Amendment Report

Application for Licence Amendment

Part V Division 3 of the *Environmental Protection Act 1986*

Licence Number	L4611/1987/11
Licence Holder	Agnew Gold Mining Company Pty Ltd
ACN	098 385 883
File Number	2012/006836-1
Premises	Agnew Gold Mine LEINSTER WA 6437 Legal description – Mining tenements M36/27, M36/32, M36/53, M36/55, M36/65, M36/150, M36/174, M36/248, M36/314 and 36/450 As defined by the Premises maps attached to the Revised Licence
Date of Report	17 October 2023
Decision	Revised licence granted

Christine Pustkuchen
Digitally signed by Christine Pustkuchen
Date: 2023.10.17 13:50:57 +08'00'

A/MANAGER, RESOURCE INDUSTRIES
REGULATORY SERVICES
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Table of Contents

1. Decision summary

Licence L4611/1987/11 is held by Agnew Gold Mining Company Pty Ltd (Licence Holder) for the Agnew Gold Mine (the Premises), located on mining tenements M36/27, M36/32, M36/53, M36/55, M36/65, M36/150, M36/174, M36/248, M36/314 and M36/450, at Leinster, Western Australia.

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the construction and operation of the Premises. As a result of this assessment, Revised Licence L4611/1987/11 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this Amendment Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.2 Application summary

On 30 January 2023, the Licence Holder submitted an application to the department to amend licence L4611/1987/11 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought:

Category 5

- Increase authorised throughput for Category 5 activity from 1,400,000 tonnes per annual period (tpa) to 1,500,000 tpa, through operation of recently installed tertiary crusher and upgraded tailings pipeline;
- Increase the authorised operating height of the Songvang in-pit tailings storage facility (TSF) 4 from RL 404.0 m to RL 422.0 m;

Category 6

- Increase authorised throughput for mine dewatering discharge from 2,000,000 tpa to 3,500,000 tpa (removed from scope, see text below);
- Authorise discharge of mine dewater from the Barren Lands open pit to the Crusader Complex (comprising three open pits: Cox Pit, Deliverer Pit and Pilgrim Pit) (removed from scope, see text below);
- Construction and operation of a dewatering pipeline from the Barren Lands open pit to the Barren Lands turkeys nest to the Crusader Complex (partially removed from scope, see text below);

Category 52

- Authorise Category 52 activity on the licence through the operation of the Agnew Power Station expansion (removed from scope, see comment below); and

Category 85

- Construct and operate an additional wastewater treatment plant (WWTP) to replace the existing Waroonga Biomax WWTP.

At the time of the submission of this application to amend licence L4611/1987/11, the department was also assessing an application for a new works approval (W6757/2022/1) for the

construction of the Agnew Power Station expansion. As the relevant infrastructure has yet to be constructed, the addition of Category 52 prescribed activity was not considered as part of this licence amendment.

On 13 July 2023, the Licence Holer notified the department that, following an update to the mine water strategy (AECOM 2023), an increase in mine dewatering discharge throughput was no longer required. Furthermore, the transfer of mine dewater from the Barren Lands open pit and discharge at the Crusader Complex will also no longer be required due to less dewatering required than was initially anticipated. As such, the proposed amendments to the authorised Category 6 activities were removed from the scope of this amendment application.

This amendment is limited only to changes to Category 5, 6 and 85 activities from the existing licence. No changes to the aspects of the existing licence relating to Category 89 have been requested by the Licence Holder.

Table 1 below outlines the proposed changes to the existing licence.

Table 1: Proposed throughput capacity changes

Category	Current throughput capacity	Proposed throughput capacity	Description of proposed amendment
5: Processing or beneficiation of metallic or non-metallic ore	1,400,000 tpa	1,500,000 tpa	Operation of tertiary crusher and upgraded tailings pipeline. Increase authorised operating height of Songvang in-pit TSF to RL 422.0 m.
6: Mine dewatering	2,000,000 tpa	No change	Storage of mine dewater at the Barren Lands turkeys nest.
85: Sewage facility	80 m^3/day	No change	Replace current Waroonga Biomax WWTP with a Tristar Sequential Batch Reactor WWTP modular system.

2.2.1 Category 5 activities

The premises consists of two active underground mines, the EMU processing plant, two operational TSFs and a paste fill plant.

The Licence Holder proposed to increase the design capacity of the EMU processing plant (located at the Waroonga site on mining tenement M36/53) by 100,000 tpa. This expansion will be achieved through operation of an upgraded crushing circuit and an upgraded tailings pipeline. These improvements would enable a reduction in downtime and the ability to process more ore. Overall, the proposed amendments would fall into Stage 2 of the three-part mine expansion that is being planned by the Licence Holder (Table 2).

Table 2: EMU processing plant staged expansion

Stages	Processing capacity (mtpa)	Tailings pipeline requirements
Pre-expansion	1.25	No changes to tailings system required.
Stage 1 expansion	1.35	Larger tailings hopper required.

Stages	Processing capacity (mtpa)	Tailings pipeline requirements
Stage 2 expansion[1]	1.50	Tailings pump and pipeline upgrade required.
Stage 3 expansion	1.70	No changes to tailings system required.

Note 1: The scope of this amendment relates to the Stage 2 expansion, which includes increasing the processing capacity to 1.5 mtpa of ore beneficiated.

The construction and operation of new crushing circuit was authorised under L4611/1986/11 on 5 July 2021. The current setup comprises of a three-stage crushing, where a double deck vibrating screen is utilised after primary crushing to determine whether secondary or tertiary crushing is required, based on crushed ore size. Crushed ore will either be store to a fine ore bin feed or a fine ore stockpile, depending on operational needs. No changes to the downstream carbon-in-leach circuit were proposed.

The department has assessed and found that the infrastructure constructed was compliant with the construction requirements of the licence on 1 September 2022.

The upgraded tailings pipeline was constructed under works approval W6690/2022/1 on 12 September 2022. The department has assessed and found that the infrastructure was constructed in accordance with the requirements of the works approval on 18 April 2023. Environmental commissioning on the upgraded tailings pipeline was undertaken in January 2023.

The upgraded tailings pipeline replaced the previous tailings delivery pipeline installed in 2017. The upgrade was undertaken to meet future tailings disposal demands in terms of volume and pumping capabilities, as well as reduce the risk of environmental incidents and decrease pipeline pressure issues. The upgraded pipeline is approximately 10.6 km in length, transporting tailings slurry from the EMU processing plant to the Redeemer TSF3 and Songvang TSF4.

The primary upgrades included a larger bore, higher specification high density polyethylene (HDPE) and limited steel pipes. The pipeline was constructed within the existing bund for the previous pipeline, which have been shown to have adequate capacity to contain leaks and pipeline ruptures (Mintrex 2023).

In the assessment of works approval W6690/2022/1, the Delegated Officer considered the risks associated with the pipeline operation to be adequately managed under the existing conditions in licence L4611/1987/11 and the controls proposed during the construction of the pipeline. As such, the upgraded tailings pipeline was able to operate under the licence without an amendment at the existing throughput. As part of this assessment, a risk assessment will be undertaken on potential emissions from the upgraded pipeline as a result of increasing the tonnage of tailings slurry being pumped.

In addition, the Licence Holder also proposed to increase the authorised operating height at the Songvang TSF4 from RL 404.0 m to final designed height of RL 422.0 m. Currently, there is approximately 2,101,800 m^3 of tailings storage capacity remaining until the current operating height is reached (i.e., RL 404.0 m). Based on the current life of mine expectancy, approximately 5,361,400 m^3 of tailings will be generated by 2029, resulting in a need for additional tailings storage. The proposed operating height of RL 422.0 m (i.e., an increase of 18 m) will provide an additional 3,290,300 m^3 of storage, slightly higher than the capacity required.

