinity, Sodium, Chloride, Sulphate, TDS and EC in September and December. The same pattern occurred in June and September 2018and is likely due to the tailings level in TSF2 reaching a point where a fault or crack has allowed water to escape. Concentrations are being monitored and levels are expected to return to normal as the fault or crack is sealed by tailings. **Figure 3-22** indicates results remain within historic ranges.

GW13) (adjacent 31-1, GW14 (adjacent BHP chimney) and GW15 (adjacent rail load out) and GW16 (adjacent S49)

As perched water seepage may occur from ponds located near the CML7 boundary when these ponds store water, bores have been installed adjacent these locations. All bores were dry in the period.

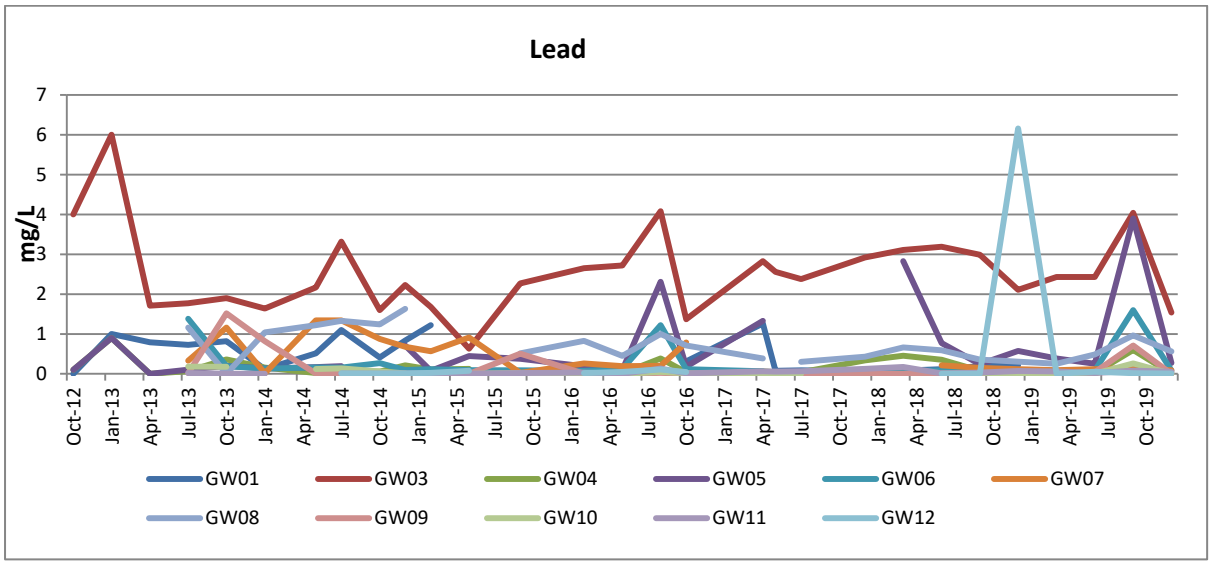
Table 3-13 Piezometer Monitoring Results for the Reporting Period (2019)

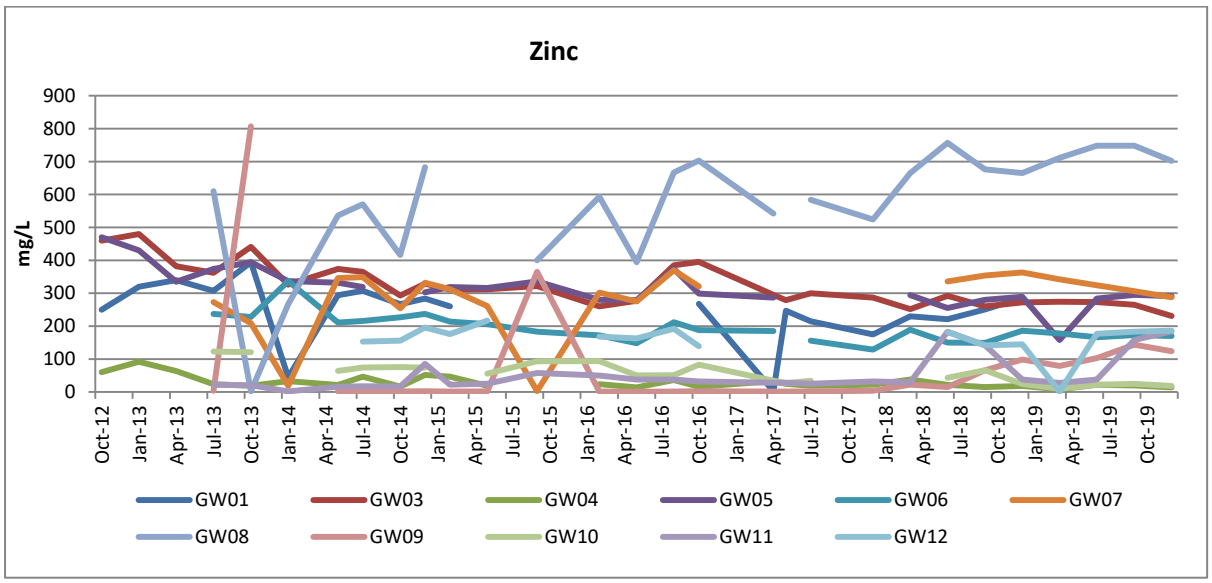
Site	Month Sampled	pH	EC	TDS	Alk	SO4	Cl	Ca	Mg	Na	Cd	Pb	Mn	Zn	Fe
GW01	Mar, Jun, Sep, Dec	Dry													
GW02	Mar, Jun, Sep, Dec	Insufficient depth for sample													
GW03	Mar	5.89	14900	13200	10	4500	3120	584	358	2260	1.87	2.43	304	274	0.05
	Jun	5.13	13400	12000	<1	5080	2950	560	372	2260	1.69	2.43	290	273	<0.05
	Sep	5.25	14600	12700	1	4750	3200	547	357	2190	1.46	4.04	288	265	19
	Dec	5.57	15400	12600	3	5160	3070	566	387	2250	1.5	1.54	253	231	<0.05
GW04	Mar	7	14800	14000	285	4510	2870	595	517	2350	0.0812	0.059	32.2	8.34	0.05
	Jun	7.13	13600	10700	250	4850	2700	572	521	2370	0.108	0.021	49	22	<0.05
	Sep	6.4	13500	13200	73	4610	1890	534	413	2070	0.0932	0.599	38.8	19.9	5.93
	Dec	7.35	15300	12000	287	4940	2840	626	565	2510	0.0592	0.008	28.4	13.9	<0.05
GW05	Mar	6.17	8340	7420	63	3050	1120	285	257	1140	2.05	0.384	139	158	0.05
	Jun	6.35	14200	13800	118	6750	2700	506	654	2640	0.705	0.253	348	284	<0.05
	Sep	6.32	16400	16700	108	5970	1980	508	648	2600	0.668	3.9	370	295	34.2
	Dec	6.64	17200	15300	127	6610	2960	504	686	25880	0.629	0.273	335	291	<0.05
GW06	Mar	6.26	13800	7100	54	4690	2620	548	420	2080	0.802	0.054	300	178	0.05
	Jun	6.42	12100	11200	49	4150	2440	530	436	2140	0.815	0.081	267	166	<0.05
	Sep	6.31	13900	11900	51	4710	1860	534	432	2060	0.82	1.6	260	173	41.8

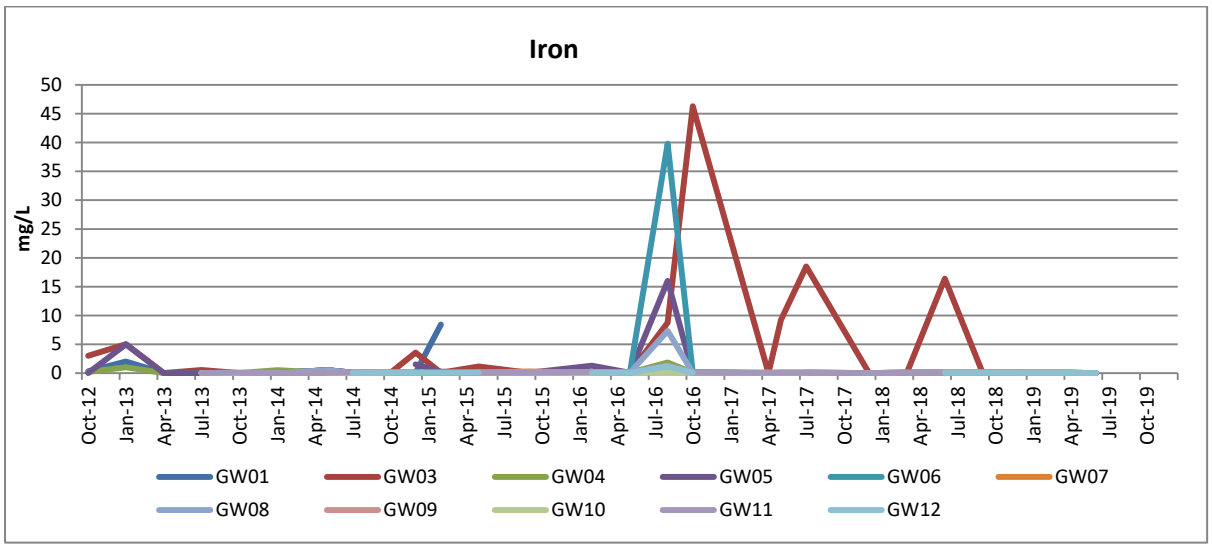
Site	Month Sampled	pH	EC	TDS	Alk	SO4	Cl	Ca	Mg	Na	Cd	Pb	Mn	Zn	Fe
	Dec	6.69	14600	11100	60	4930	2730	528	467	2080	0.778	0.084	262	170	<0.05
GW07	Mar	6.2	12100	11400	37	4410	1720	534	293	1660	2.45	0.092	297	342	0.05
	Jun	6.3	10500	10300	34	4680	1710	520	301	1740	520	0.118	273	324	<0.05
	Sep	6.06	11800	9210	26	4470	1580	529	296	1700	2.35	0.15	256	306	0.49
	Dec	6.63	12400	10600	44	4470	1870	521	308	1690	1.98	0.088	242	288	<0.05
GW08	Mar	5.91	12200	13000	13	4430	1970	577	271	1380	2.46	0.254	651	711	0.05
	Jun	6.02	10900	11600	13	4270	2410	550	304	1630	2.19	0.487	634	748	<0.05
	Sep	5.95	13100	13300	14	4860	1880	544	300	1660	2.13	0.964	702	748	23.1
	Dec	6.44	13900	12600	23	5290	2500	549	332	1710	1.88	0.561	605	702	<0.05
GW9	Mar	6.7	11200	6580	104	4160	1490	610	513	1320	0.872	0.001	65	79.2	0.05
	Jun	6.77	10000	10200	89	3980	1660	623	539	1400	1.07	0.04	84.1	103	<0.05
	Sep	6.57	11400	10200	86	4400	1550	602	527	1380	1.22	0.709	95.1	144	5.2
	Dec	7.13	12300	10800	109	4550	1840	614	584	1510	1.02	<0.001	92.8	124	<0.05
GW10	Mar	7.14	14200	7020	316	4360	2740	587	503	2170	0.204	0.001	16	9.63	0.05
	Jun	7.15	12400	11500	281	4860	2680	571	526	2240	0.191	0.005	9.13	22.5	<0.05
	Sep	7.14	14100	11800	274	4420	1980	590	525	2200	0.167	0.259	4.54	24.7	14.6
	Dec	7.4	15600	10200	299	4450	2790	589	537	2280	0.158	0.001	1.93	18.6	<0.05
GW11	Mar	6.91	5060	3490	80	2140	513	299	146	605	0.0587	0.06	21.5	27.8	0.05

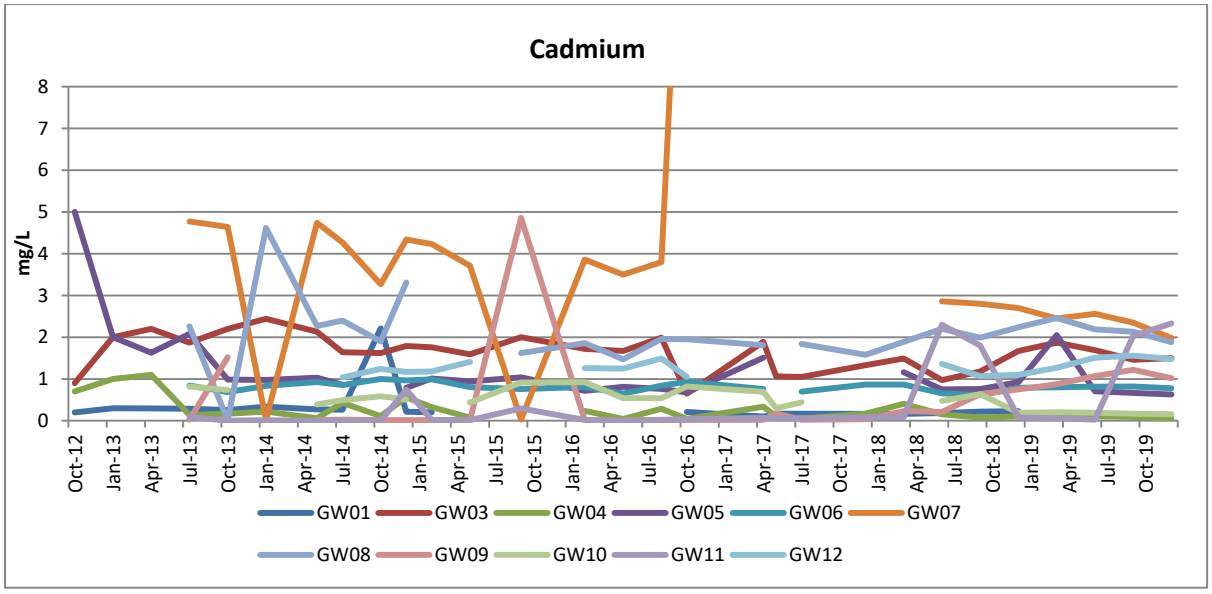
Site	Month Sampled	pH	EC	TDS	Alk	SO4	Cl	Ca	Mg	Na	Cd	Pb	Mn	Zn	Fe
	Jun	7.04	4600	3890	72	2390	487	297	152	628	0.0264	0.021	23.7	37.9	<0.05
	Sep	6.44	10100	8860	68	4090	1250	402	409	1390	2.03	0.082	114	158	0.76
	Dec	6.81	11400	9910	81	4410	1540	505	533	1760	2.33	0.05	135	184	<0.05
GW12	Mar	6.25	12300	9840	86	4690	1460	403	472	1880	1.27	0.002	62.9	162	0.05
	Jun	6.37	11300	12200	72	5000	1760	444	559	2100	1.51	0.05	83.4	177	<0.05
	Sep	6.3	13600	12000	68	5190	1630	449	557	2040	1.56	0.014	81.3	183	0.12
	Dec	6.66	14300	12800	79	5550	1970	485	577	2110	1.48	0.009	84.5	186	<0.05
GW13	Mar, Jun Sep, Dec	Dry													
GW14	Mar, Jun, Sep, Dec	Dry													
GW15	Mar, Jun, Sep, Dec	Dry													
GW16	Mar, Jun, Sep, Dec	Dry													