The lowest point of the pit crest was estimated to be approximately 442.2 m. By authorising operating height of the in-pit TSF to RL 422.0m, there will be a freeboard of approximately 20.2 m remaining. This is sufficient capacity to contain a 1:100 Annual Exceedance Probability (AEP) 72-hour storm event, with at least 0.5 m of additional freeboard throughout all stages of operation.

As per current operations, tailings will be transported from the EMU processing plant to the Songvang TSF4 (or Redeemer TSF3 when deposition at Songvang TSF4 is not available), during through a tailings distribution pipework installed along the western perimeter of the TSF. Tailings will be deposited into the in-pit TSF through spigots. Currently, tailings deposition is from the northern end of the pit from a single-point discharge. In future, tailings discharge will be required from multiple spigots along the western side of the pit to ensure even build-up of the tailings beach and better position the supernatant pond (CMW 2022). No other changes to the operation of the TSF or additional ancillary infrastructure was proposed.

Stability analysis was undertaken to assess the potential critical failure modes of the existing Songvang TSF4 (CMW 2022). The stability of the in-pit TSF walls are expected to increase as the pit is filled with tailings (Golder 2018). The physical and geochemical characteristics of the tailings being discharged is not expected to change (CMW 2022).

2.2.2 Category 6 activities

In November 2021, the Licence Holder commenced operations at the Barren Lands open pit. The mining of the pit will require dewatering, which was proposed to be stored at the Barren Lands turkeys nest (Figure 1). The mine dewater at the turkeys nest will primarily be used for dust suppression and to support operational services for the Barren Lands underground development (Figure 2).

The turkeys nest has been constructed to the following specifications:

- Contains a total storage capacity of 3,964 m^3;
- Contains a storage capacity with the one metre freeboard is 2,791 m^3.
- Constructed to be aboveground, comprising of 3 m embankments, to prevent capture of surface water runoff;
- Lined with 2mm-thick high-density polyethylene (HDPE); and
- Maintaining a freeboard of one metre to prevent overtopping.

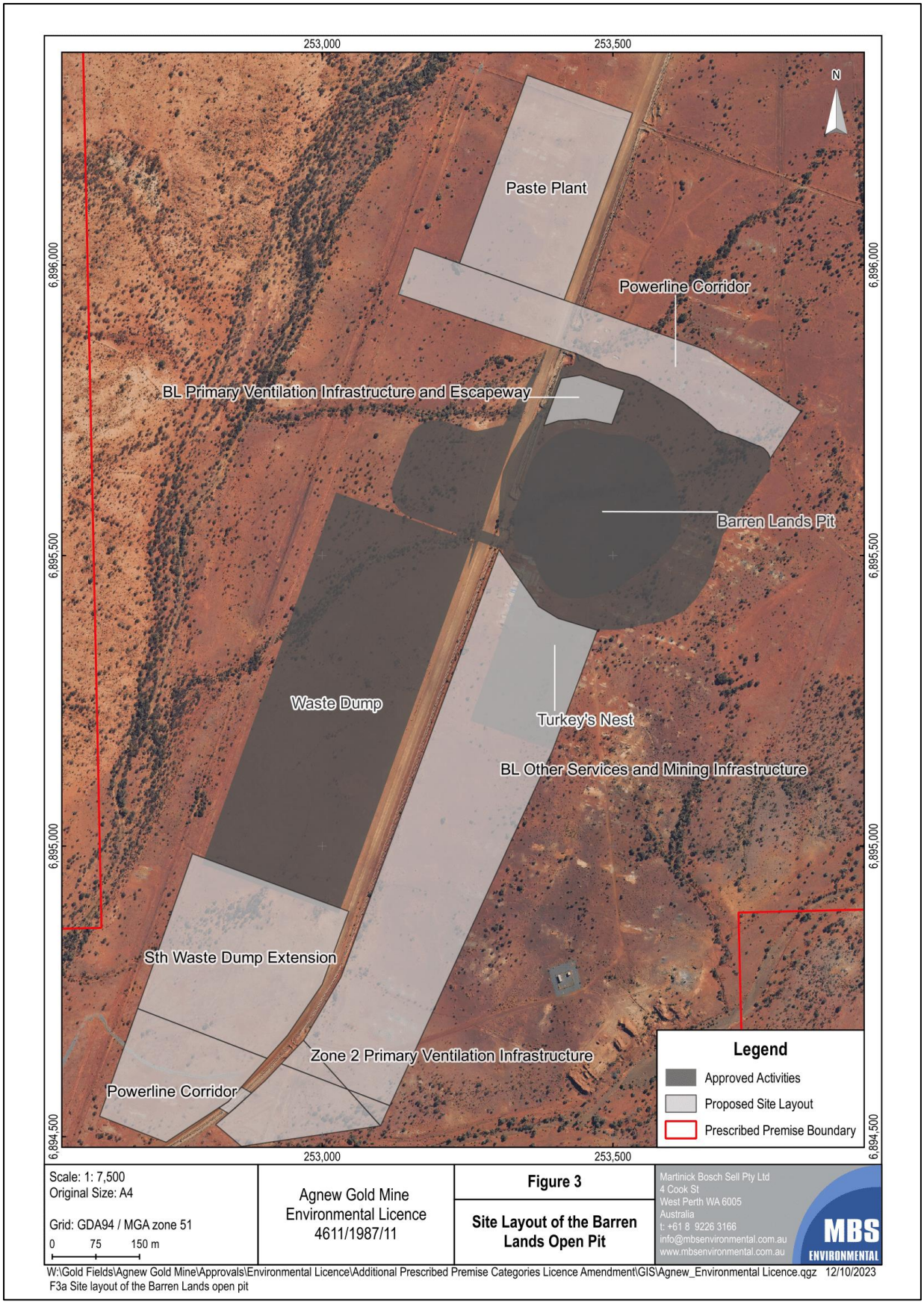


Figure 1: Site layout of the Barren Lands open pit and dewatering infrastructure

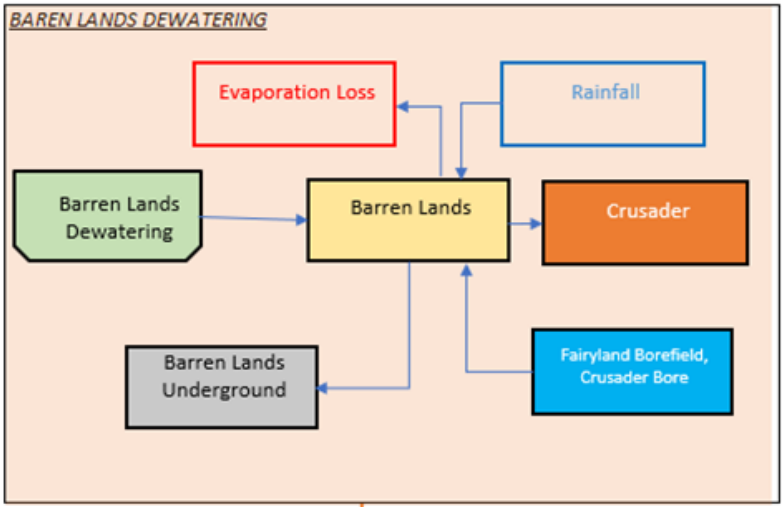


Figure 2: Conceptual water balance for the Barren Lands turkeys nest

2.2.3 Category 85 activities

In 2021, the Licence Holder installed additional anaerobic wastewater treatment tanks for the Biomax wastewater treatment plant (WWTP) at the Waroonga site of the premises (Figure 4) to increase treatment plant capacity to 80 m^3/day. The construction works were authorised under works approval W6752/2021/1 and subsequently operated under the licence L4611/1987/11 in 2022. Treated wastewater was being discharged to a 4 hectares (ha) sprayfield adjacent to and partly overlying a waste rock dump. Department of Health (DoH) approval no. 221.20 was granted for the Biomax WWTP in 2021.

Currently, the Biomax WWTP is not operating as anticipated and appeared to be under-designed for operational requirements at the premises. The Licence Holder proposed to replace the Biomax WWTP with a Tristar Sequential Batch Reactor (SBR) WWTP modular system. The Tristar WWTP is designed as a “plug-and-play” system, comprising of a 12 m containerised system constructed of 6 mm steel, and will have external tanks for balance and sludge storage (Figure 3). The proposed SBR system comprises of: (1) a 50 m^3 balance (equilisation) tank, (2) an 80 m^3 reactor (aeration) tank where processed wastewater is treated, (3) a 50 m^3 poly sludge storage tank where sludge is dewatered, and (4) a 50 m^3 irrigation tank to store the treated effluent ready for discharge. Wastewater will be treated in a five-stage process: (1) Filling of the reaction basin, (2) Reactor phase (i.e., combination of anoxic and aerobic phases to achieve high biochemical oxygen demand [BOD] and nitrogen removal), (3) Settling phase, (4) Decant phase, and (5) Idle phase.

The Tristar WWTP will be designed and built to meet relevant Australian standards and operated in accordance with the Tristar Operation and Maintenance Manual, including regular inspections and monthly services completed by the supplier.

The replacement Tristar WWTP will be located adjacent to the existing Biomax WWTP (Figure 4), which will be decommissioned once the Tristar WWTP is operational. The same sprayfield will be utilised for the discharge of treated wastewater.

Sludge produced by the Tristar WWTP undergo dewatering in the poly sludge storage tank, dosed with polymer to assist coagulation before being transferred to an inline screw filter press, which entraps the sludge and drains the excess supernatant water. The collected supernatant is pumped to the start of the WWTP for processing. The final product is a compressed sludge (i.e., sludge cake) which goes through the incline auger and be disposed directly to a skip bin or bulk bag. The sludge cake will be disposed as a ‘biosolid other than those categorised for unrestricted use’ at the Class II putrescible waste landfill at the premises. The sludge cake needs to meet the acceptance criteria for acceptance at a Class II landfill, as detailed in the

Landfill Waste Classification and Waste Definitions 1996 (as amended 2019) (DWER 2019).

Although overall design specifications will vary, the design capacity of the replacement WWTP will remain below 80 m^3/day. Effluent quality and quantity are not expected to differ significantly from the Biomax WWTP, with higher total nitrogen and BOD (Table 3). Changes in total nitrogen and phosphorus in treated wastewater will result in a maximum nutrient loading of approximately 219.0 kg/ha/year and 58.4 kg/ha/year, respectively (assuming discharge rate is 80 m^3/day). As such, the Licence Holder is likely able to comply with existing loading limits on the licence for the four-hectare sprayfield, which is based on the DoW (2006) *Water Quality Protection Notice 22: Irrigation with nutrient-rich wastewater* (Risk Category D). The Licence Holder has also requested the flexibility to increase the irrigation sprayfield footprint if the volume of treated wastewater discharged needs to be increased, in order to comply with *Water Quality Protection Notice 22* (DoW 2006).

Table 3: Tristar and Biomax wastewater treatment plant effluent performance standards

Parameter	Influent quality	Effluent quality	
		Biomax WWTP	Tristar WWTP
Biochemical oxygen demand (BOD)	350 mg/L	<30 mg/L	<20 mg/L
Total suspended solids (TSS)	350 mg/L	<30 mg/L	<30 mg/L
Total nitrogen (TN)	60 mg/L	<20 mg/L	<30 mg/L
Total phosphorus (TP)	14 mg/L	<12 mg/L	<8 mg/L
Escherichia coli (E. coli)	-	<1,000 cfu/100 mL	<1,000 cfu/100 mL
pH	6.5 to 8.5 pH units	6.5 to 8.5 pH units	6.5 to 8.5 pH units
Residual chlorine	-	0.2 to 2.0 mg/L	0.5 to 2.0 mg/L