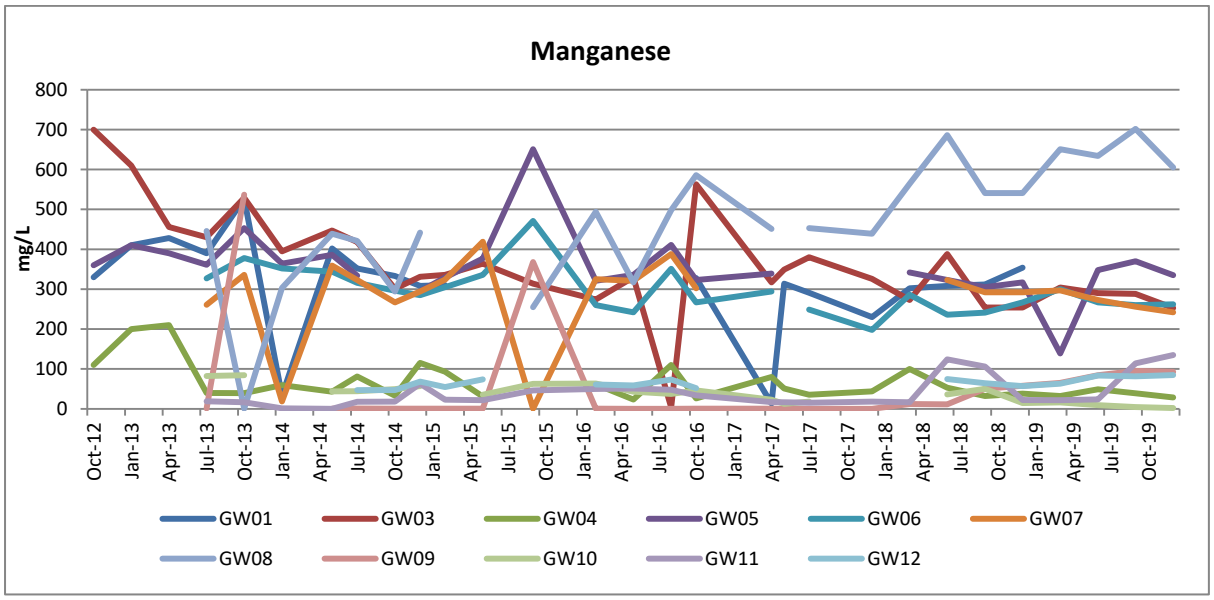
Figure 3-22 Groundwater Quality Results for Sampled Parameters for the Period 2012 to 2019

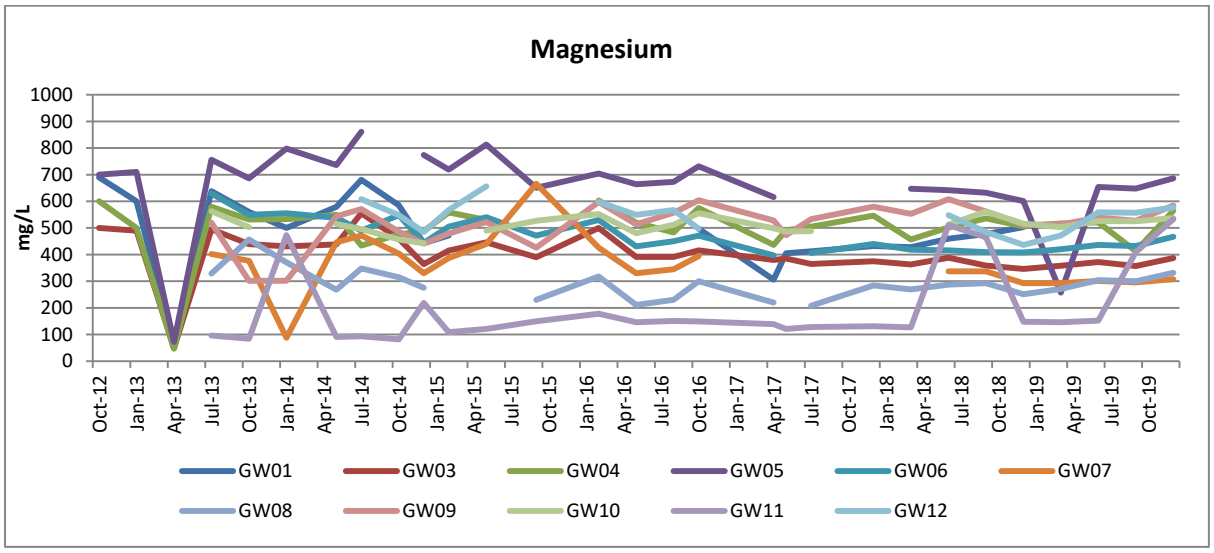


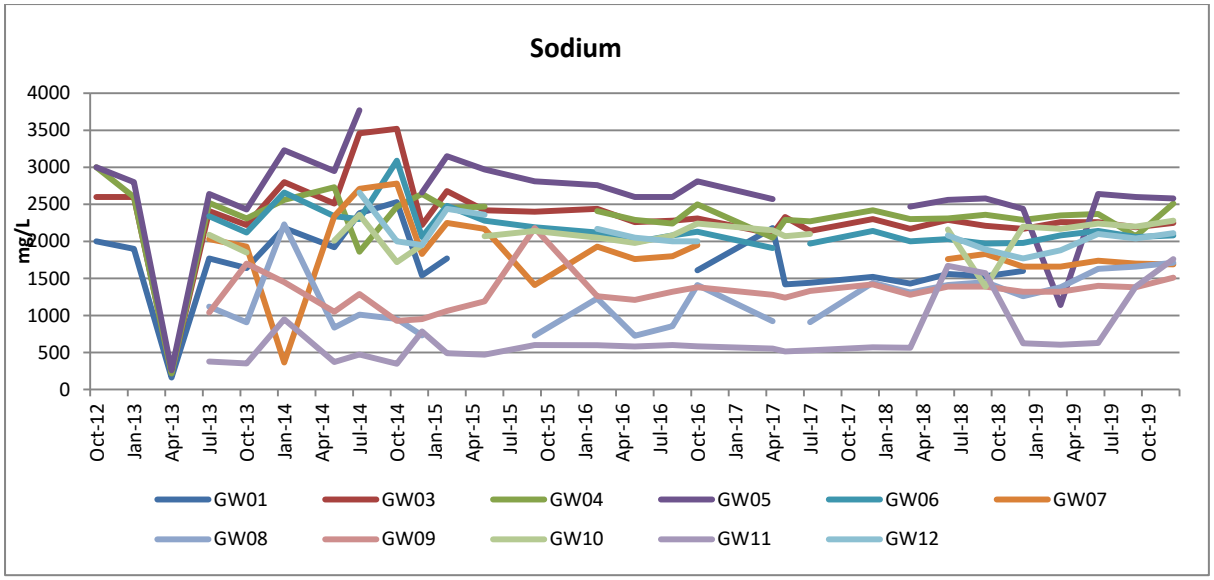


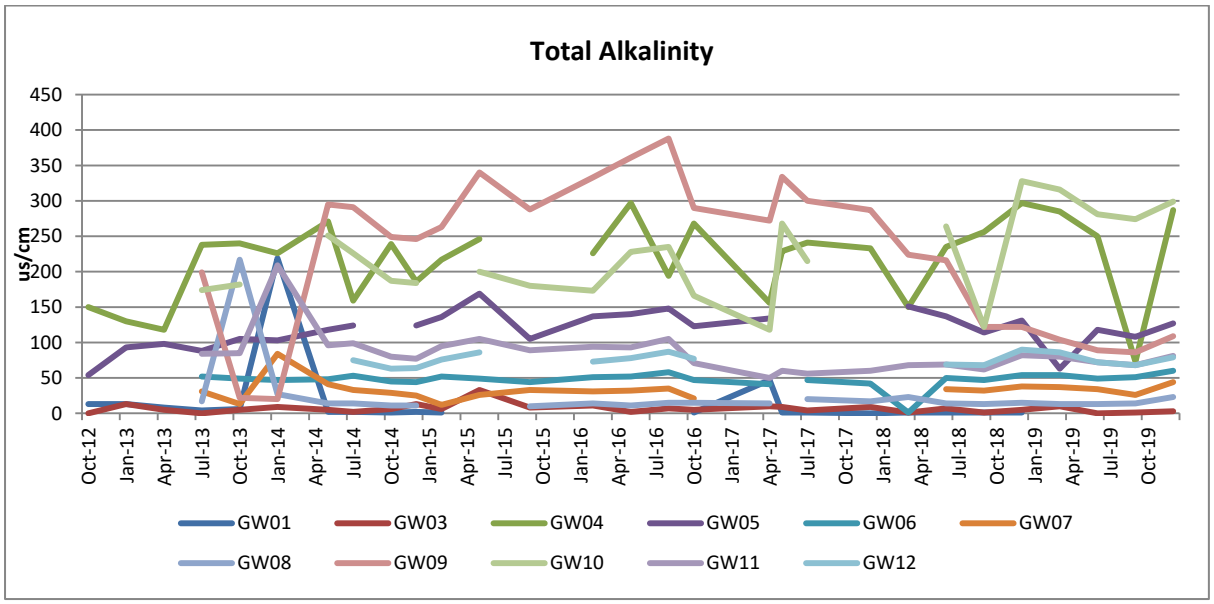


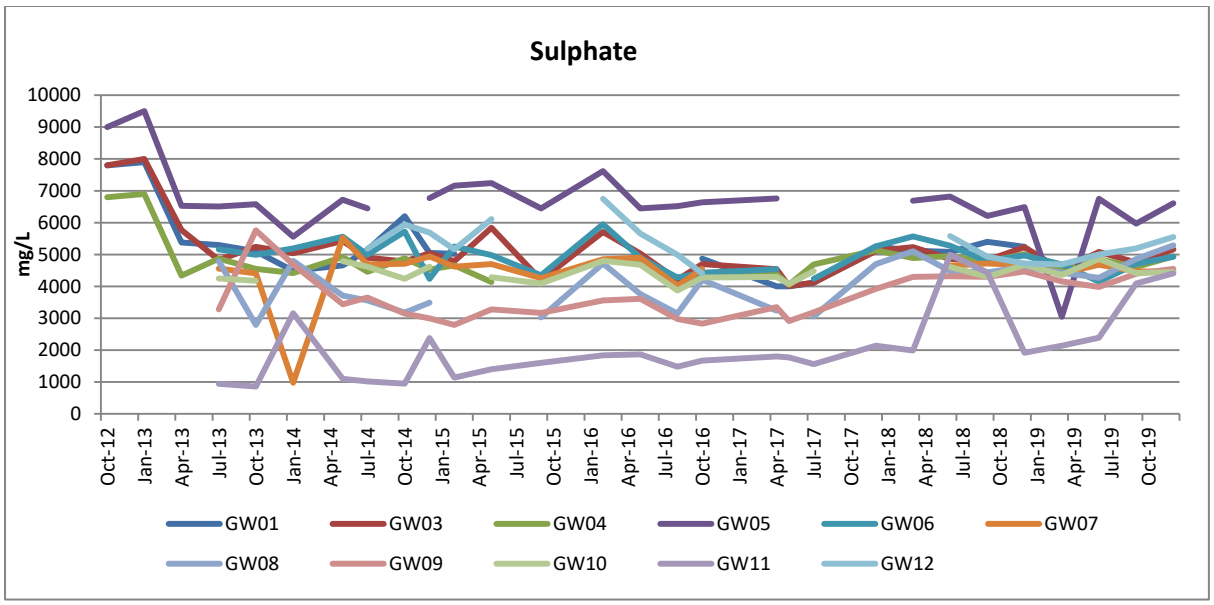

Cadmium
mg/L
0
1
2
3
4
5
6
7
8
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12

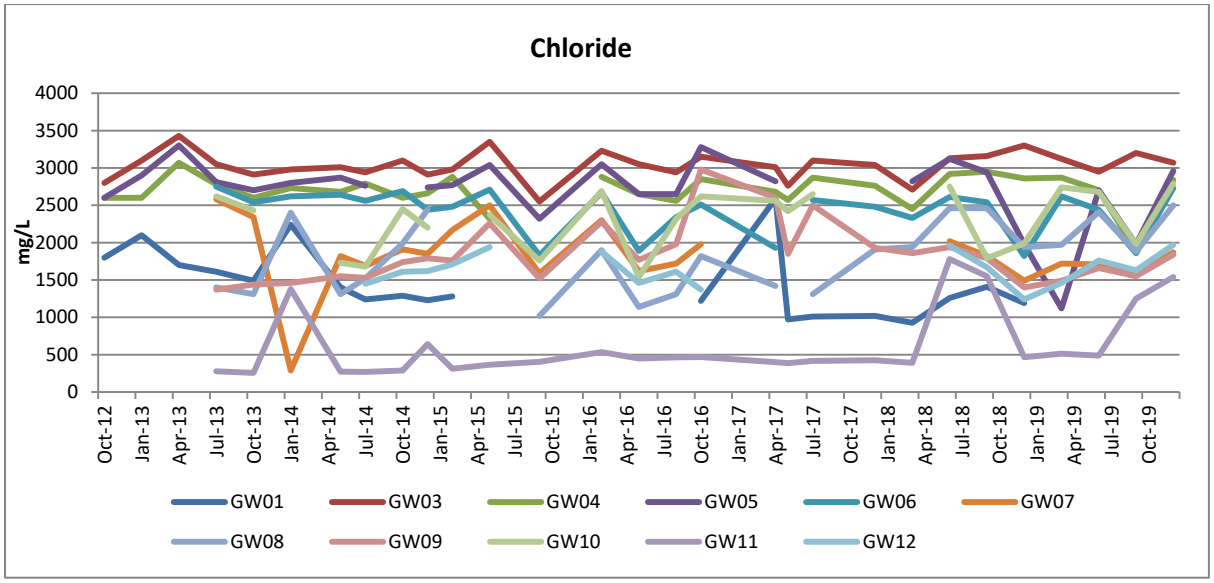

Manganese
mg/L
0
100
200
300
400
500
600
700
800
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12

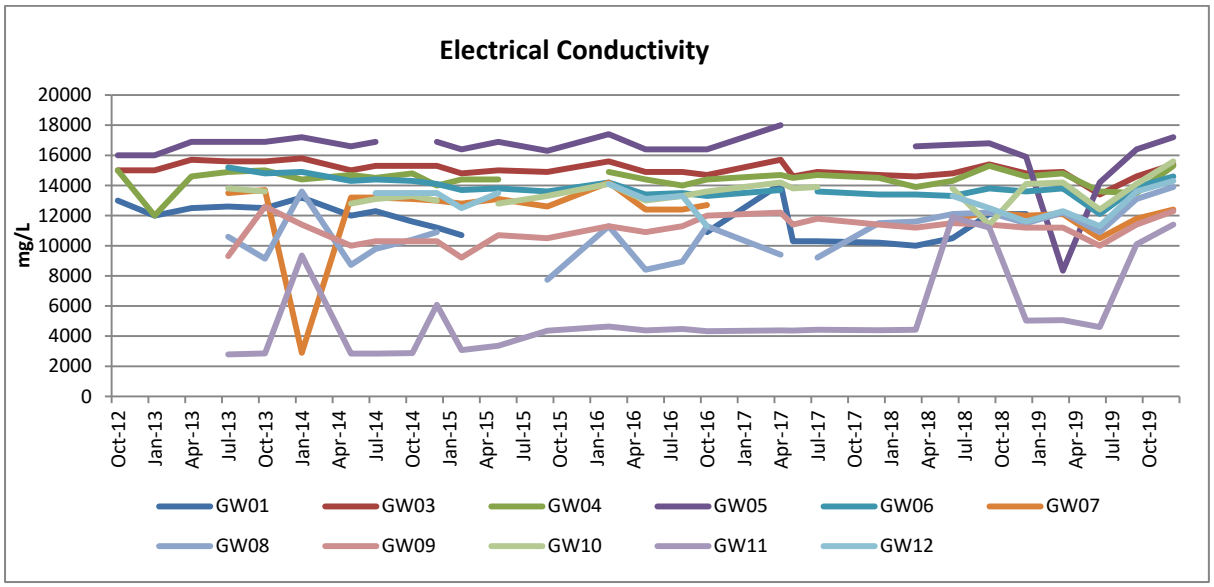

Magnesium
mg/L
0
100
200
300
400
500
600
700
800
900
1000
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12