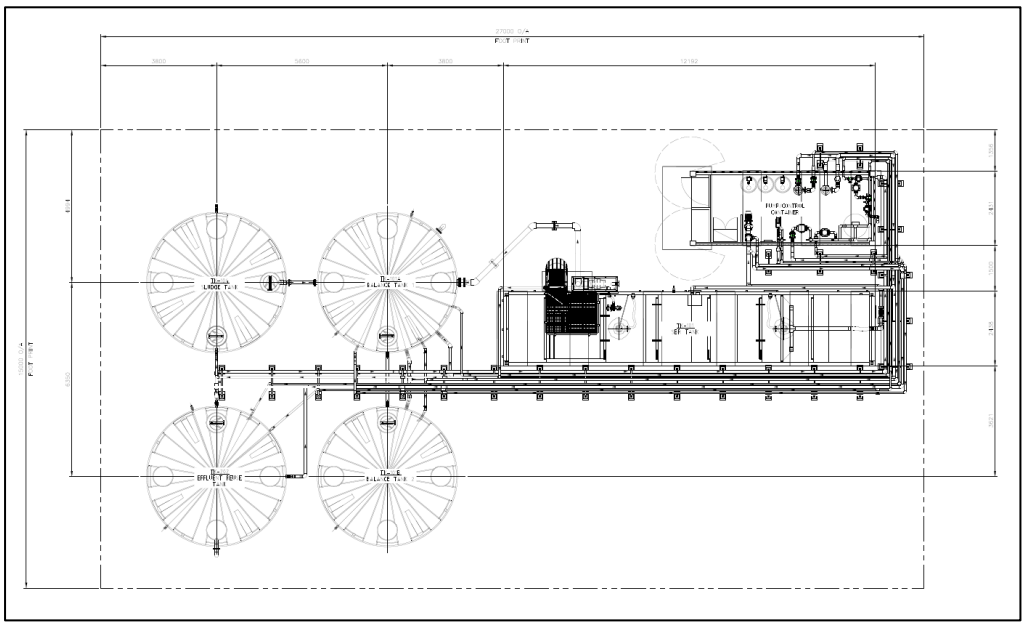


Figure 3: Indicative layout of Tristar wastewater treatment plant

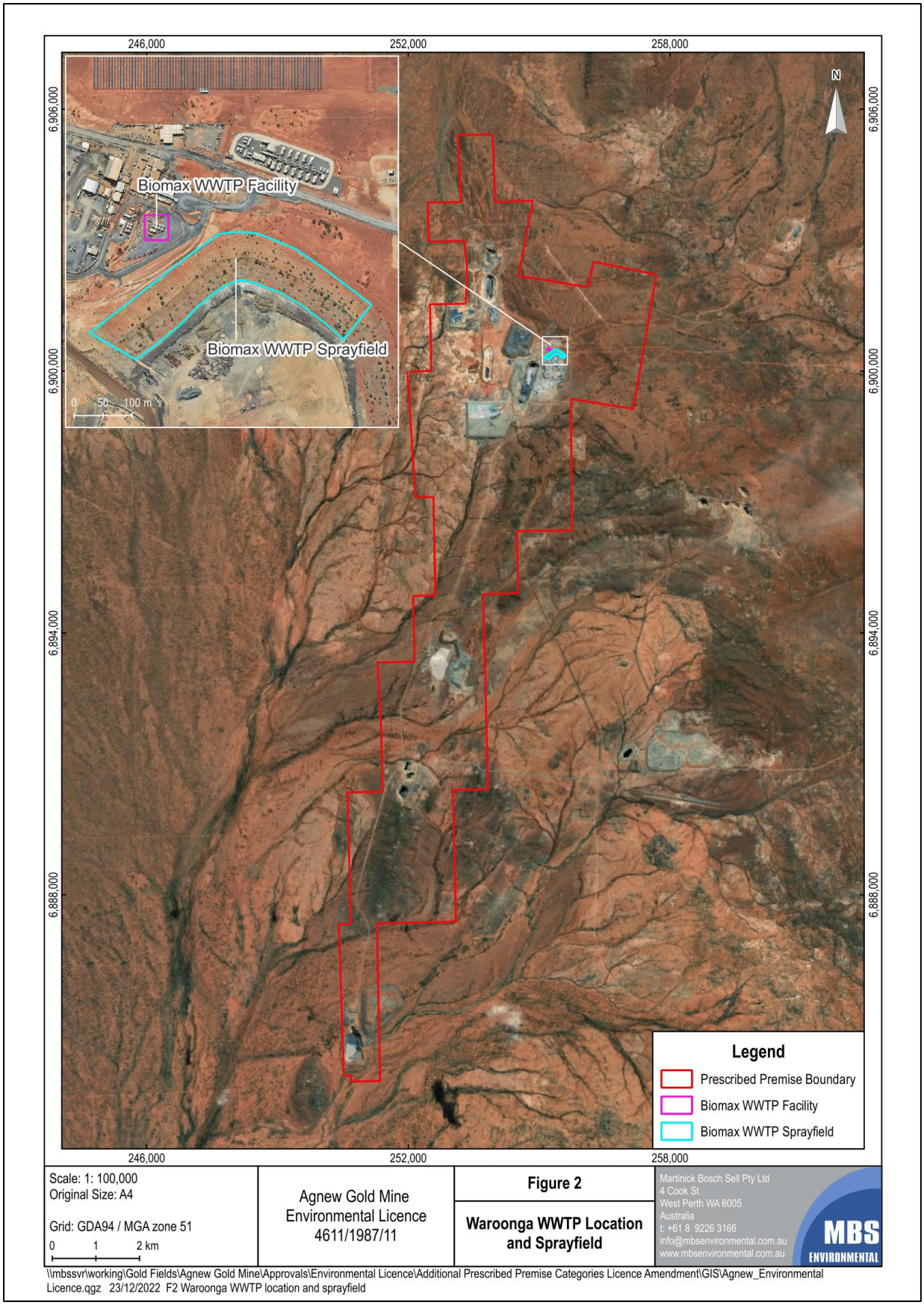


Figure 4: Location of existing Biomax wastewater treatment plant and sprayfield

2.3 Wildlife incidents at Songvang TSF4

Wildlife deaths were observed at the Songvang TSF4 during the summer periods in 2022 and 2023. On 7 January 2022, routine inspection at the Songvang TSF4 identified twelve avian carcasses. During the next summer period, a further 26 carcasses were identified at the Songvang TSF4 and return water ponds between 9 December 2022 to 26 January 2023.

These incidents were subsequently reported to the department, in accordance with licence L4611/1987/11. Since then, the Licence Holder has investigated the root cause of these incidents, which are detailed in Section 2.3.1 and 2.3.2. As part of this amendment, the Licence Holder has proposed controls for preventing and managing similar incidents in the future. A detailed risk assessment was undertaken by the department, as detailed in Section 3.4.

2.3.1 Wildlife incidents during the summer 2021/22 period

The carcasses were identified as hardheads (*Aythya australis*), a diving duck species endemic to Australia. Hardheads are commonly found in the south-west of Western Australia, often congregating in flocks near the middle of waterbodies, such as freshwater swamps and wetlands. They typically avoid coastal waters and are rarely seen on land. The species is not listed as threatened under State or Federal legislation.

As a diving duck, hardheads feed on aquatic vegetation, macroinvertebrates, and molluscs by diving deeply and remaining submerged whilst feeding. To reduce buoyancy and remain submerged, they absorb water through their feathers and therefore into the skin.

Following the January 2022 incident, an autopsy was conducted two carcasses. Internal and third-party investigations found the following:

- Cyanide-related causes were unlikely as WAD CN concentrations were reported below 50 mg/L (i.e., the numerical criterion stipulated by the International Cyanide Management Code) prior to and after the carcasses were found. No spike in cyanide was recorded in the previous 30 days. Given that cyanide is a rapid asphyxiant with a steep response curve, if exposed to toxic concentrations, the toxin usually kills all the wildlife exposed. This was not the case with the hardheads at Songvang TSF4, who were recorded on the subsequent two days after the incident, albeit in deteriorating conditions. Autopsy of the two carcasses did not detect cyanide in the liver and lungs. However, arsenic was detected, meaning that it had metabolised.
- Arsenic is an accumulative toxin that can be toxic when ingested, affecting organs, including stomach, liver and brain. Arsenic also affects the nervous system in birds (Wilson *et al.* 2004), incapacitating them such that they are not capable of leaving the TSF. Symptoms of acute arsenic poisoning including loss of coordination, anaemia and death (ANZG 2018). Dissolved arsenic concentrations ranged between 16 mg/L to 31 mg/L during the incident. A similar incident was reported at a god mine in Leinster, Western Australia in 2006, where arsenic concentrations of 42 mg/L were detected among duck and swan species. Furthermore, the ANZG guideline for safe drinking water for livestock and wildlife is 0.5 mg/L, which is two orders of magnitude lower. Therefore, arsenic concentrations detected at the Songvang TSF4 supernatant pond was considered toxic if consumed or adsorbed in sufficient quantities.
- Hardheads are likely to be exposed and absorb more toxin compared to other Australian duck species because of their behaviour as diving ducks. They also remain submerged while feeding and absorb water through their feathers to reduce buoyancy. As such, significant arsenic uptake had possibly occurred through dermal contact.
- At the time of the incident, the Bureau of Meteorology station (Leinster) recorded maximum mean temperatures ranging between 39°C to 42°C, with less than 2.5 mm of rainfall in the week leading up to the incident. Due to the hot environmental conditions, hardheads were likely to consume considerable amounts of water and remain

submerged for longer period at the supernatant pond, increasing arsenic exposure through ingestion and dermal contact.

Briefly, the cause of the hardhead deaths at Songvang TSF4 was likely to be caused by arsenic poisoning, exacerbated by hardhead diving behaviour and the hot weather conditions.

2.3.2 Wildlife incidents during the summer 2022/23 period

In the subsequent summer period, between 9 December 2022 to 26 January 2023, a further 26 hardheads were found deceased at TSF2, Redeemer TSF3, Songvang TSF4 and their respective process water ponds. In one instance, a sick hardhead was observed during a morning inspection and death observed in the subsequent afternoon inspection. The carcass was largely scavenged the following day, with only parts remaining.

A total of 15 carcasses were recovered for autopsy, with the remainder being unable to be assessed to either due to being predated upon or being too decomposed to be tested.

Findings from these additional autopsies and investigation include:

- Dissolved arsenic concentration at the Songvang TSF4 supernatant pond was within range of concentrations experienced during previous hardhead incidents in January 2022 (Table 4). Arsenic speciation has shown arsenic(III) at concentrations below the limit of reporting while arsenic(V) was observed at concentrations comparable to total arsenic concentrations, indicating that arsenic(V) is the most abundant arsenic species in tailings water circuit. Arsenic(III) appeared to be unstable in the mine waste solution and oxidised to the more stable, less toxic arsenic(V).
- Carcass autopsies showed arsenic at high concentrations in skin (0.9-4.93 mg/L), kidney (4.75-17.8 mg/L) and liver (6.5-19.1 mg/L) samples. The presence of arsenic in organs demonstrated that arsenic was ingested or adsorbed, and subsequently, metabolised. Cyanide was not recorded in any organs. Botulism was detected in five of ten carcasses.
- During this period, no spikes or disruptions in cyanide concentrations were evident. While WAD CN concentration from tailings sampled at the discharge spigot was elevated on some days, WAD CN concentrations in the supernatant pond did not exceed 50 mg/L.
- The timing of hardhead death during summer periods suggest that extreme hot weather likely contributes an ecological pattern prolonged diving and water drinking at the supernatant pond (and at other water containment infrastructure along the tailings water circuit) to increases arsenic uptake.
- Arid zone-inhabiting Australian duck species occur in flocks, are not prescriptively migratory, usually nomadic and fly nocturnally. Therefore, the impacts observed can be stochastic and unpredictable, with periods of mortalities occurring over days or weeks, followed by long periods of no mortalities. Hardheads are known to be more resident in the southern and southern coastal regions in Western Australia, and more opportunistic and nomadic in arid and northern Western Australia. The presence of a hardhead flock at the premises during January 2023 was likely a response of the species moving north to take advantage of the heavy rainfall/cyclonic conditions in the Kimberley and Pilbara regions. As conditions dry, it is thought that reverse nomadic movements would occur at some stage (i.e., migrating from north to south).

Table 4: Arsenic and WAD cyanide monitoring undertaken in January 2023

Date	Monitoring location	Concentration (mg/L)			
		Dissolved arsenic	Arsenic(V)	Arsenic(III)	WAD CN

4 Jan 2023	TSF4	22.1	---	---	32.0
6 Jan 2023	TSF4 return	---	30.1	<LOR[1]	37.6
	TSF4 spigot	---	---	---	60.0
8 Jan 2023	TSF RW[2]	---	42.2	<LOR[1]	52.6
	TSF3 pond	22.1	---	---	35.0
	TSF4 pond	---	21.5	<LOR[1]	36.0
16 Jan 2023	HSDIS water	17.5	21.1	<LOR[1]	21.7
19 Jan 2023	TSF4	18.6	25.6	<LOR[1]	29.8
	TSF2	17.7	21.0	<LOR[1]	---
26 Jan 2023	HSDIS	16.0	18.8	<LOR[1]	---
	TSF3 RW	27.0	35.2	<LOR[1]	---
	TSF4 RW	27.0	37.5	<LOR[1]	36.6
	TSF4	11.6	24.5	<LOR[1]	---

Note 1: <LOR means below the analytical limit of reporting.
Note 2: Assumed to be return water pond at Songvang TSF4.

On 20 February 2023, a bird carcass, identified as a grey teal (*Anus gracilis*), a common duck species in inland Australia, was found at Songvang TSF4. The species is a generalist, feeding in shallow water, filter feeding for aquatic macroinvertebrates and aquatic vegetation. While it does not dive, it upends in shallow water to feed on benthos. The species is not listed as threatened under State or Federal legislation.

Grey teals have been frequently observed feeding in shallow supernatant ponds and flowing tailings streams in tailings systems at the premises. Upon recovery, the carcass' plumage had lost its water repellency properties, indicating that the carcass was at least three days old but unlikely to be more than seven days old. The age of the carcass corresponded to a period of elevated WAD CN in tailings discharged into Songvang TSF4. Nevertheless, WAD CN concentrations in the supernatant pond water remained below 50 mg/L in the week leading up to the incident.

Arsenic was detected at 7.48 mg/kg and 20.8 mg/kg in the kidney and liver of the carcass, respectively. In birds, residues in the range of 2 mg/kg to 10 mg/kg are typically considered elevate, with concentrations above 10 mg/kg considered indicative of arsenic poisoning.

While previous wildlife mortalities were attributed hardheads and their diving behaviours, this incident demonstrates that other duck species may also be susceptible to arsenic poisoning at the supernatant pond, albeit at lower frequencies due to the lack of diving characteristics leading to increased arsenic uptake.

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk assessments* (DWER 2020b).

To establish a Risk Event there must be an emission, a receptor which may be exposed to that

emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises construction and operation, which have been considered in this Amendment Report are detailed in Table 5 below. Table 5 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

Table 5: Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
Construction phase (Category 85: Sewage facility)			
Dust	Installation of: • Dewatering pipeline from Barren Lands turkey's nest to Crusader Complex pits; and • Tristar WWTP.	Air/ windborne pathway	• Tristar WWTP will be installed as a prefabricated sequential batch reactor unit, requiring minimal onsite construction; • Vehicle and earthmoving equipment will be kept to defined roads; • Dust suppression will be undertaken using a water cart, as required; • Occupational hygiene requirements for dust will be complied with in operational areas.
Noise			• Construction will occur in daylight hours only; • All vehicles, plant and equipment will be regularly maintained to ensure they are operating efficiently and are not unduly noisy; • Additional engines will incorporate exhaust mufflers and other sound attenuating measures, which will be serviced and operated in accordance with the manufacturer's specifications.
Sediment laden stormwater		Overland runoff during rainfall events	• Tristar WWTP will be installed as a prefabricated sequential batch reactor unit, requiring minimal onsite construction; • Tristar WWTP will be constructed in previously cleared areas.
Operation phase (Category 5: Processing of beneficiation of metallic or non-metallic ore)			
Dust	Crushing and screening at the EMU processing plant at a throughput of 1,500,000 tpa	Air/ windborne pathway	• Dust emissions will continue to be managed in accordance with licence L4611/1987/11, internal Environment Management Plan, Air Quality Management Procedure and Processing Dust Management Procedure; • Dust suppression sprinklers will be maintained and operated at the processing plant; • Fine ore bin will be used to contain fine