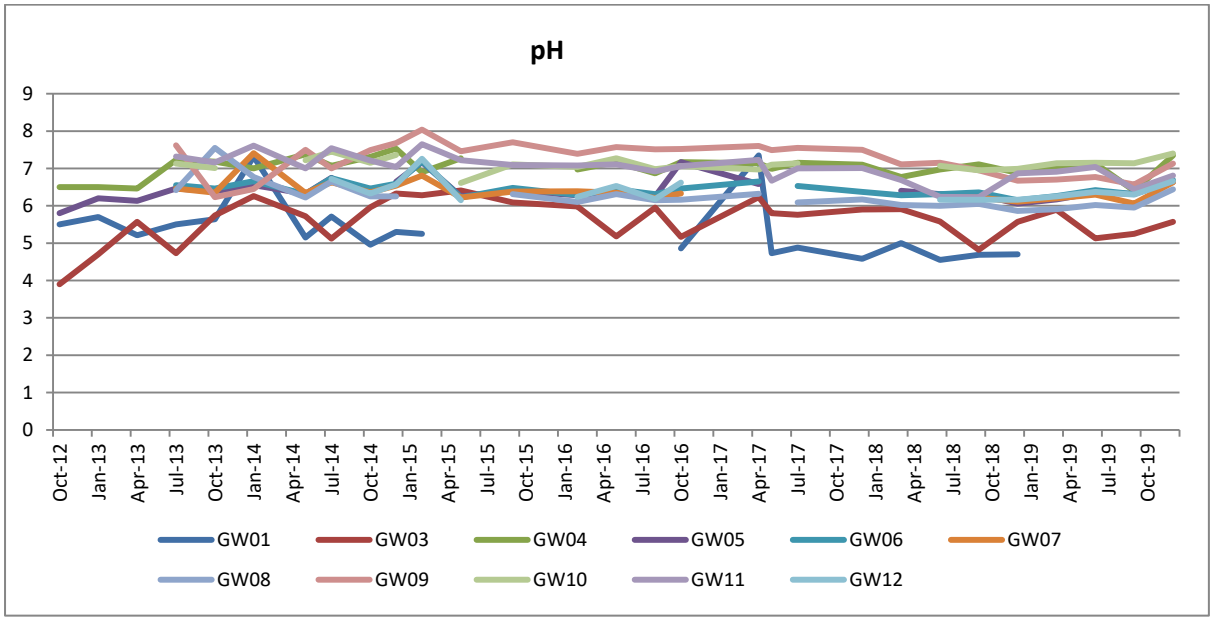

Sodium
mg/L
4000
3500
3000
2500
2000
1500
1000
500
0
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12


Total Alkalinity
us/cm
450
400
350
300
250
200
150
100
50
0
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12


Sulphate
mg/L
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12


Chloride
mg/L
4000
3500
3000
2500
2000
1500
1000
500
0
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12


Electrical Conductivity
mg/L
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12


pH
9
8
7
6
5
4
3
2
1
0
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12

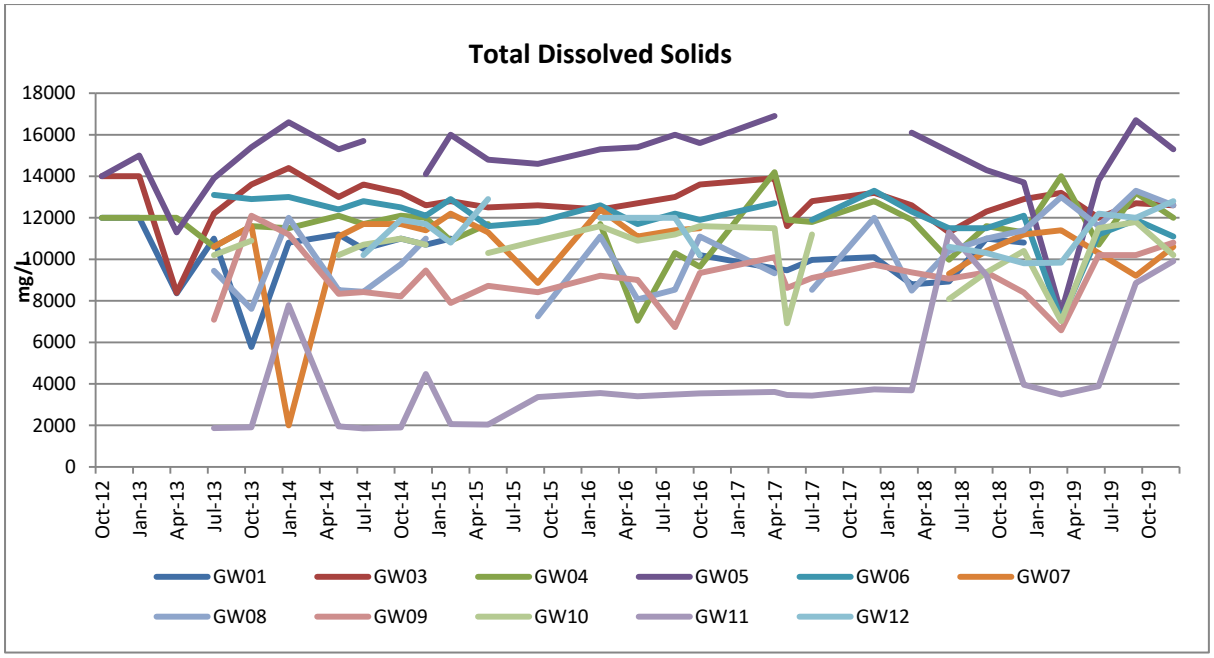

Total Dissolved Solids
mg/L
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
GW01
GW03
GW04
GW05
GW06
GW07
GW08
GW09
GW10
GW11
GW12

Table 3-14 Groundwater Monitoring Results for Shaft 7 and Mine Dewatering for the Reporting Period (2019)

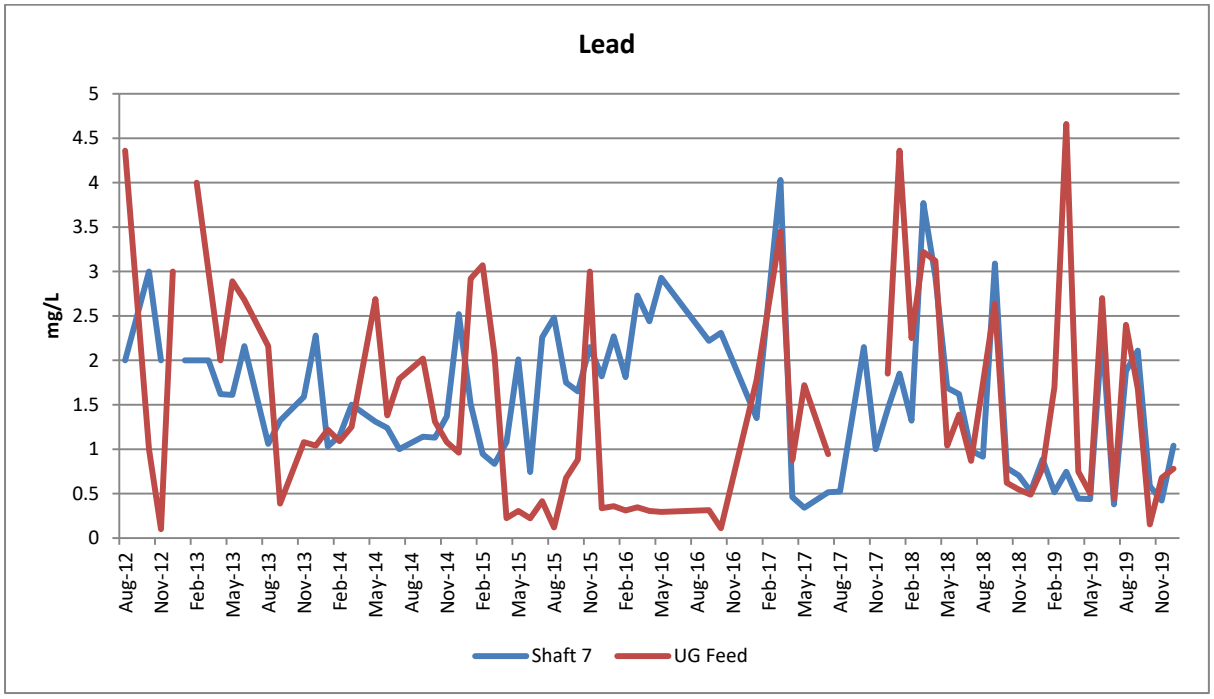
Site	Date	pH	EC	TDS	Alkalinity ($CaCO_3$)	SO4	Cl	Ca	Mg	Na	Cd	Pb	Mn	Zn	Fe
			(µS/cm2)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
Shaft 7	4/01/2019	6.18	13200	13300	8	5560	1840	543	310	1780	2.52	0.884	312	889	0.05
	1/02/2019	6.38	12200	12500	10	5480	1680	510	280	1580	2.26	0.516	290	892	0.05
	1/03/2019	6.2	12500	11800	7	5470	1740	558	300	1760	2.22	0.746	328	938	0.05
	2/04/2019	6.52	12700	12900	9	5410	1680	502	276	1620	2.02	0.444	290	876	1.94
	6/05/2019	6.31	12600	12500	8	5480	1460	545	294	1780	2.2	0.438	323	910	0.38
	3/06/2019	6.41	14100	12000	8	6240	1900	513	318	1730	2.2	2.31	352	891	0.78
	5/07/2019	6.34	13200	12800	8	5730	1610	502	271	1690	2.28	0.379	305	931	2.05
	7/08/2019	6.05	11800	12800	11	6380	1720	536	316	1770	1.94	1.88	327	796	<0.05
	24/09/2019	6.05	12800	13200	21	5280	1510	528	286	1730	2.32	2.11	303	928	2.99
	1/10/2019	5.94	12400	10800	4	5920	1450	523	264	1630	2.16	0.583	309	1050	0.05
	13/11/2019	5.99	12800	13100	4	5040	1620	547	282	1700	2.29	0.421	297	929	<0.05
	6/12/2019	6.21	13600	13400	7	6330	1970	534	290	1690	2.42	1.04	318	1090	4.62
UG Water	4/01/2019	6.27	13000	13100	10	5470	1770	525	282	1730	2.51	0.79	294	939	3.01
	1/02/2019	6.37	13400	13400	10	5740	1970	530	312	1760	2.46	1.7	347	883	0.05
	1/03/2019	6.19	13300	11500	5	5660	1870	590	311	1920	2.64	4.66	351	1060	0.05
	2/04/2019	6.3	12800	13100	5	5620	1660	487	258	1580	2.36	0.748	288	998	3.07
	6/05/2019	6.34	12600	12900	8	5560	1450	476	302	1860	2.5	0.502	306	1030	3.22
	3/06/2019	6.6	15100	13800	23	6350	2300	530	332	1860	2.56	2.7	446	852	0.29
	5/07/2019	6.38	13100	12700	11	5660	1580	497	268	1680	2.47	0.441	312	975	2.83
	7/08/2019	6.34	13200	13700	22	6520	2370	545	373	2070	2.36	2.4	415	822	<0.05
	24/09/2019	6.03	12400	12500	3	5190	1430	492	253	1590	2.44	1.68	283	1040	8.32
	1/10/2019	5.98	12600	11800	3	5410	1470	523	264	1650	2.38	0.153	330	1140	0.24
	13/11/2019	6.29	13600	13700	6	5440	1730	573	287	1820	2.86	0.678	319	1150	<0.05
	6/12/2019	6.2	13800	13100	7	6140	1980	537	292	1760	2.53	0.78	318	1050	0.58
Baseline		5.8	13900	8000	40	9660	1360	472	395	3550	6.32	2.25	907	3330	1.57
Trigger		7.54	18070	10400	52	12558	1768	614	514	4615	7.58	2.93	1179	4329	2.04

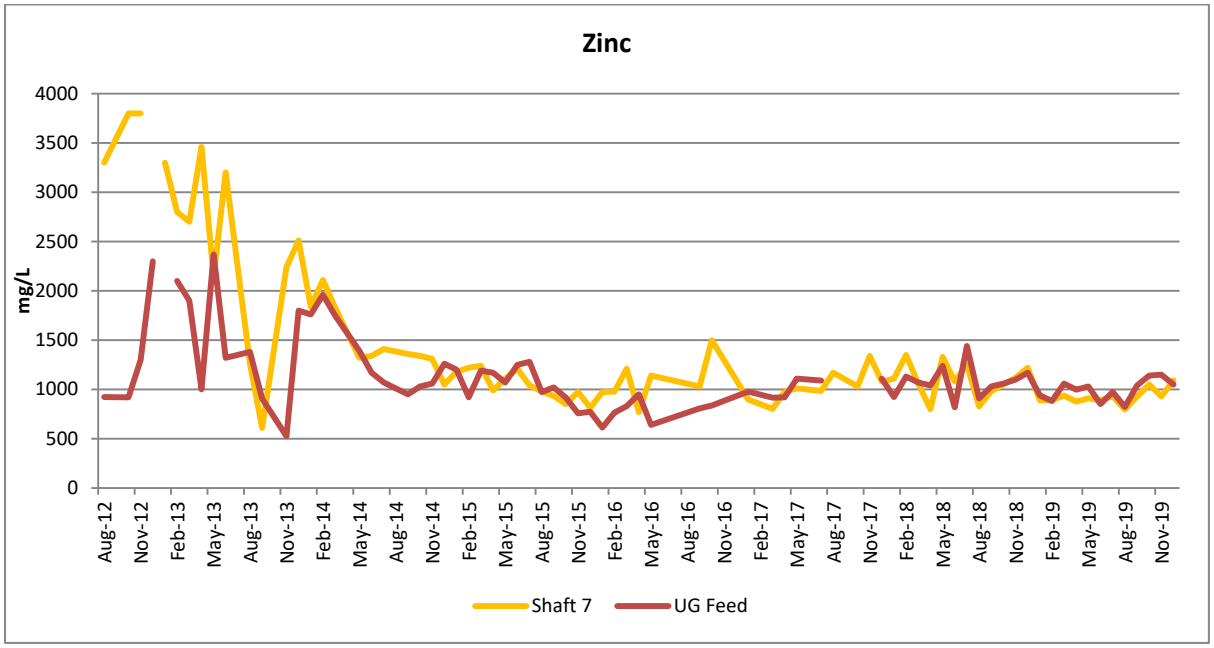
Trigger = Baseline + 30%

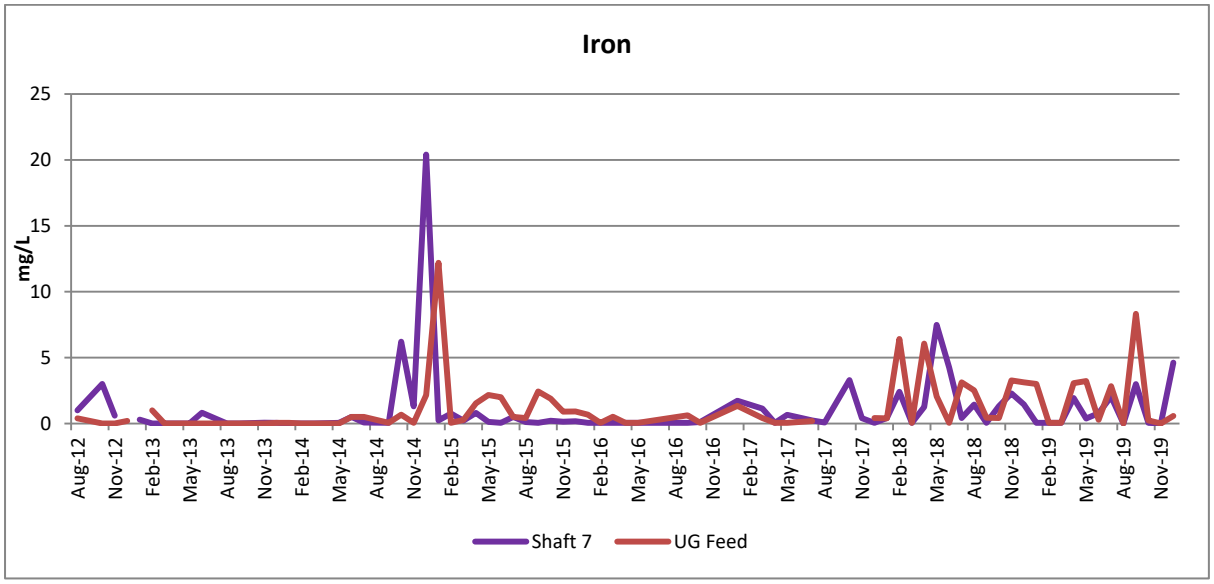
Results for both Shaft 7 and UG Feed occasionally exceeded trigger thresholds for Chloride, Iron and Lead, but are variable. Total dissolved solids (TDS) results were above the trigger threshold for most of the year; however, results were within the historic range for TDS. Iron and Chloride levels were slightly elevated compared to previous periods but within historic levels and is probably consistent with mining works in the area where the water is extracted.