Emission	Sources	Potential pathways	Proposed controls
			material after crushing and prior to processing in the mill.
	Tailings deposition at Songvang TSF4		• Deposition of tailings slurry will keep tailings beach damp.
Sediment laden stormwater	Crushing and screening at the EMU processing plant at a throughput of 1,500,000 tpa	Overland runoff during rainfall events	None.
Hydrocarbon and chemical reagents		Loss of containment due to pipeline failure, spills or storage overflow	• Hydrocarbon will be contained or stored within either an approved bunded area or in double-skinned, self-bunded tanks; • Fuel bowsers and fuel delivery inlets will be located on concrete or HDPE-lined pads to contain any rips and spills. Pas will drain to a sump to allow for removal of collected material; • Leakage and spillage of engine oil will be contained within enclosure bund and be pumped out of sumps; • Spill kits will be located at strategic locations throughout the project area; • Minor spillage will be cleaned up immediately and reported; • Hydrocarbon waste will be segregated from other waste and collected for offsite disposal by licensed contractor.
Tailings slurry	Deposition of increased tailings slurry into Songvang TSF4 up to maximum operating height of RL 422.0 m	Overtopping of Songvang TSF4	• Operating height will be limited to RL 422.0 m, with existing 300 mm minimum freeboard maintained at all times; • Daily visual inspection of pit walls; • Quarterly geotechnical and environmental inspection, as well as annual audit will be undertaken.
	Transport of increased tailings slurry (and return water) between EMU processing plant and Songvang TSF4	Pipeline leak or rupture (including buried pipelines beneath creek crossings)	• Existing upgraded tailings pipeline has valves installed at regular intervals to allow shut down as necessary during operations; • Existing upgraded tailings pipeline installed with telemetry system for flow monitoring and leak detection; • Daily visual inspection of all pipelines.
Tailings supernatant and seepage	Deposition of increased tailings slurry into Songvang TSF4 up to maximum operating height of RL 422.0 m	Vertical infiltration and lateral migration of tailings-impacted supernatant water	• As elevation of tailings beach within the TSF is below than ambient groundwater table, the pit will act as a sink for the entire duration of tailings deposition, limiting seepage migration; • Configuration of tailings discharge spigots will be designed to ensure appropriate tailings beach and supernatant pond development and minimise seepage potential;

Emission	Sources	Potential pathways	Proposed controls
			• Modelled localised seepage expected to migrate a rate of approximately 2 L/s to a maximum extent of 120 m from the TSF, and is expected to return to the TSF over time once deposition has ceased (Rockwater 2022); • The TSF will be managed in accordance with a TSF Operating Manual (Gold Fields Australia 2022); • Ambient groundwater monitoring will continue to be undertaken, in accordance with licence L4611/1987/11; • Extraction boreholes may be commissioned to manage groundwater mounding, if required.
	Deposition of increased tailings slurry into Songvang TSF4 up to maximum operating height of RL 422.0 m	Ingestion of tailings-impacted water at supernatant pond	• Monitoring for wildlife presence/status will undertaken daily; • Monitoring of supernatant pond for weak acid dissociable (WAD) cyanide will continue to be undertaken, with aim of maintaining a concentration of 50 mg/L or less to ensure risk of cyanide exposure is minimised; and • Refer to Section 3.4.3 for proposed controls for managing wildlife exposure to arsenic.
Category 6: Mine dewatering			
Mine dewater	Storage at Barren Lands turkeys nest	Vertical infiltration and lateral migration of mine dewater	• Turkeys nest lined with 2mm-thick HDPE liner.
		Overtopping of the Barren Lands turkey's nest	• Freeboard of one metre will be maintained; • Contingency measures in place to increase usage rate of mine dewater, where needed.
		Pipeline leak or rupture	None
Category 85: Sewage facility			
Sewage and partially treated sewage Sludge (solid waste) Treatment chemicals	Operation of the Tristar WWTP	Loss of containment due to pipeline failure, spills or storage overflow	• Storage components of WWTP will be impermeable and installed on compacted and stabilised earthen pad; • WWTP will be fitted with alarms to warn of high water levels in the tank or if a pump failure occurs, such that the unit can be isolated and shut down, if required; • WWTP will be operated in accordance with the Tristar Operation and Maintenance Manual; • WWTP will be inspected and serviced monthly by manufacturer;

Emission	Sources	Potential pathways	Proposed controls
			• WWTP will be hydro-tested with fresh water during commissioning; • Waste sludge will be dewatered, dosed with polymer and filtered and compressed to produce a spadable sludge cake, which will be disposed at an appropriately authorised landfill facility at the premises; • Any spills of sludge will be cleaned up immediately; • Safety Data Sheets will be available and accessible in areas where hazardous materials and stored and used;
Noise		Air/ windborne pathway	• WWTP unit will be enclosed to attenuate noise emissions; • WWTP and sprayfield components will be regular maintained to ensure they are operating efficiently and within manufacturer's requirements.
Odour			• WWTP will be maintained in accordance with manufacturer's specifications; • Irrigation area will be fenced with safety signage, with a 5m spray drift buffer.
Treated wastewater	Discharge of treated wastewater at irrigation sprayfield	Direct discharge to land	• Treated wastewater will be expected to be of comparable quality and be discharged at the same sprayfield will be utilised, which has been previously assessed (DWER 2022); • Validation and verification monitoring of WWTP irrigation tank will be undertaken at low exposure risk level, as outlined in the *National Guideline for Water Recycling: Managing Health and Environmental Risks* (NRMMC 2006); • Irrigation area will be at least four hectares (in accordance with *Water Quality Protection Note 22* [DoW 2008]) and managed to prevent ponding and pooling of treated wastewater on ground surface; • The extent of the irrigation sprayfield will be increased if required as a result of increased throughput at the WWTP, in order to meet requirements of annual nitrogen and phosphorus loading rates in accordance with *Water Quality Protection Note 22* (DoW 2008); • Irrigation area will be inspected weekly to ensure no surface runoff; • Irrigation area will be fenced with visible safety signage; • Flow meter will be installed at the irrigation area to monitor volume of treated wastewater discharged.

Emission	Sources	Potential pathways	Proposed controls
		Vertical infiltration and lateral migration of treated wastewater	• Sprayfield is located on a waste rock dump slope with good infiltration; • Depth of water table ensures minimal interactions between treated wastewater and local aquifer.

3.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020b), the Delegated Officer has excluded employees, visitors and contractors of the Licence Holder's from its assessment. Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 6 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental siting* (DWER 2020a)).

Table 6: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	Distance from prescribed activity
None	N/A
Environmental receptors	**Distance from prescribed activity**
Native vegetation	Native vegetation within and surrounding the prescribed premises comprises low mulga (Acacia aneura) woodlands, with an understory of Acacia shrubland. Based on aerial imagery, native vegetation at the location of prescribed activities (i.e., Crusader Complex, Songvang TSF4, EMU processing plant) is likely sparse and degraded to some extent. There are no threatened or priority ecological communities within and around the premises boundary. This receptor is relevant for all the prescribed activities considered in this amendment, with the exception of Category 85 activities, as the WWTP infrastructure are located within the operational area with no native vegetation present.
Birdlife	Birdlife in the surrounding area may access the supernatant water and use it as drinking water at the Songvang in-pit TSF4. As such, birdlife is considered a potential sensitive receptor.
Surface water bodies	The are no major natural surface water bodies at the premises. A number of minor creek lines are present at the premises, draining towards the south-west into Scotty Creek (near the EMU processing plant) or Lawlers Creek (near the Songvang TSF4). This receptor is relevant for all the prescribed activities considered in this amendment.
Groundwater aquifer	The premises is located within the Goldfields Groundwater Area. The local groundwater aquifer is considered a sensitive receptor in relation to the proposed tailings deposition at the Songvang TSF4.

	Based on recent groundwater monitoring around Songvang TSF4 in December 2022, groundwater depth ranged between 20.8 m below top of casing (mbTOC) to 37.5 mbTOC. Groundwater quality is considered fresh, with total dissolved solids ranging from 598 mg/L to 825.5 mg/L. There are no production bores of third-party groundwater users in the surrounding of Songvang TSF4, with the closest potential receptor being the Hanson Well, located 3.6 km south-west of the pit.
Cultural receptors	**Distance from prescribed activity**
Aboriginal heritage places	There are potentially up to 65 Aboriginal heritage places located within or surrounding the premises boundary, with 23 registered sites located at the middle to southern portion of the premises, beginning at the Crusader Complex pits and ending around Songvang TSF4. These sites are primarily artefacts/scatter in nature. The Lawlers Creek (Place ID 20666) flows along the eastern and southern portions of Songvang TSF4 and is also a registered Aboriginal heritage site, classified as 'mythological' and a water source. The Licence Holder have noted that Aboriginal heritage place values are not expected to be impacted as a result of the granting of this amendment.