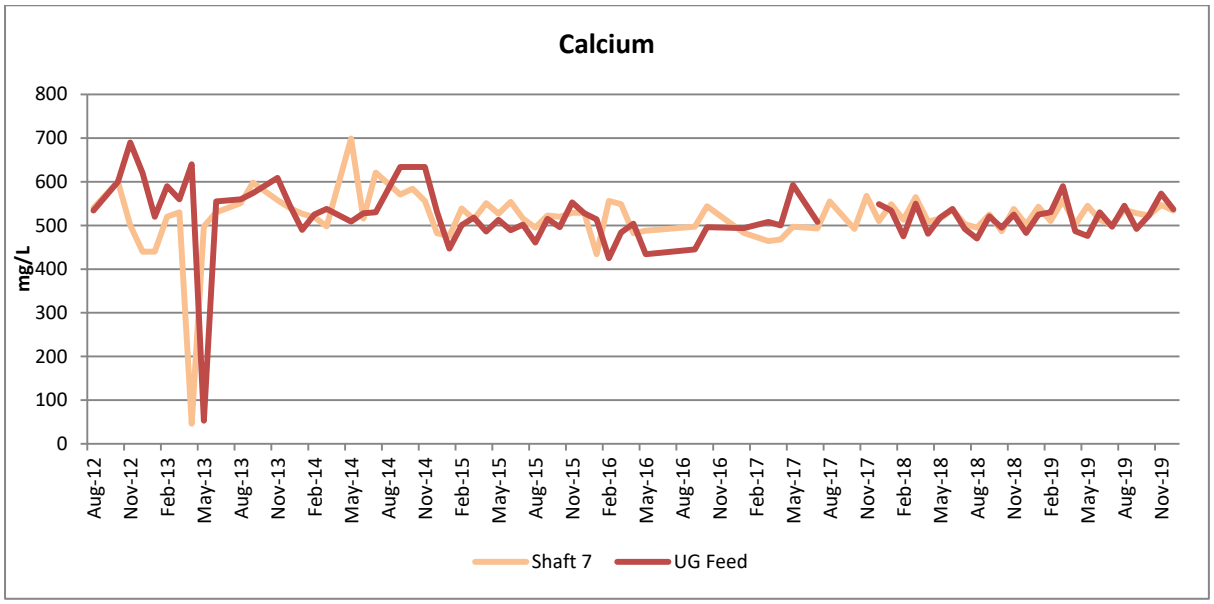
Figure 3-23 provides a series of graphs indicating results for the period 2012, commencement of operations, to 2019. Results are within the historic range for all parameters, and in some cases such as with Zinc and Manganese, lower.

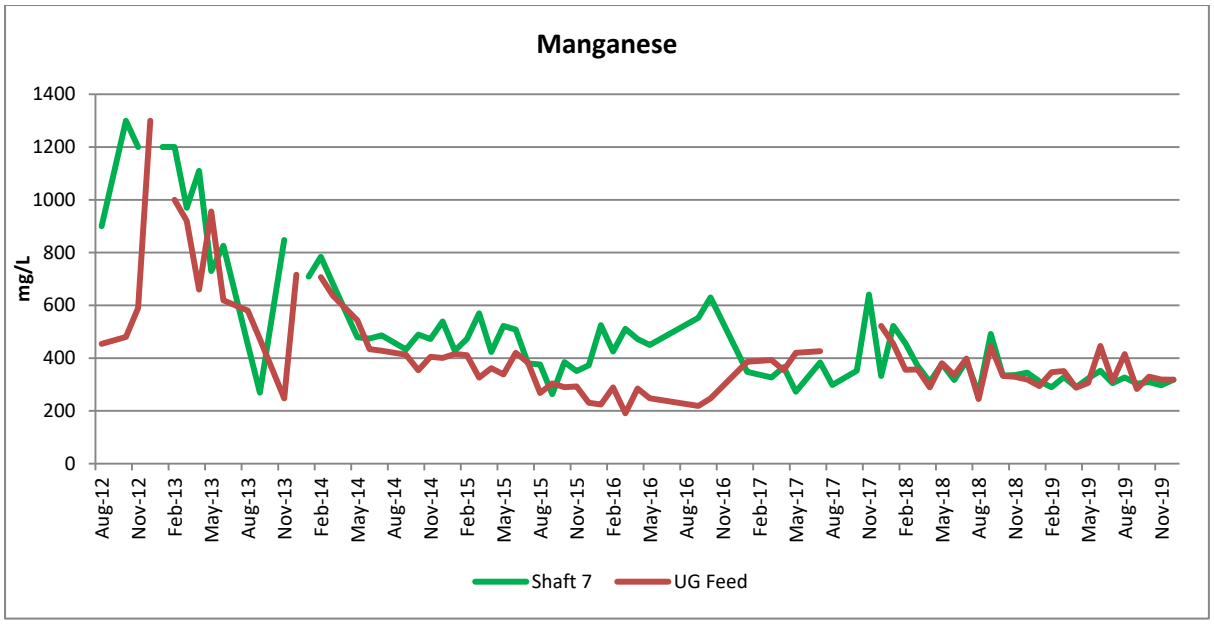
Figure 3-23 Shaft 7 & Mine Dewatering Results for Sampled Parameters - Period 2012 to 2019

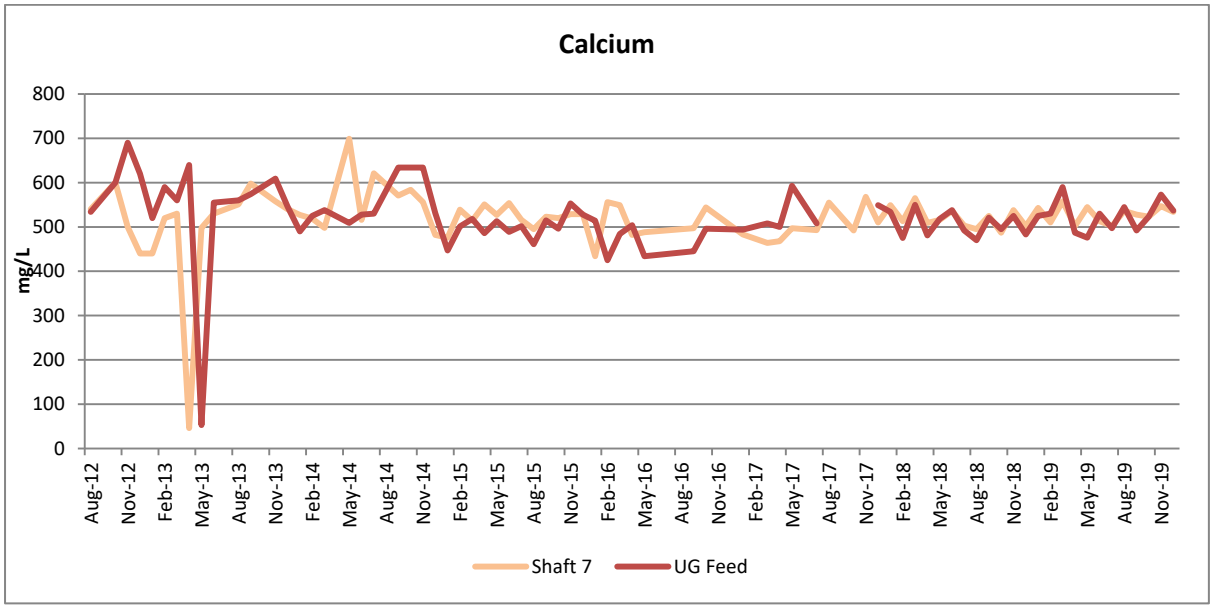


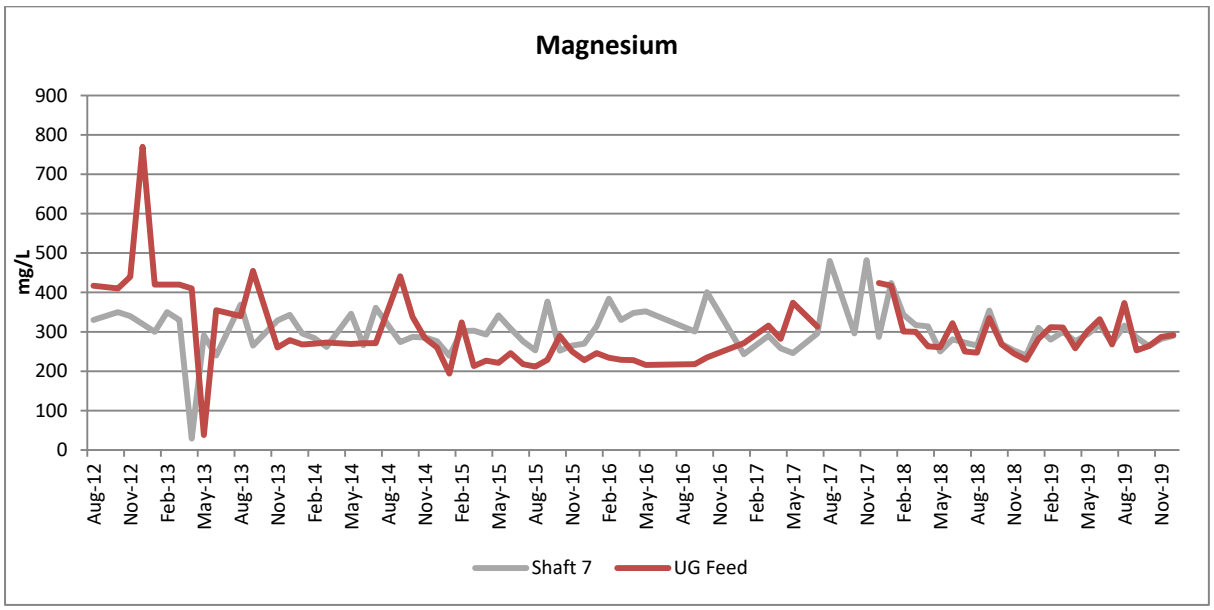


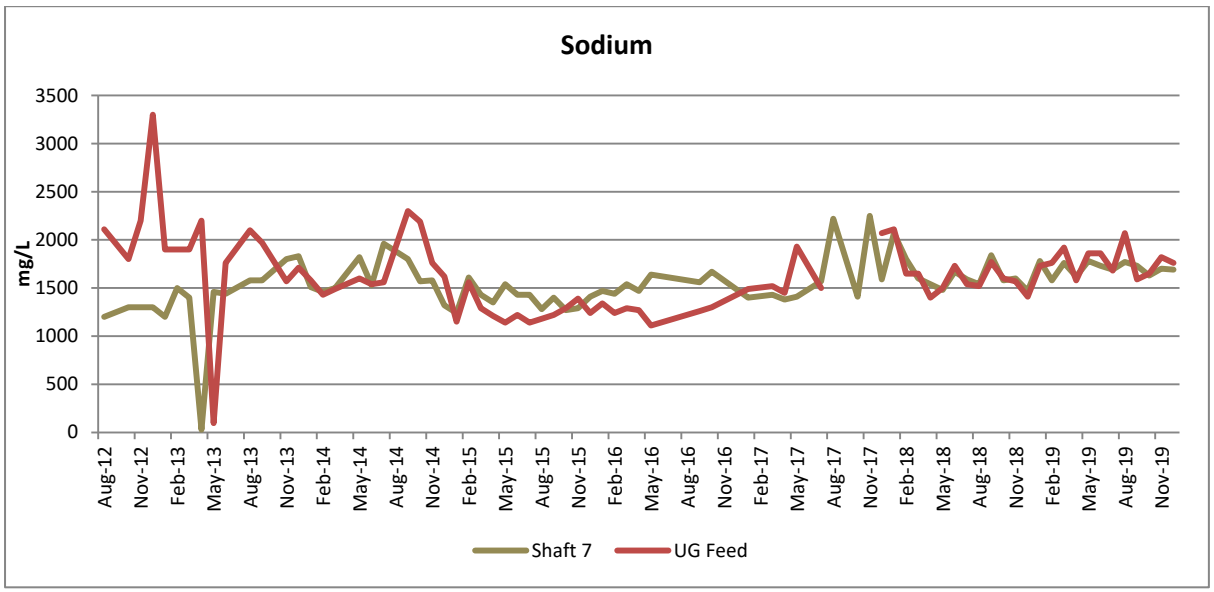

Iron
mg/L
25
20
15
10
5
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
Aug-17
Nov-17
Feb-18
May-18
Aug-18
Nov-18
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Calcium
mg/L
800
700
600
500
400
300
200
100
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
Aug-17
Nov-17
Feb-18
May-18
Aug-18
Nov-18
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Manganese
mg/L
1400
1200
1000
800
600
400
200
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
Aug-17
Nov-17
Feb-18
May-18
Aug-18
Nov-18
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Calcium
mg/L
800
700
600
500
400
300
200
100
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
Aug-17
Nov-17
Feb-18
May-18
Aug-18
Nov-18
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Magnesium
mg/L
900
800
700
600
500
400
300
200
100
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
Aug-17
Nov-17
Feb-18
May-18
Aug-18
Nov-18
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Sodium
mg/L
3500
3000
2500
2000
1500
1000
500
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
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May-18
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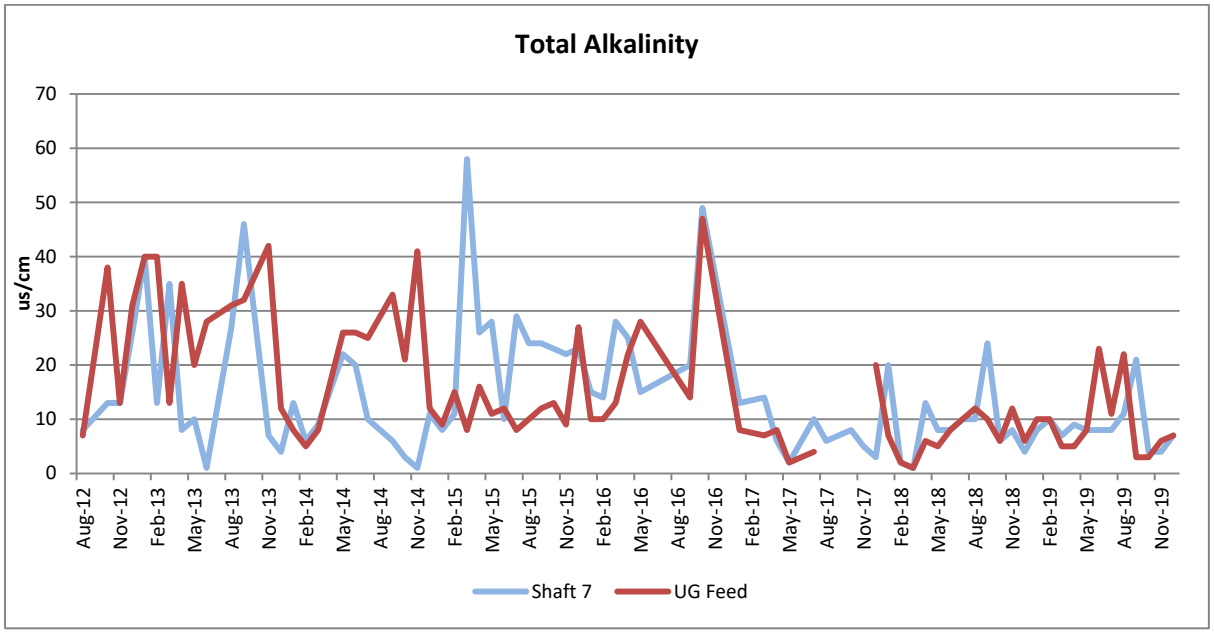
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Total Alkalinity
us/cm
70
60
50
40
30
20
10
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
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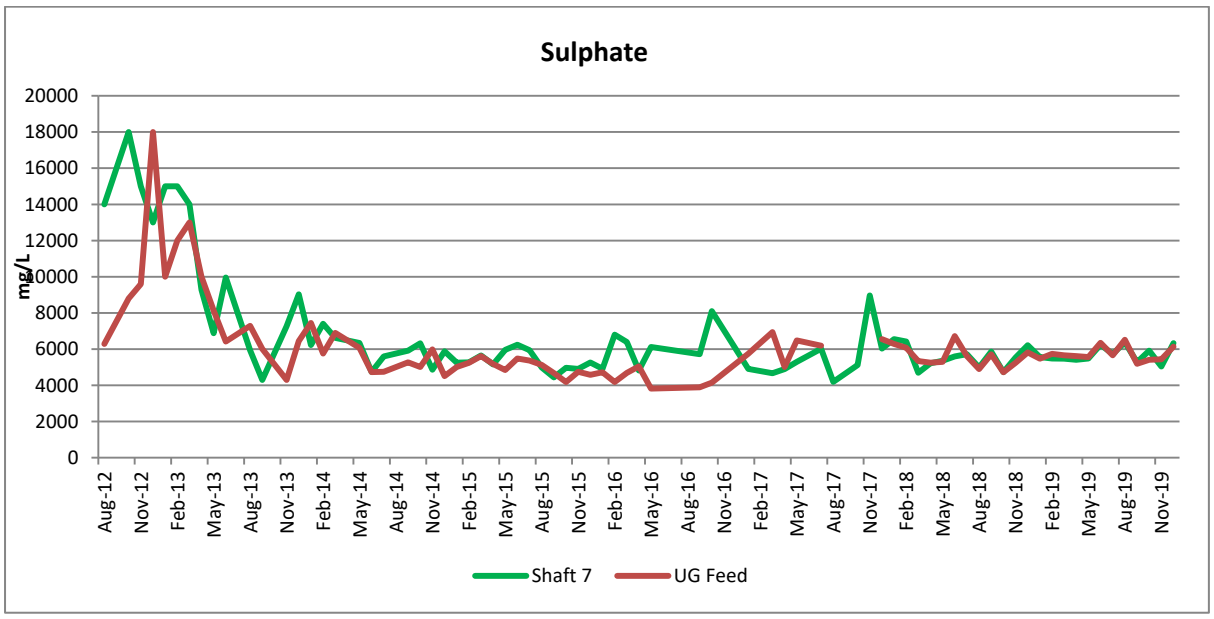
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
Aug-17
Nov-17
Feb-18
May-18
Aug-18
Nov-18
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Sulphate
mg/L
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Aug-12
Nov-12
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May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
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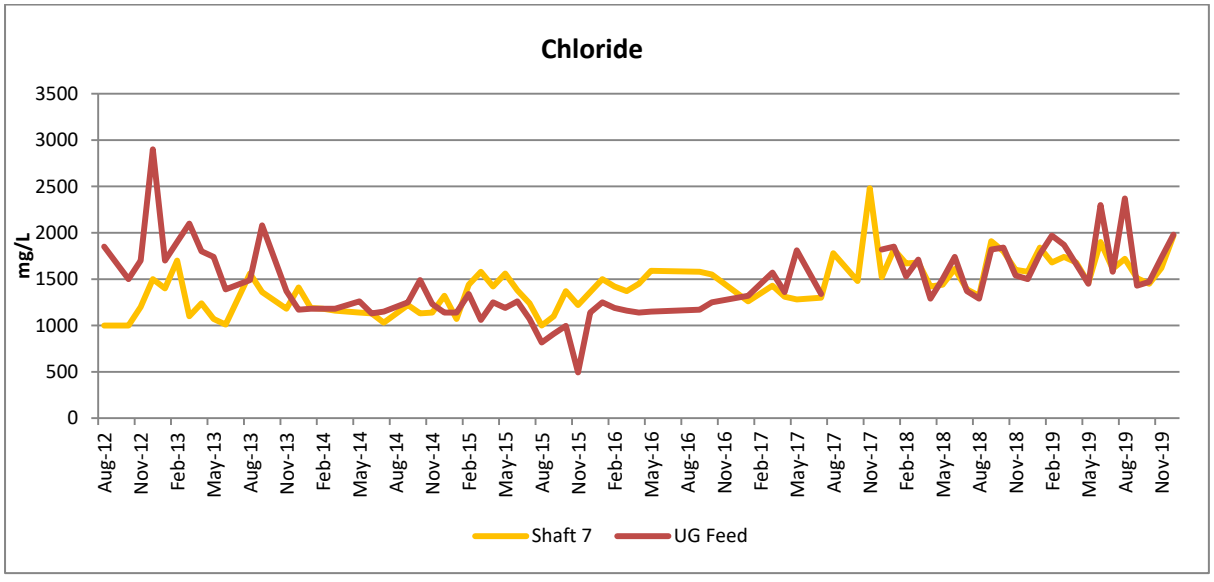
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Chloride
mg/L
3500
3000
2500
2000
1500
1000
500
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
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Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
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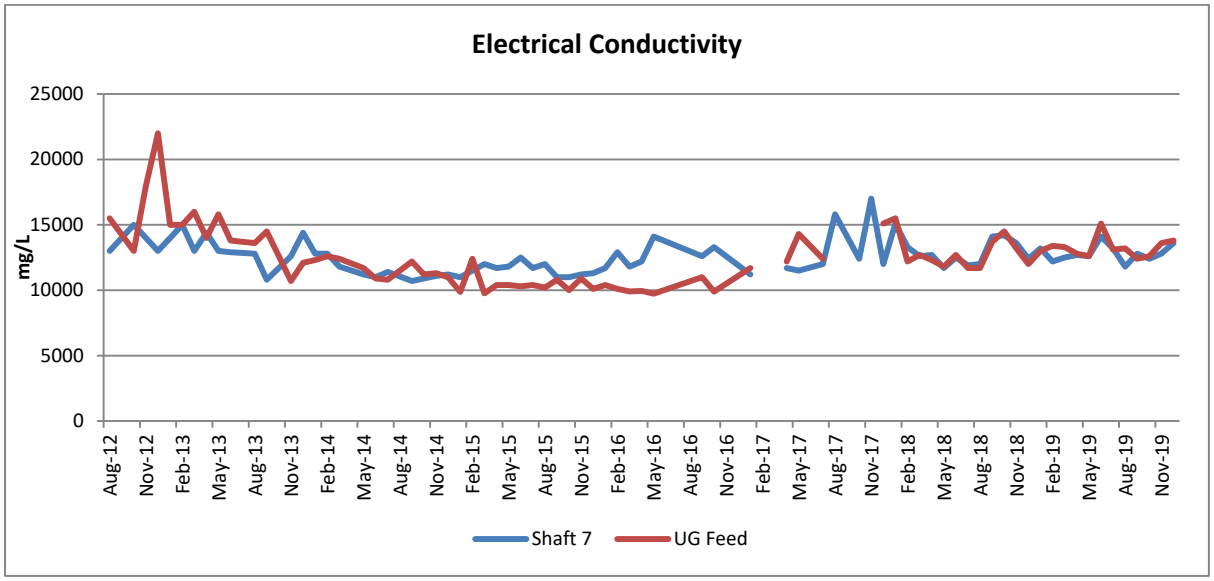
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Electrical Conductivity
mg/L
25000
20000
15000
10000
5000
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
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Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
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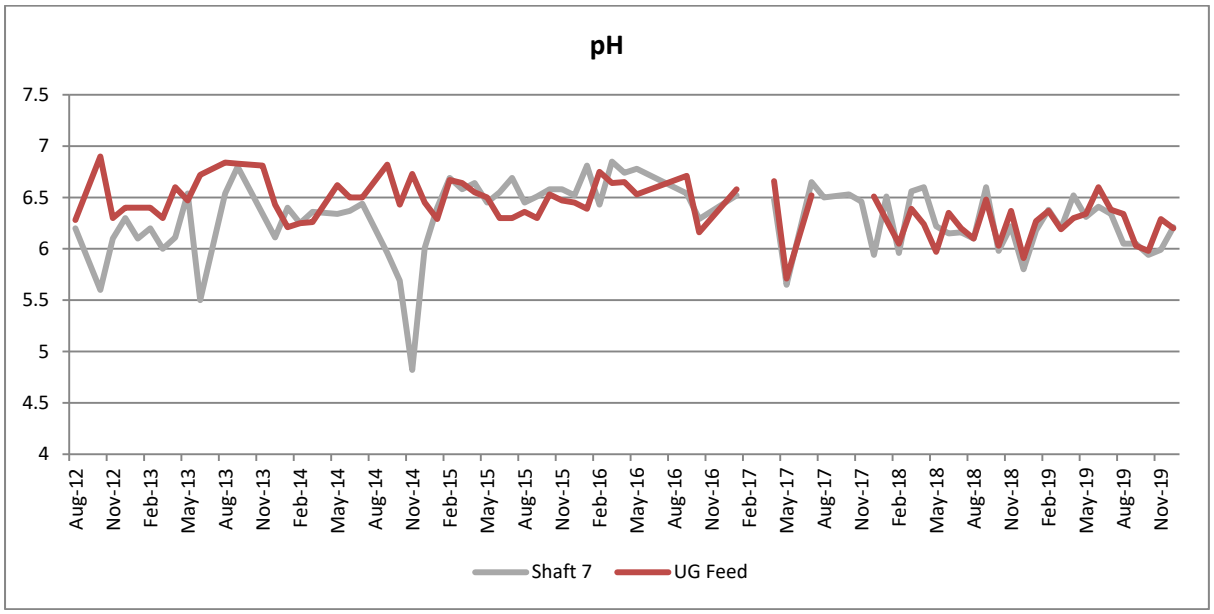
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


pH
7.5
7
6.5
6
5.5
5
4.5
4
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
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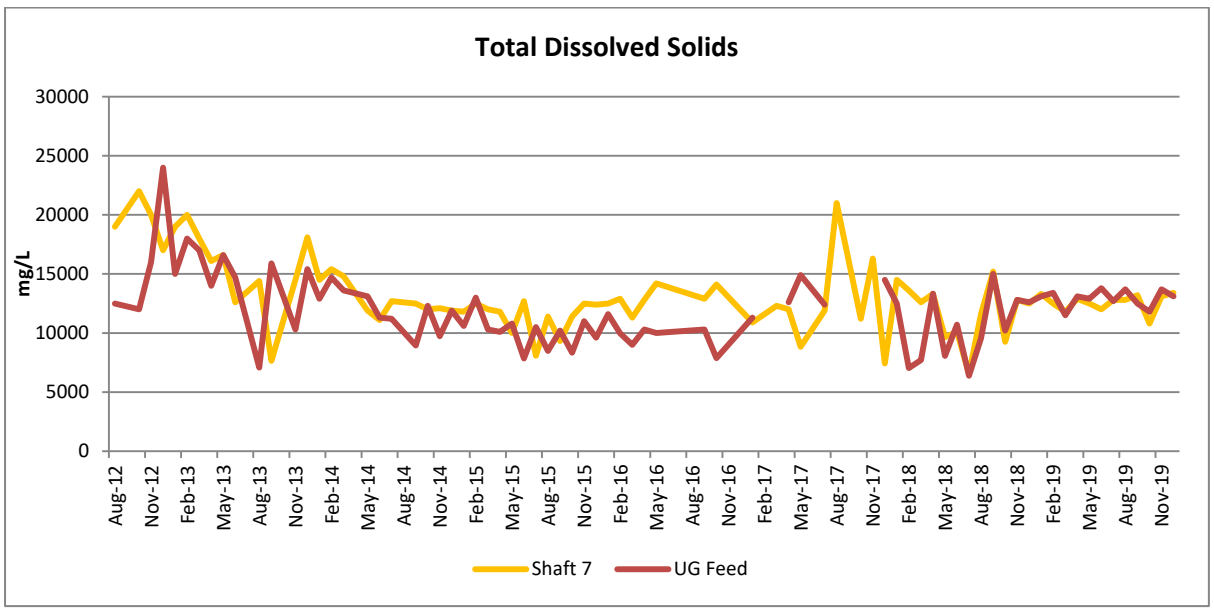
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed


Total Dissolved Solids
mg/L
30000
25000
20000
15000
10000
5000
0
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Feb-16
May-16
Aug-16
Nov-16
Feb-17
May-17
Aug-17
Nov-17
Feb-18
May-18
Aug-18
Nov-18
Feb-19
May-19
Aug-19
Nov-19
Shaft 7
UG Feed

3.7 Contaminated Land

The majority of the surface land area that makes up the Rasp Mine is contaminated historic mining waste material including waste rock emplacements and tailings.

The storage and handling of diesel fuels, lubricants and oils, and waste rock material are the only aspects of the operation, which have the potential to contribute to contaminated land. The sections below outline how dangerous goods are handled onsite and procedures in place for managing and reporting spills.

3.8 Hydrocarbon and Chemical Management

The main streams of hydrocarbons managed on site include:

- Fuel (diesel) - storage and distribution;
- Grease oils and lubricants - storage distribution and recovery for recycling; and
- Solvents used in the parts washer.

3.8.1 Fuel

Diesel is stored in two tanks each with a capacity of 68,000L. These self-bunded trans-tanks are located adjacent to the workshop and are sitting on a constructed concrete re-fuelling station. The facility has been designed and manufactured in accordance with AS1940 and AS1692. BHOP has provision for diesel storage on its Dangerous Goods Licence; UN 00C1 Diesel 150,000 L. Surface distribution of diesel is by direct collection from the fuel browser. The tanks operate on a float and cut-off system that prevents overfilling of the tanks.

A 10,000L diesel tank was commissioned in October 2017. The tank is situated at the 13L Service Bay underground. It is double skinned and self-bunded.

Rasp's fuel management system enables monitoring of fuel usage by each vehicle and piece of plant. This assists with maintenance and security as well as providing an accurate reporting mechanism for the collecting of data for NPI and NGERS reporting.

3.8.2 Grease, oils and lubricants

Lubricants and oils are stored in individual pods located on a portable bund. A storage facility for these lubricants and oils has been constructed on the western side of the main workshop. It consists of a raised concrete pad incorporating drainage to a sump to facilitate cleaning.

3.8.3 Solvents

Oil solvent used for cleaning of mechanical parts at the workshop is removed by a contractor on a fixed maintenance schedule.

3.8.4 Processing reagent storage

All reagents are stored in a purpose built storage facility designed to prevent contamination and capture spillage.