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020b) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are incomplete they have not been considered further in the risk assessment.

Where the Licence Holder has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the Licence Holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the Licence Holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 7.

The Revised Licence L4611/198711 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises i.e., crushing activities, tailings deposition, sewage treatment etc.

The conditions in the Revised Licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 7. Risk assessment of potential emissions and discharges from the Premises during construction and operation

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
Construction								
Installation of Tristar SBR modular system replacement WWTP	Dust	***Pathway:*** Air/ windborne pathway ***Impact:*** Impact to ecological health and amenity	Native vegetation	Refer to Section 3.1	C = Slight L = Rare **Low risk**	Y	None	N/A
	Sediment laden stormwater	***Pathway:*** Overland runoff during rainfall event ***Impact:*** Discharge to land, resulting in impact to ecological health and amenity	Native vegetation Minor creek line	Refer to Section 3.1	C = Slight L = Rare **Low risk**	Y		N/A
Operation (Category 5: Processing or beneficiation of metallic or non-metallic ore)								
Operation of tertiary crusher – loading, unloading, ore conveyance and ore stockpiling Increase of ore processed from 1.4 mtpa to 1.5 mtpa	Dust	***Pathway:*** Air/ windborne pathway ***Impact:*** Impact to ecological health and amenity	Native vegetation	Refer to Section 3.1	C = Minor L = Unlikely **Medium risk**	Y	None	Crusher has been constructed with sprinklers installed. No additional controls required.
	Sediment laden stormwater	***Pathway:*** Overland runoff during rainfall event ***Impact:*** Discharge to land, resulting in impact to ecological health	Native vegetation Minor creek line	None	C = Minor L = Rare **Low risk**	Y	None	N/A

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
		and amenity						
Increased tailings deposition as a result of increased ore processing. Tailings deposition at Songvang in-pit TSF4 to operational height of RL 422.0 m	Dust	***Pathway:*** Air/ windborne pathway ***Impact:*** Impact to ecological health and amenity	Native vegetation	Refer to Section 3.1	C = Slight L = Rare **Low risk**	Y	None	N/A
	Tailings slurry	***Pathway:*** Overtopping of Songvang TSF4 pit, resulting in overland runoff ***Impact:*** Discharge to land, resulting in impacts to ecological health and amenity	Native vegetation Minor creek lines, including Lawlers Creek Aboriginal heritage site	Refer to Section 3.1	C = Moderate L = Rare **Medium risk**	Y	Condition 2: Containment infrastructure requirements	N/A
		Pathway: Pipeline leak or rupture (including buried pipelines beneath creek crossings) ***Impact:*** Discharge to land, resulting in impacts to ecological health and amenity		Refer to Section 3.1	C = Moderate L = Unlikely **Medium risk**	Y	Condition 3: Inspection requirements (pipeline) Condition 4: Pipeline operational requirements	N/A
	Tailings supernatant	***Pathway:*** Vertical infiltration and lateral migration of tailings supernatant water ***Impact:*** Impacts to groundwater resources and	Groundwater aquifer Minor creek lines, including Lawlers Creek	Refer to Section 3.1	C = Minor L = Possible **Medium risk** Refer to Section 3.3	Y	Condition 8: Cyanide detoxification requirement Condition 15: Groundwater monitoring requirements and	N/A

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
		surface water quality					limits Conditions 16 to 18 – groundwater recover plan	
		Pathway: Ingestion of supernatant water ***Impact:*** Impacts to wildlife health	Transient birdlife	Refer to Section 3.1	C = Major L = Possible **High risk** Refer to Section 3.4	Y	Condition 2: Bird deterrent requirements Condition 3: Inspection requirements (bird and wildlife) Condition 8: Cyanide detoxification requirement Condition 15: Supernatant pond monitoring requirements **<u>Condition 28: Specified actions (Item 1 to Item 5)</u>**	Refer to Section 3.4
Operation (Category 6: Mine dewatering)								
Dewatering activities at Barren Lands open pit and storage of mine dewater at Barren Lands turkeys nest	Mine dewater	***Pathway:*** Overtopping of Barren Lands turkeys nest, resulting in overland runoff ***Impact:*** Discharge to land, resulting in impacts to ecological health and amenity	Native vegetation Minor creek line	Refer to Section 3.1	C = Slight L = Rare **Low risk**	Y	Condition 2: Containment infrastructure requirements	N/A

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence Holder's controls**				
		Pathway: Vertical infiltration and lateral migration of tailings supernatant water ***Impact:*** Impacts to groundwater resources		Refer to Section 3.1	C = Slight L = Unlikely **Low risk**	Y	Condition 2: Containment infrastructure requirements	N/A
		Pathway: Pipeline leak or rupture ***Impact:*** Discharge to land, resulting in impacts to ecological health and amenity		None	C = Slight L = Unlikely **Low risk**	Y	Condition 3: Inspection requirements (pipelines) Condition 4: Pipeline operational requirements	N/A
Operation (Category 85: Sewage facility)								
Operation of Tristar SBR modular system replacement WWTP	Sewage Partially treated sewage Treated wastewater Treatment chemicals Solid waste (sludge)	***Pathway:*** Loss of containment, resulting in spills and leaks ***Impact:*** Direct discharge to land, resulting in impacts to ecological health and amenity	Native vegetation Minor creek line	Refer to Section 3.1	C = Moderate L = Unlikely **Medium risk**	Y	Condition 1: Infrastructure operational requirements Condition 25: Construction requirements	N/A
Discharge of treated wastewater to irrigation sprayfield	Treated wastewater (containing nitrogen and phosphorus)	***Pathway:*** Irrigation at sprayfield ***Impact:*** Direct discharge to land, resulting in impacts to		Refer to Section 3.1	C = Minor L = Unlikely **Medium risk**	Y	Condition 1: Infrastructure operational requirements Condition 10: Authorised point source discharge to	N/A

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
		ecological health and amenity					land Condition 11: Sprayfield discharge limit Condition 13: Sprayfield discharge monitoring requirements Condition 14: Sprayfield discharge process monitoring requirements Condition 25: Construction requirements	

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk assessments* (DWER 2020b).
Note 2: Proposed Licence Holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

3.3 Detailed risk assessment for seepage from operation of Songvang TSF4 to RL 422.0m

3.3.1 Background

The Songvang TSF4 is an in-pit TSF located in the southern end of the premises. It is currently operational, receiving tailings from the EMU Processing Plant through a recently upgraded tailings delivery pipeline. The tailings are treated through a cyanide detoxification unit to reduce the concentration of WAD cyanide in tailings prior to discharge. The process involves dosing the tailings with hydrogen peroxide, or with Caro's acid (H_2SO_5) by mixing sulfuric acid and hydrogen peroxide. The facility is currently authorised under licence L4611/1987/13 to operate up to a maximum elevation of RL 404.0 m (DWER 2017).