The reagents stored here include:

- Hydrated Lime
- Copper Sulphate
- Sodium metabisulphite
- Sodium ethyl xanthate
- Flocculent
- InterFroth F228
- Cytec S9232 (zinc collector)
- Anti-scalant

- Defoamer
- Zinc Sulphate

All quantities and map with storage locations are reference in the Pollution Incident Response Management Plan which is tested annually and available on the CBH website.

3.9 Hazardous Material Management

3.9.1 Licensing

Rasp holds Licence XSTR100095 for the storage and handling of dangerous goods and Radiation Management Licence 5063802. Additionally, Rasp holds an explosives licence (licence number XMNF200003) to manufacture, possess, store explosives and ammonium nitrate emulsion on site.

3.9.2 Dangerous goods management

Site dangerous goods management is managed according to the site Chemical Management Procedure BHO-PRO-SAF-020.

A Safety Data Sheet (SDS) database for each chemical is maintained. SDS's are kept at each location where chemicals are stored and in the mines rescue room. SDS's are also electronically available on the intranet.

General and contractor inductions outline the required actions in the event of a spill, including completing an Incident Report.

All quantities and a map with storage locations are referenced in the Pollution Incident Response Management Plan, which is tested annually and updated as required.

Storage, management and access to explosives onsite is outlined in the Store, Manage and Access Explosives Standard BHO-STD-MIN-001. A security plan compiled and submitted by the supervising licensee detailing the security measures for explosives on the Broken Hill Operations Pty Ltd, Rasp Mine site. (Document PLN- 03-06-01)

Explosives are stored both on the surface and underground. The surface explosive magazines (SEM) are located within the BHP Pit approx. 3 km north from the main office on Eyre Street. The area encompasses one detonator magazine (IE), one packaged explosives magazine (HE) and one emulsion bulk storage compound. The magazines are separated by a minimum of 7 metres and are bunded in accordance with AS 2187.1. All gates and magazines are secured with locks, and signage that meet the minimum required standards.

The underground explosive magazines (UEM) are located within the underground operations of Broken Hill Operations Pty Ltd, Rasp Mine. Separate storages are utilised for the storage of (IE) and (HE) Explosives Magazines are secured with locks, and signage that meet the minimum required standards.

SEM & UEM keys are locked in a secured key cabinet in the Broken Hill Operations Pty Ltd, Rasp Mine Site Office and are to be issued only by the Emergency Service Officers, who must check the identity and authority of the person wishing to take possession of the keys. The SEM & UEM Explosive Magazine Access Log Book BHO-TRN-REG-004 must be completed prior to issuing and returning the keys. Personnel will only be granted access if they possess a Security Clearance and their name appears on the Key Register (Section 7 of the Site Security Plan).

3.10 Waste Management

Waste management at the mine is classified into two broad categories: mineral wastes (mining and mineral processing wastes discussed above), and non-mineral wastes which include recyclables and non-recyclables.

3.10.1 Mineral wastes

Mineral wastes consist of waste rock from underground workings and tailings residue from the processing of ore.

Waste rock that cannot be returned underground to fill voids is stored in Kintore Pit or used for underground roads. In the reporting period 357,792 t of waste rock was placed underground and 134,706 t was placed on the stockpile/tipple in Kintore Pit.

Tailings is discharged into Blackwood Pit (TSF2) with water recycled for use in processing where possible. In the reporting period 578,472 t of tailings was placed in Blackwood Pit.

3.10.2 Non-mineral waste

Rasp Mine has four main laydown areas where used parts and equipment are stored for future use. The recyclable area has dedicated sections for scrap metal, timber, batteries, rubber, electronic goods and used pods. Used 1000L pods are returned to the manufacturer for reconditioning and reuse or removed by a waste contractor for recycling or disposal.

Waste oil, oily water, coolant, hydrocarbon-contaminated solids (rags, spill control material, etc.), grease, oil filters, hydraulic hoses, and batteries are collected by a waste contractor for disposal or recycling.

Paper and cardboard are disposed on in blue recycling bins and skips which are collected by City Council. Printer cartridges are collected in “Planet Ark” disposal bags and delivered to the local Post Office for recycling. Scrap Metal is sold to a local scrap metal merchant and Cans and Bottles are sold to a local bottle collection merchant.

Waste disposed of in 2019 is summarised in **Table 3-15**.

No tyres were disposed in underground workings during the reporting period. Tyres for heavy mobile equipment have been stored or reused around the mine site for barricades on roadways and within the laydown yards. Occasionally heavy tyres will be transported off-site for disposal with ten haul truck tyres removed from site in 2019 by a local contractor. All other LV and light truck tyres are removed from site under arrangement with the tyre supplier.

Table 3-15 Waste Summary - 2019

Waste	Quantity Disposed
Oil	44,250 L
Oily water	11,000 L
Coolant	2,000 L
Scrap metal	248 t
Grease	15,785 L
Oil filters, hoses,	21 m^3
Contaminated drums/IBC’s	80 m^3
Printer cartridges	8 bags
E-waste	Nil
Waste to Landfill	223.5t

3.11 Flora and Fauna

The site is a highly disturbed environment that provides little value as native flora and fauna habitat. There have been no threatened flora, fauna or species habitat identified at the Rasp Mine. Goats frequent the site and removal is planned in 2020.

3.12 Weeds

During site inspections in 2019, individual Bush Tobacco (*Nicotiana glauca*) trees and a stand of rhizomatous bamboo (likely *Phyllostachys spp*) have been identified for removal in 2020. The Bush Tobacco, which grows along water storages and some isolated locations on dumps, will be removed by cutting at the stump. The bamboo is growing in the Eyre St trench and will likely be sprayed with a Glyphosate-based herbicide.

3.13 Blasting

There are six monitors installed to record blasting vibration and over pressure. Blast monitors are installed at five locations around Broken Hill and there is one monitor located on-site near the core shed (this is used to monitor blast impacts at South Road). Locations are shown on **Figure 6-2**.

If a blast complaint is received, the complainant is given the opportunity to have a 'roving monitor' placed at their residence/location. By doing so BHOP can monitor the impact at the location for a time. Normally, a roving monitor is placed at the complainants' location for at least two months to develop an accurate K Factor, which is used in blast design to predict ground vibration at a set location. BHOP maintains a spare monitor to replace compliance monitors removed for calibration or due to fault. In 2018, BHOP purchased two additional monitors to be employed as roving monitors. In April 2017, blast monitor V4 at 123 Eyre St was removed at the residents request and placed at the Eyre St Bowls Club.

Table 6-16 and **Table 6-17** lists the criteria for blasting ground vibration and overpressure for Western Mineralisation / Main Lodes (Western Min/Main Lodes) and Block 7, respectively**.**

Table 3-16 Overpressure and Ground Vibration Western Min/Main Lodes (excluding Block 7)

Location	Airblast Overpressure (dB(Lin Peak))	Ground Vibration (mm/s)	Allowable Exceedance
Residence on privately owned land (7am-7pm)	115	5	5% of the total number of blasts over a 12-month period[ab]
(7am-7pm)	120	10	0%
(7pm-10pm)	105	-	-
(10pm-7am)	95	-	-
Public Infrastructure[d]	-	100	0%

Table 3-17 Overpressure and Ground Vibration Block 7 (includes Zinc Lodes)

Location	Airblast Overpressure (dB(Lin Peak)	Ground Vibration (mm/s)	Allowable Exceedance
Residence on privately owned land (7am-7pm)	115	3 (interim)[c]	5% of the total number of blasts over a 12-month period[a]
(7am-7pm)	120	10	0%
(7pm-10pm)	105	-	-
(10pm-7am)	95	-	-
Broken Hill Bowling Club, Italio (Bocce) Club, Heritage Items within CML7	-	50	0%
Perilya Southern Operations	-	100	0%
Public Infrastructure[d]	-	100	0%

The Project Approval provides the following notes to these **Table 3-1618** and **6-19:**

a) The allowable exceedance must be calculated separately for development blasts and production blasts;
b) The 5% allowable exceedance does not apply to production blasts until the Proponent has successfully completed a Pollution Reduction Program aimed at achieving this goal, as required by the EPA under the Proponent's EPL (No. 12559), or as otherwise agreed with the EPA;
c) The interim criteria applies unless and until such time that the Proponent has written consent from the Secretary to apply site specific criteria in accordance with condition 19 of this approval; and
d) The Proponent must close South Road to pedestrians if blasts are expected to exceed a peak particle velocity ground vibration of 65 mm/s at the road reserve surface, while the blast firing occurs.

In addition, the following conditions also apply:-

- Production blasts may occur between 6.45 am and 7.15 pm on any day
- 1 production blast per day, with 6 per week averaged over a calendar year
- 6 development blasts per day, with 42 per week averaged over a calendar year

In accordance with Project Approval and EP Licence conditions:

- All production-blasting times occurred between 6.45am and 7.15pm on any day.
- Production blasts averaged 4.3 per week over the previous calendar year
- Development blasts averaged 34.2 per week over the previous calendar year

A total of 2,094 blasts were fired during the reporting period, 1,880 for development and 214 for production. **Table 3-19** and **Table 3-21** lists the total number of blasts for each area per month during the reporting period and **Tables 3-20** and **3-22** summarise the blasts over 5 mm/s (Western Min/Main Lodes) and 3 mm/s (Block 7). "No Record" are the number of blasts that did not trigger vibration monitors.

In the Western Mineralisation/Main Lodes mining areas (external to Block 7), 2,089 blasts were fired. Of these, 1,880 were for development and 209 were for production. Nine blasts exceeded 5 mm/s, all recorded from production blasts. The percentage of production blasts exceeding 5 mm/s was 4.3% and the percentage of development blasts was 0.0%, both within the criteria of 5% allowable exceedance.

Blast monitors are set to trigger (record) when they detect ground vibration of 13 mm/s or higher.

Table 3-18 Western Mineralisation/Main Lodes Summary of Blasts for Reporting Period (2019)

	Western Mineralisation / Main Lode									
	Production					Development				
	Blasts	< 5	>= 5	>= 10	No Trigger	Blasts	< 5	>= 5	>= 10	No Trigger
Jan 2019	20	19	0	0	1	143	0	0	0	143
Feb 2019	19	15	4	0	0	141	0	0	0	141
Mar 2019	11	11	0	0	0	143	0	0	0	143
Apr 2019	10	10	0	0	0	159	2	0	0	157
May 2019	21	20	1	0	0	165	2	0	0	163
Jun 2019	17	16	0	0	1	131	0	0	0	131
Jul 2019	27	22	3	0	2	174	0	0	0	174
Aug 2019	19	19	0	0	0	184	0	0	0	184
Sep 2019	15	15	0	0	0	157	0	0	0	157
Oct 2019	21	21	0	0	0	170	0	0	0	170
Nov 2019	13	12	1	0	0	161	0	0	0	161
Dec 2019	16	16	0	0	0	152	0	0	0	152
TOTAL	209	196	9	0	4	1880	4	0	0	1876

Table 3-19 Western Mineralisation/Main Lodes Blasts > 5 mm/s for the Reporting Period (2019)

Production	Blasts >5 mm/s	Result	Development	Blasts >5 mm/s	Result	TOTAL	Blasts >5 mm/s	Result
209	9	4.3%	1880	0	0%	2089	9	0.4%

All criteria were met for the Western Mineralisation / Main Lodes during the reporting period.

In Block 7, mining areas (including the Zinc Lodes), a total of 5 production blasts were fired during the reporting period. Two blasts exceeded 3 mm/s, all recorded from production blasts. The percentage of production blasts exceeding 3 mm/s was 40%.In November 2019 it was determined that the percentage of production blasts exceeding 3 mm/s was over the allowable limit of 5% for the EPL 12559 reporting period.

Table 3-20 Block 7 (and Zinc Lodes) Summary of Blasts for the Reporting Period (2019)

	Block 7 (includes Zinc Lode)									
	Production					Development				
	Blasts	< 3	>= 3	>= 10	No Trigger	Blasts	< 3	>= 3	>= 10	No Trigger
Jan 2019	0	0	0	0	0	0	0	0	0	0
Feb 2019	0	0	0	0	0	0	0	0	0	0
Mar 2019	0	0	0	0	0	0	0	0	0	1
Apr 2019	0	0	0	0	0	0	0	0	0	2
May 2019	0	0	0	0	0	0	0	0	0	0
Jun 2019	0	0	0	0	0	0	0	0	0	0
Jul 2019	2	0	2	0	0	0	0	0	0	0
Aug 2019	1	0	0	0	1	0	0	0	0	0
Sep 2019	0	0	0	0	0	0	0	0	0	0
Oct 2019	2	0	0	0	2	0	0	0	0	0
Nov 2019	0	0	0	0	0	0	0	0	0	0
Dec 2019	0	0	0	0	0	0	0	0	0	0
TOTAL	5	0	2	0	3	0	0	0	0	0

Table 3-21 Block 7 Blasts Exceeding 3 mm/s for Reporting Period (2019)

Prod	Blasts >3 mm/s	Result	Dev	Blasts >3 mm/s	Result	TOTAL	Blasts >3 mm/s	Result
5	2	40%	0	0	0%	5	2	40%

Table 3-22 lists the highest recorded results for ground vibration (mm/s) at each of the vibration monitors.

Table 3-22 Ground Vibration Results at Vibration Monitors for the Reporting Period (2019)

Vibration Monitor/Location	Highest Recorded Ground Vibration (mm/s)
V1 Silver Tank (located on CML7)	2.00
V2 Hire yard	8.34
V3 Air Express	5.84
V4 123 Eyre St / Bowls Club	1.99
V5 80 Eyre St	1.51
V6 BHOP Core Shed (located on CML7)	3.53

All blasts recorded off-site were under 10 mm/s.

There were no exceedances of criteria for overpressure levels.

3.14 Operational Noise

During the reporting period, noise was generated by operational activities, movement of heavy vehicles and delivery trucks leaving and entering site.

Noise monitoring is completed annually at noise monitoring locations shown together with the relevant location criteria in **Table 3-23**.

During the reporting period, EMM Consulting Pty Ltd conducted a noise assessment for these receptors, **Figure 3-24**. Attended noise monitoring was conducted during two consecutive night-time periods from 28 to 30 October 2019 to quantify off-site noise levels from the Rasp Mine. While the EPL nominates noise limits for day, evening and night, attended monitoring was completed during the night-time period to minimise the contamination of monitoring data by extraneous noise sources (e.g. domestic and road traffic noise).

A total of 28 operator-attended noise measurements were completed, including two measurements at each of the 14 monitoring locations. For 11 out of the 28 samples (39%), the wind speed was below 3 m/s and therefore the noise limits did apply for these samples according to the site's EPL. Site noise was inaudible during one of two measurements at locations A5, A8, A10 and A11. Noise monitoring results are shown in **Table 3-24**.

Figure 3-24 Noise Receptors

Low frequency noise was assessed by using the Noise Policy for Industry (NPfI) (EPA 2017) methodology for each attended measurement and for audible contributions only. Low frequency noise, as defined in the NPfI, was not identified during the attended measurements.

Rasp Mine LAeq,15min noise contributions (including the addition of the relevant modification factor) satisfied the relevant night-time noise limits at all assessment locations, including during attended measurements when noise limits did not apply due to adverse weather conditions

Noise attenuation measures on site include:

- Plant and equipment operator training. This included correct gear selection to minimize noise emission, retraining in travelling haul road procedure and educating personnel of the noise criteria for site.
- The use of an “ice-creaming” technique when loading the crusher allows the crusher to be loaded to maximum capacity at all times reducing the noise generated by rock fall onto the grizzly. “Ice-creaming” is where the crusher bin volume is maintained at a high level by the ROM front end loader.
- Optimisation of haul truck speed and gear changing via the use of intermediate markers along haulage route.
- Extension of both length and height of the existing earth bund along the southern haul road (from Kintore Pit to ROM pad).
- Installation of noise abatement material in the crusher house.
- A 2.5 m high by 6 m long tyre wall was constructed to reduce noise transition from the filtration area of the processing plant.

Table 3-23 Operational Noise Criteria

Location	Day (dB(A))	Evening (dB(A))	Night (dB(A))
A1 – Piper Street North	38	37	35
A2 – Piper Street Central	38	37	35
A3 – Eyre Street North	44	41	39
A4- Eyre Street Central	44	41	39
A5 – Eyre Street South	44	41	39
A6 – Bonanza and Gypsum Streets	48	41	39
A7 – Carbon Street	35	35	35
A8 – South Road	48	39	39
A9 – Crystal Street	46	39	39
A10 – Barnet and Blende Streets	42	41	35
A11 – Crystal Street	46	39	39
A12 – Crystal Street	46	39	39
A13 – Eyre Street North 2	38	35	35
A14 – Piper Street North	35	35	35

Table 3-24 Noise Monitoring Results

Location	Date	Start	LA_{EQ}	LA_{MAX}	Rasp contribution $LA_{EQ(15\text{-}min)}$	Criteria	Compliant
A12	28/10	**22:00**	**51**	**75**	**36**	**39**	Y
A11	28/10	22:19	**53**	**74**	37	39	Y
A10	28/10	**22:40**	**48**	**71**	**35**	**39**	**Y**
A9	28/10	23:01	**58**	**79**	**34**	39	Y
A8	28/10	**23:20**	**46**	**76**	**31**	**39**	**Y**
A7	28/10	23:40	**44**	**76**	**34**	35	Y
A6	29/10	**0:00**	**55**	**78**	**<27**	**39**	**Y**
A5	29/10	0:21	**52**	**74**	**IA**	39	Y
A4	29/10	**0:40**	**48**	**76**	**27**	**39**	**Y**
A3	29/10	0:58	**41**	**65**	**33**	39	N/A
A2	29/10	**1:18**	**54**	**74**	**27**	**35**	**Y**
A1	29/10	1:38	38	**67**	**30**	35	N/A
A14	29/10	**1:58**	**34**	**56**	**<31**	**35**	**Y**
A13	29/10	2:18	**48**	**74**	**34**	35	N/A
A12	29/10	**22:02**	**55**	**79**	**31**	**39**	**Y**
A11	29/10	22:20	**53**	**69**	**IA**	39	Y
A10	29/10	**22:40**	**44**	**70**	**IA**	**35**	**Y**
A9	29/10	23:00	**57**	**75**	**35**	39	Y
A8	29/10	**23:18**	**36**	**60**	**IA**	**39**	**Y**
A7	29/10	**23:38**	**34**	**53**	**<27**	35	Y
A6	29/10	**23:57**	**50**	**73**	**<26**	**39**	**Y**
A5	30/10	**0:16**	**47**	**72**	**<33**	**39**	**Y**

IA: Inaudible

3.15 Visual, Stray Light

Light towers around machinery, where practicable, are designed to face light away from residents.

There were no light complaints for the reporting period.

3.16 Indigenous Heritage

There are no known significant indigenous sites within CML7.

3.17 Natural and Social Heritage

3.17.1 Conservation management strategy

The Conservation Management Strategy draft has been developed however cannot be finalised until the Line-of-Lode Interagency Panel provides advice.

An Options Analysis Study for mine closure is being developed along with recommendations for rehabilitation methods and trials.

3.18 Spontaneous Combustion

Products with high sulphur content (tailings, ore and concentrate) are prone to spontaneous combustion. Combustion is caused by the oxidation of the sulphides, which is an exothermic chemical reaction that causes heat build-up, and the remaining sulphides begin to start smouldering. In extreme cases, the sulphides may burn producing a flame. Requirements for combustion to occur are high sulphur material, oxygen, moisture and sufficient material to generate heat build-up.

No incidences occurred during the period.

3.19 Bushfire

No bushfires affected the site during the reporting period. Broken Hill and surrounding areas have limited potential for bushfires due to the lack of suitable fuel.

The Rasp Mine has a fully equipped fire truck available at all times to respond to fires and has a trained mines rescue team for firefighting. There are fire hydrants and hoses installed at strategic locations across the mine site and within vehicles with deluge systems installed on loaders and in the underground fuel bay.

3.20 Mine Subsidence

Monitoring occurs on Bonanza St/South Road to detect any movement that may be associated with mining activities in the Zinc Lodes.

Surveying results indicate that most of the detected “movement” is due to instrument set-up errors, atmospherics etc. This is evidenced by the fact that the plot for each prism vector looks very similar to the same vector for the other prisms (i.e. all northing plots look the same, all easting plots look the same) indicating that the errors affect all prisms. Mining in the area of the Zinc Lodes has now been completed with the exception of some minor remnant ore extraction, BHOP will continue to monitor road movement and has back-filled the mining/production voids in this area.

No subsidence from mining activities was detected in the reporting period.

3.21 Methane Drainage/Ventilation

As the nature of the mine is not gassy (e.g. coal mine), there are no permanent methane monitoring locations. However, all personnel carry gas monitors while performing the following underground activities to monitor any hazardous gases:

- All production rigs while drilling;
- All production loaders (Boggers) while bogging;
- All Jumbos;
- Vent Officer while doing vent surveys;
- Re-Entry Crews while performing re-entry; and
- Service crew when required.

3.22 Public Safety

All active mine areas of the Rasp Mine site are signposted and fenced to restrict any unauthorised access.

Visitors to the mine are only allowed on site with management approval and are required to undertake a visitor briefing (induction), and are accompanied by a site representative at all times. Visitor briefing cards are distributed to ensure key information is readily at hand for visitors. Visitors must follow site policies and conform to personal protective equipment (PPE) requirements.

All employees and contractors complete a general induction and work area specific inductions where required (e.g. underground, mill).

3.23 Radiation

BHOP has a Radiation Management Licence, RML5063802 current until 26 July 2020. The Licence permits BHOP to “sell, possess, store or give away regulated material (including radiation apparatus, radioactive substances or items containing radioactive substances)”.

Radiation is used in gauges in the processing plant to measure slurry density and identify the percentage of lead/zinc/iron. Radiation is used by technical services to identify the percentage of lead/zinc or other materials. The Rasp Mine Radiation Management Plan outlines how radiation and radiation equipment must be used, stored and disposed. An external contractor conducts biennial

inspections of the individual radiation gauges on site while the site RSO conducts semi-annual inspections. During the reporting period, no issues were identified during inspections and audits in relation to their use.

The Rasp Mine Radiation Store meets the requirements for storage of fixed radiation gauges, Code of Practice for the Safe Use of Fixed Radiation Gauges, ARPANSA. The Radiation Store is of solid construction (historically in the early 1900's it was used as an explosives magazine store) and is located on the side of a hill so it is not prone to flooding. It is clearly signed and is not accessed by the public.

No radiation apparatus was dismantled during the reporting period.

Table 3-25 lists the regulated materials (fixed radiation gauges) that make up the schedule to the licence.

Table 3-25 Regulated Radiation Equipment

Location	Rasp Mine Asset Number	Type	Equipment	Components	Purpose
Mill - Flotation building	2321727346	Radiation apparatus	X-RF	- Control console / generator - X-ray tube insert	Analysis of materials
Primary cyclone feed	1566643388	Sealed source device	Fixed Radiation Gauge	- Container - Sealed source	Density gauge
Backfill plant-transfer pump discharge	1570661547	Sealed source device	Fixed Radiation Gauge	- Container - Sealed source	Density gauge
Admin Bld, Geological vault	2321727385	Radiation apparatus	X-RF	- Control console / generator	Analysis of materials
Radiation Store 'REMOVED FROM SERVICE'	1570661354	Sealed source device	Fixed Radiation Gauge	- Container - Sealed source	Density gauge

4. WATER MANAGMENT

Raw water and potable water are supplied by Essential Water with take off valves at the Eyre Street entrance to the Rasp Mine. Raw water, water from the town supply, is supplied untreated to the mine site via existing connections.

Potable water is supplied direct from the town supply and is used for drinking, safety showers and in the crib rooms and change houses. Water from the town supply is treated at the Mica Street treatment plant and supplied to the Project via existing connections and is used for showers, toilets, and laundry. Average annual usage of potable water is 9 ML supplying the offices, workshop, core shed and processing facility.

BHOP are required to dewater the mine workings to ensure the safety of both the employees at the adjacent Perilya South Mine and its own employees. This water is extracted under licence and can be used on the Rasp Mine site or transferred for use at the Perilya operations.

Water is reclaimed onsite from various sources to be recycled for the Project, mainly from underground dewatering. If necessary, the reclaimed water is treated onsite to ensure that it is suitable for use as process water in both the processing plant and underground operations. Reclaimed water is returned after treatment to the process water tank which has a three hour holding capacity or to the Silver Tank which has a capacity of 8 ML.

The sources for the reclaimed water include:

- No. 7 Shaft dewatering;

- Underground mine operations dewatering;
- TSF decant pond; and
- Stormwater containment dams (only during extreme rain events)

The Rasp Mine has installed a number of water meters to monitoring water supplies and movements these are listed in **Table 4-1**.

Table 4-1 Flow Meters and Recording Frequency

Flow Meter	Recording Frequency
Underground supply	Weekly
Mill supply	Weekly
Concentrate shed	Weekly
Raw water supply	Weekly
Mine water (U/G water & Shaft 7)	Weekly
Evaporation dam pump well	Weekly
Patto's Pond	Weekly

Raw water used during the period was 316ML, decreased from 353 ML used in the previous period. This was primarily due to the decrease in throughput through the mills, resulting in pumps running less, and less gland water and reagent mixing, when compared to the previous reporting period.

Potable water used during the period was 15.6 ML, increased from 11.7 ML used in the previous period due to an increase in personnel and contractors.

BHOP has a water extraction licence, 85BL256102, to extract by active pumping 370 ML pa.

Table 4-2 provide details for this licence and water pumping. The level of pumping is required to maintain the safety of personnel working underground at both the Rasp Mine and the adjacent Perilya South Mine.

Table 4-2 Water Extraction and Return during the Period (2019)

Location	Total extracted (L)	Storage Location	Total Stored as at 30 June 2018
Shaft 7	202,460,000	**S22**	0
U/G Dewatering	287,08,000	**S22A**	0
Used U/G	310,473,000	**TSF Decant**	0
Used Mill	335,710,000		
Perilya	0		

Note 1: Suspect over estimate due to intermittent pumping which results in the pipe where the meter is installed not always being full, however, both flow meters install in this pipe (mechanical and ultrasonic) continue to record even under low / insufficient flows. The meter readings are used as a guide to indicate pumping flowrate as opposed to volume being pumped from underground.

No water was transferred to Perilya South Mine Operations, during the reporting period.

5. REHABILITATION

5.1 Buildings

No buildings were constructed on CML7 in 2019.

5.2 Rehabilitation and Disturbed Land

Dust deposition gauges were installed on top of Mt Hebbard in October 2017 as part of the waste rock trial to be undertaken in this area in 2018. It was proposed in the MOP to install the gauges to monitor current dust conditions for a 12 month period, then place the waste rock and re-install the gauges for another 12 month period and compare results. AS BHOP are still developing an updated waste rock testing procedure and are unable to crush extracted material (waste rock) on the surface, waste rock has not yet been applied to the surface of Mt Hebbard. As 12 months of dust results had been collected from the Mt Hebbard dust gauges, dust suppressant was applied at the end of 2018 and again in 2019 to control dust as the surface of Mt Hebbard is one of the “free areas” identified on the site to be potential contributors of dust to the surrounding environment.

A rehabilitation strategy has not been finalised although an Options Study for rehabilitation at Rasp Mine was begun in 2018 by Mine Earth. The draft report included a revegetation assessment (with a review of previous revegetation programs) and recommendations for rehabilitation trials. BHOP is considering expanding the Options Study as a project with the Centre for Mined Land Rehabilitation, University of Queensland. Guidance from the Resources Regulator following the Department of Premier & Cabinet Broken Hill Post Mining Interagency Meeting held in Broken Hill on 13 and 14 August 2019 is still forthcoming. During the Interagency meeting there was agreement that paddock dumping of waste rock on free areas may be a suitable method of capping them.

The Waste rock trials planned for Mt Hebbard have been postponed whilst Cone Penetrometer Testing is conducted across tailings dumps on site as part of the Instability and Inrush Risk Assessment. The CPT works and assessment is expected to be completed in the first half of 2020.

Table 5-1 and **Table 5-2** detail disturbed areas. No new areas were disturbed during the reporting period.

Table 5-1 Rehabilitation Summary

	Area Affected / Rehabilitated (hectares)		
	To date 1/1/2018-31/12/2018	**Last Report 1/1/2017-31/12/2017**	**Next Report 1/1/2019 – 31/12/2019**
A: MINE LEASE AREA			
A1 Mine lease(s) Area	226.4	226.4	226.4
B: DISTURBED AREAS			
B1 Infrastructure area (other disturbed areas to be rehabilitated at closure including facilities, roads)	64.5	64.5	64.5
B2 Active Mining Area (excluding items B3 – B5 below)	11.5	11.5	11.5
B3 Waste emplacements, (active / unshaped / in or out-of-pit)	2.27	1.92	2.27
B4 Tailings emplacements (active / unshaped / uncapped)	3.8	3.8	3.8
B5 Shaped waste emplacement (awaits final vegetation)	0.0	0.0	0.0
ALL DISTURBED AREAS	77.2	77.2	77.2
C REHABILITATION			
C1 Total Rehabilitated area (except for maintenance)	149.1	149.1	149.1
D REHABILITATION ON SLOPES			
D1 10 to 18 degrees	4.1	4.1	4.1
D2 Greater than 18 degrees	14.7	14.7	14.7
E SURFACE OF REHABILITATED LAND			
E1 Pasture and grasses	N/A	N/A	N/A
E2 Native forest / ecosystems			
E3 Plantations and crops	2.6	2.6	2.6
E4 Other (include non-vegetative outcomes)	151.3	151.3	151.3

Table 5-2 Maintenance Activities on Rehabilitated Land

	Area Treated (ha)		
NATURE OF TREATMENT	**Report Period**	**Next Period**	**Comment / control strategies / treatment detail**
Additional erosion control works (drains re-contouring, rock protection)	0	0	N/A
Re-covering (detail further topsoil, subsoil, sealing etc.)	0	0	N/A
Soil treatment (detail – fertiliser, lime, gypsum etc.)	0	0	N/A
Treatment / Management (detail – grazing, cropping, slashing etc.)	0	0	N/A
Re-seeding / Replanting (detail – species density, season etc.)	0	0	N/A
Adversely Affected by Weeds (detail – type and treatment)	0	0	N/A
Feral animal control (detail – additional fencing, trapping, baiting etc.)	0	0	N/A

6. COMMUNITY RELATIONS

6.1 Environmental Complaints

During the period of the AEMR, BHOP has maintained a register for community complaints and concerns which is available on the CBH website.

A total of 24 complaints were received over the reporting period; 22 relating to blasting vibration and two for dust emissions. **Table 6-1**. All complainants if requested and if details were provided.

One dust complaint was made to the BHCC about site activities continuing during a dust storm. No specific activities were identified by the complainant. Although there were high winds on the day, the highest average wind speed measured at the site weather station was 43.6 km/hr. At 50 km/hr BHOP is required to cease all dust generating activities in accordance with the site Air Quality Management Plan. When winds are under 50 km/hr, BHOP monitors its activities and utilises multiple water carts to control dust generation.

On another occasion a complainant contacted the site directly to complain of dust generating activities. Works were halted and the work area was sprayed with water from the project water cart.

The majority of complaints were made due to blast vibration. Where requested, a blast monitor was placed at the complainant's location for at least two months. Two months is considered the minimum amount of time for a suitable K Factor to be developed for the location to be used in calculating vibration impacts at the location from future blasts. Results in the form of a letter and a visit by BHOP staff are provided to the complainants after the blast monitor is collected from the complainants' location.

In January, there were two blasts that elicited a number of complaints, and some complaints over the period were from the same complainant.

Table 6-1 Complaints register

Date	Complaint Type	Information
6 January 2019 Event # 4438	Vibration	A complainant contacted BHOP regarding blast vibration from the blast of 6 January and potential damage to the property. The residence was inspected by BHOP staff on 7 January. A blast monitor has been installed at the residence.
6 January 2019 Event # 4439	Vibration	A complainant contacted BHOP regarding blast vibration from the blast of 6 January and potential damage to the property. The residence was inspected by BHOP staff on 7 January. A blast monitor has been installed at the residence.
6 January 2019 Event # 4440	Vibration	A complainant contacted BHOP regarding blast vibration from the blast of 6 January and potential damage to the property. The residence was inspected by BHOP staff on 17 January as the complainant was out of the town. A blast monitor has been installed at the residence.
6 January 2019 Event # 4441	Vibration	A complainant contacted BHOP about blast vibration from the blast of 6 January and potential damage to the property. Blast reports were provided to the EPA upon request. The residence was inspected by BHOP staff on 7 January.
8 January 2019 Event # 4443	Vibration	A complainant contacted BHOP about blast vibration from a blast on 8 January. The complainant had made a complaint to BHOP previously. The complainant was contacted regarding the complaint. An inspection of the residence for alleged damage from blast vibration had been conducted previously. A monitor has been installed at the residence.
9 January 2019 Event # 4378	Vibration	A complainant contacted the EPA about blast vibration from a blast on 8 January. Blast reports were provided to the EPA upon request. The complainant was contacted regarding the complaint. A blast monitor was already installed at the complainant's residence. An additional house inspection has been conducted and the blast

Date	Complaint Type	Information
		results discussed with the complainant.
9 January 2019 Event # 4491	Vibration	A complainant contacted the EPA about blast vibration from a blast on 8 January. The complainant asked that BHOP contact them to discuss the issue. Blast reports were provided to the EPA upon request. The complainant was contacted regarding the complaint. No blast monitor installation or inspection of the premises was requested.
3 February 2019 Event # 4475	Vibration	A complainant contacted BHOP about blast vibration from a blast on 3 February. The complainant had made a complaint to BHOP previously. A blast monitor was installed at the residence and inspected by an independent blast vibration expert.
13 March 2019 Event # 4573	Vibration	A complainant contacted BHOP about blast vibration from a blast on 13 March. The complainant had made a complaint to BHOP previously. A blast monitor was installed at the residence and has since been removed.
14 March 2019 Event # 4590	Smoke from site	A complainant contacted BHOP about alleged damage to property due to previous blasting. A structural inspection of the property will be conducted. A blast monitor has been installed at the property.
20 March 2019 Event # 4589	Vibration	A complainant contacted BHOP about alleged damage to property due to previous blasting. A structural inspection of the property will be conducted.
7 May 2019 Event #4748	Vibration	A complainant contacted BHOP about blast vibration from 7 May. The Complainant had made a complaint to BHOP previously. A blast monitor was installed at the residence and has since been removed.
12 May 2019 Event #4751	Vibration	A complainant contacted BHOP about blast vibration from 12 May. The Complainant had made a complaint to BHOP previously. A blast monitor was installed at the residence and has since been removed.
16 May 2019	Vibration	A complainant contacted the EPA about blast vibrations.

Date	Complaint Type	Information
Event #4771		Blast data has been provided to the EPA. A blast monitor was installed at the residence and inspected by an independent blast vibration expert. An inspection of the residence was conducted. A structural inspection of the property will be conducted.
23 May 2019 Event #4792	Vibration	A complainant contacted BHOP about blast vibration from23 May. The Complainant had made a complaint to BHOP previously. A blast monitor was installed at the residence and has since been removed. An independent blast vibration expert conducted a follow-up inspection of the residence with BHOP staff and the complainant.
6 June 2019 Event #4842	Vibration	A complainant contacted BHOP about blast vibration from6 June. The Complainant had made a complaint to BHOP previously. A blast monitor was installed at the residence and has since been removed.
9 June 2019 Event #4868	Vibration	A complainant contacted the EPA about blast vibrations. Blast data has been provided to the EPA. Contact details were not provided.
25 June 2019 Event #4899	Vibration	A complainant contacted the EPA about blast vibrations. Blast data has been provided to the EPA. An inspection of the residence was conducted. A blast monitor has been installed at the property.
31 July 2019 Event #5024	Vibration	A complainant contacted the EPA about blast vibrations. Blast data has been provided to the EPA. An inspection of the residence was conducted. A blast monitor will be installed at the property.
15 August 2019 Event #5074	Vibration	A complainant contacted BHOP about blast vibration from 14 August BHOP staff visited the complainant A blast monitor will be installed at residence when available

Date	Complaint Type	Information
19 August 2019 Event #5167	Vibration	A complainant contacted the EPA about blast vibrations from 12/14 August Blast data has been provided to EPA
18 September 2019 Event #5179	Dust	A complainant contacted the BHCC about activities continuing on site during high winds on 6 September. No specific activities were identified by the complainant. Although there were high winds on the day, the highest average wind speed measured at the site weather station was 43.6 km/hr. At 50 km/hr BHOP is required to cease all dust generating activities in accordance with the site Air Quality Management Plan. When winds are under 50 km/hr, BHOP monitors its activities and utilises multiple water carts to control dust generation.
19 September 2019 Event #5198	Dust	A complainant contacted the BHCC about dust generated by site activities. Works were halted for the day and the site sprayed with water.
16 November 2019 Event# 5328	Vibration	A complainant contacted the EPA about blast vibrations. Blast data has been provided to the EPA. An inspection of the residence was conducted. A blast monitor will be installed at the property.

All blasts were found to be compliant with the applicable licence limits. The finalised data was distributed to the EPA and the affected resident.

6.2 Community Liaison

During the period of the AEMR, BHOP has conducted direct and indirect consultation with neighbours, members of the public, local community organisations, state government agencies and local council.

The major stakeholders include:

- Broken Hill City Council (BHCC)
- Department of Industry Resource (DIR)
- Environment Protection Authority (EPA)
- Department of Planning and Environment (DPE)
- Department of Industry- Lands (DI-L)
- Essential Energy
- Essential Water
- Australian Rail Track Corporation Ltd (ARTC)
- Roads and Traffic Authority (RTA)
- Broken Hill Health Service, Child and Family Health Centre

The following community communication activities occurred during the period:

- BHOP was represented at all meetings of the BHCC Lead Reference Group.
- Child and Family Health Centre Lead Week – BHOP participated in the 2019 Lead week program and provided water, fruit, a fruit or vegetable seedling, and bags for these items and information pamphlets provided by the Leadsmart group.

6.3 Community Support

During the reporting period, Rasp provided the following financial support to community groups:

- $1,000 St Pat's Sponsorship
- $1,000 BHCC Heritage Sponsorship
- $9,000 BH Foundation (previous commitment)
- $1,000 RFDS
- $1,265 Cancer Council Broken Hill
- $500 BHCC Xmas Pageant Sponsorship
- $3,000 Various Broken Hill Schools for presentation nights (etc.)
- $250 BH Swimming Carnival Sponsorship
- $500 BH Scouts Donation
- $500 BH Girl Guides Donation
- $2,000 BH Football – Miners Cup Sponsorship
- $957 BH Football – Auskick

Moving forward BHOP will focus on supporting local education and major events that support the promotion of the Broken Hill Community.

7. INDEPENDENT AUDIT

An independent audit was conducted by Integrated Environmental Systems Pty Ltd in the week of 9 to 15 March 2019. The audit was commissioned by BHOP to satisfy Schedule 4, Conditions 7 and 8 of the Project Approval, requiring an audit to be conducted every three years.

The audit was conducted tom determine how BHOP was maintaining compliance against applicable conditions specified in:

- Project Approval 07_0018 MOD 5 approved under the former Part 3A of the Environmental Planning and Assessment Act 1979 (which continues as an approval of a transitional Part 3A project under Schedule 6A of that Act) by the delegate of the NSW Minister of Planning ('Project Approval' or 'PA');
- Environment Protection Licence Number 12559 as at 21 December 2017 ('EPL'); and
- Consolidated Mining Lease Number 7 as renewed on 17 January 2007 ('CML7').

BHOP's level of compliance with the applicable conditions (i.e. all conditions except those which were 'not triggered') in each instrument was as follows:

- BHOP was compliant with 48 of the 67 applicable Project Approval conditions;
- BHOP was compliant with 52 of the 75 applicable EPL conditions;
- BHOP was compliant with 24 of the 28 applicable CML7 conditions.

The non-compliance against the Conditions of CML7 are as follows:

- **Notice to Landholders – Condition 1 – Administrative non-compliance** – At the time of this February 2019 audit, BHOP was unable to provide evidence of written notification to landholders of the leased land or of a published notice in a newspaper circulating in the lease area.
  It was determined by BHOP that the notification was not provided.
- **Mining, Rehabilitation, Environmental Management Process (MREMP) – Mining Operations Plan – Condition 2 – Administrative non-compliance** – In relation to paragraphs (a) and (b) of this condition:
  (a) BHOP was unable to provide evidence of the Resources Regulator's approval of the current MOP; and
  (b) The current MOP does not identify how the mine will be managed to allow mine closure due to an apparent lack of agreement for end land use, which has continued to the time of this February 2019 audit.
  A notice of assessment of 30 January 2018 acknowledges receipt of the RCE and, therefore, acceptance of the MOP. An observation to indicate on the cover of the MOP the approval status as pending or approved will be employed going forward.
- **Reports – Condition 7 – Non-compliant (low risk)** – At the time of this February 2019 audit, BHOP was unable to provide evidence of exploration reports being prepared and provided to the DPE (Division of Resources & Geoscience) within the required 28-day period.
  Reports were subsequently provided to Resources and Geosciences.
- **Exploratory drilling – Condition 15 – Non-compliant (low risk)** – At the time of this February 2019 audit, BHOP was unable to provide evidence of having given the minimum 28 days' notification of exploratory drilling to the DPE (Division of Resources & Geoscience).
  Going forward, BHOP will provide a minimum of 28 days notification of explanatory drilling to Resources and Geoscience.

8. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

Environmental incidents are reported using the Rasp Incident Reporting Procedure BHO-SAF-PRO-101. A summary of the incidents for the reporting period are presented in

. BHOP maintains a Pollution Incident Response Management Plan BHO-ENV-PLN-002 on the CBH website in accordance with EPA requirements.

There were two reportable incidents/non-compliances during the reporting period.

Asbestos material on Block 5

On 9 July 2019, BHOP notified regulators and stakeholders that fibre sheeting suspected of containing asbestos was found on Block 5, adjacent to the Bocce Club on Bonanza Street. BHOP staff took samples of sheeting and lagging from the Shaft 5 area and sent them to HSE Australia in Adelaide for a fibre ID. The sheeting has come back positive for chrysotile, amosite, and crocidolite. There were no asbestos fibres detected in the lagging. The majority of the material was around the footings of buildings associated with the shaft and some pieces had been carried down to the surrounding area. Temporary fencing with “Danger – Mine Site” signage has been installed around the area and a local asbestos disposal contractor with a Grade 2 licence was engaged to collect the asbestos sheeting across the site on 18 September 2019. When a Clearance Certificate was supplied, BHOP erected a fence with Mine Site signage around Block 5.

Incorrectly sourced material for Embankment 2

On 30 September 2019, BHOP informed regulators that material had been sources and utilised in the construction of Embankment 2 from an area other than that stated in the environmental assessment reports for Project Approval 07_0018 Mod4 and that the Lead content of the material was found to be higher than 0.5%. The material was removed from a waste dump northeast of TSF2 which was a continuation of the smaller waste dump approved for removal and incorporation into Embankment 2 at the north-east edge of TSF2. The exposed portion of the waste dump was treated with dust suppressant after extraction was halted.

Contributing factors for using the waste dump material include:

- The material had the same engineering properties of the smaller waste dump approved for removal.
- There was an opportunity to mitigate safety risks due to vehicle interactions due to its proximity to the Embankment.
- Anticipated reductions in dust and noise generation from reduced trucking distances.
- Waste dump material would be wet when handled.

Corrective actions included:

- BHOP initiated an air emissions assessment for the works to determine the impact with results to be received in March 2020.
- The material testing regime was updated to include a factor of safety for Lead and independent lab analysis of samples for each 4x4 area sampled.
- Project Management structure was clarified.
- Management signoff was required for placement of material.
- An audit of the Construction Environmental Management Plan was conducted.

Failure to monitor a blast at V2 Hire Yard

On the afternoon of the 19 April 2019 the Technical Services team at Rasp checked on the status of compliance blast monitors. This is a requirement prior to conducting any production blast. It was identified that the V2 Hire Yard Monitor had not ‘called in’ since the evening of 17 April. This would suggest the V2 Hire Yard compliance monitor had not restarted following the automated upload of blasting data on the evening of 17 April. When a compliance monitor calls home at a scheduled time,

the monitoring is stopped and an instruction is issued by the server to restart once the upload of data is complete and the memory in the monitor cleared. It is rare that the monitor will not restart, but when it does it must be restarted manually as there is no real-time remote communication with the monitor.

As it was a long weekend and the monitor is situated in a business premises, a spare monitor had to be installed nearby. The spare monitor was installed by the Technical Services Superintendent, the monitor's test function was successfully completed and the Start button to commence monitoring was pushed. After the blast the screen was observed to be blank which suggested the recording function may not have been initiated.

An upload of data to the server confirmed there was no data recorded at the time of the blast. The blast was not a large on as only two of the other five monitors were triggered on that occasion.

To prevent a recurrence, additional staff have been trained in the operation of blast monitors, the procedure for operating a blast monitor in the field has been updated, and relocation of some monitors to enable access at all times by BHOP staff has been investigated.

Incidents

Thirty internal environmental incidents (not including complaints or non-compliances) were reported during the reporting period. Twelve incidents were related to blast vibration levels in blast monitors and nine for Mill incidents such as spillages.

The Pollution Incident Response Management Plan was tested in June 2019, in accordance with the requirements of EPL 12559.

9. ACTIVITIES PROPOSED IN THE NEXT AEMR PERIOD

The following lists the proposed activities during the next AEMR period in line with the MOP some of these activities continue into the next reporting period:

- Engage with stakeholders regarding the draft Conservation MP content as well as the concept for post-mining land uses following outcomes from the inter-governmental consultation and review. This will form part of the Rehabilitation Strategy to be developed and submitted to DRG. This is dependent on receiving advice from DRG following the inter-government discussions.
- Develop in consultation with stakeholders the Rehabilitation Management Plan to be completed within 6 months of the approval of the Rehabilitation Strategy. This is dependent on receiving advice from DRG following the inter-government discussions.
- Continue an options analysis into various dust management approaches.
- Inspect all heritage structures and install identification signage on those items where signage is deficient or lacking, continued from 2018.
- Undertake further sampling of surface materials to confirm lead levels which will assist in prioritising placement of waste rock/capping material and prioritise rehabilitation activities.
- Waste-rock capping of Mt Hebbard.
- Undertake on-going maintenance and inspections of heritage buildings as required.
- Continue application of chemical dust suppressant to 'free areas' of the site to minimise dust generation, including the trialling of an alternative product for unsealed roads.
- Eyre Street dam project, remove contaminated bunding and materials from the dam and cap the area with suitable waste rock or revegetate the area or a mixture of the two. Sampling of rain runoff will be taken to assess if water quality has improved.
- Ryan Street dam project – BHOP has engaged consultants to determine and advise on appropriate closure strategies for this area. Water sampling of rain runoff will also be undertaken for rainfall events to confirm level of rainwater contamination.
- Weed control.
- Sediment removal in water storages.