In considering tailings deposition to RL 404.0 m at Songvang TSF4, the department assigned a low risk rating, based on a consequence rating of 'slight' and a likelihood rating of 'rare'. The rationale for this risk rating was detailed as:

The pit will act as a groundwater sink during operations. The greatest risk of seepage is from the supernatant pond. The supernatant water level will be managed to be at least 1 metre below the lowest currently measured groundwater elevation (currently RL 407.5 m). Local groundwater at the Songvang pit is contained within an aquifer at depths located between 14 metres below ground level (mbgl) to 30.5 mbgl (RL 425 m to RL 408.5 m, respectively). Tailings deposition will be limited to 35 mbgl (RL 404.0 m).

Given this rationale, the proposed increase in operating height above the approved RL 404.0 m would likely alter the likelihood and consequence of seepage emitted from Songvang TSF4. A detailed risk assessment was undertaken to consider the risks of emissions associated with this increase in operating height. The risk assessment considers tailings geochemistry, groundwater seepage modelling, as well as the review of groundwater monitoring data to date.

3.3.2 Tailings geochemistry

Tailings characterisation was undertaken by Golder (2016) to support the operation of the Songvang TSF4. The geochemical characteristics of the tailings can inform the quality of the resultant supernatant water and leachate. As the tailings is not proposed to be modified or altered in any way as a result of the proposed amendment, the previous findings were still considered to be applicable and can be summarised as:

- In general, trace metal concentrations in tailings were similar or lower than their respective crustal abundances. The exception to this was arsenic, gold, cadmium, sulfur and selenium, which were all at least six times higher than their respective crustal abundances;
- Tailings had a negative net acid producing potential of -16 kg H_2SO_4/tonne, which indicated that the tailings were non-acid forming (NAF). This was supported by an acid neutralising capacity to maximum potential acidity ratio of 1.96;
- Short-term leaching test (using deionised water as the leaching fluid) yielded a leachate with slightly alkaline pH (i.e., between 8.2 to 9.0 pH units), high salinity (i.e., 947 to 956 mS/cm) and enriched with soluble salts (i.e., sulfur, sodium, calcium).

The assessment concluded that the tailings seepage should not present a risk to the surrounding environment and could potentially progress above the ambient groundwater table without significant risks.

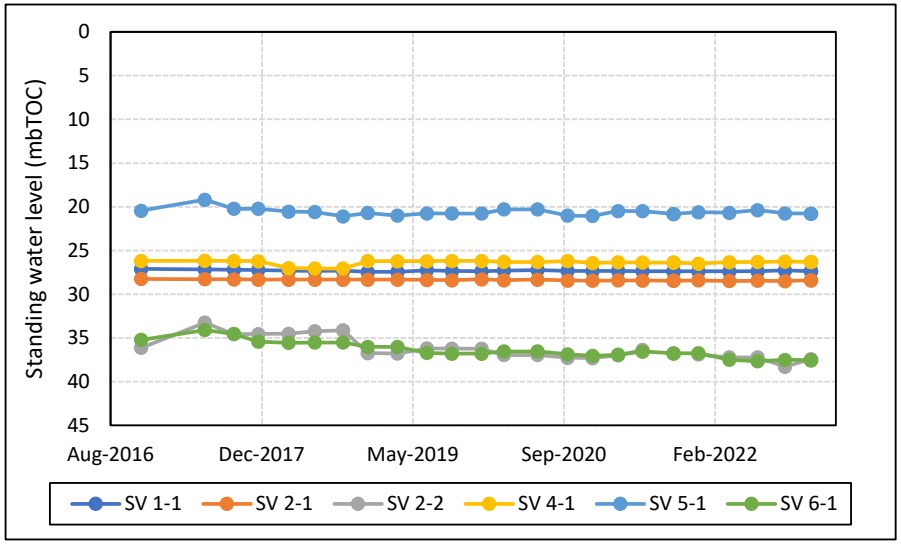
3.3.3 Review of existing monitoring data

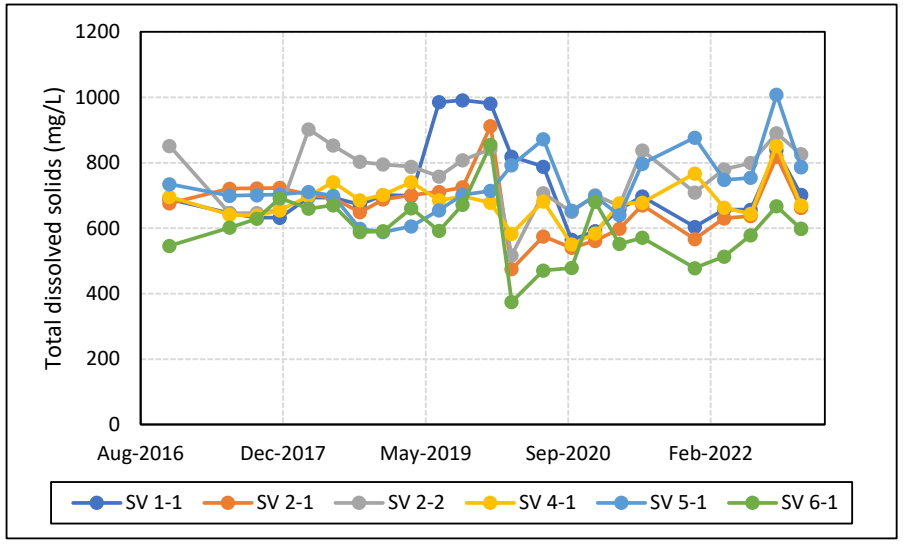
Historical groundwater monitoring data from November 2016 to March 2023 at bores

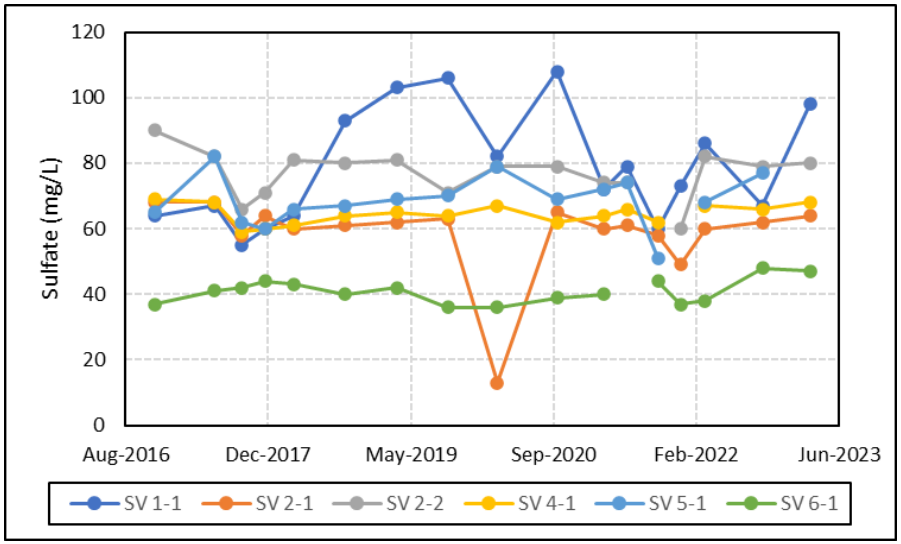
surrounding Songvang TSF4 were analysed for temporal trends. These are shown in Figure 5, with findings summarised below:

- Standing water level was shallowest to the east of Songvang TSF4 (SV5-1) at around 20 mbTOC, followed by SV4-1, SV1-1 and SV2-1 located on the north, west and south-west of the pit, respectively. The deepest standing water levels (i.e., between 35 mbTOC and 40 mbTOC) were measured at SV2-2 and SV6-1, to the south of Songvang TSF4.
- Standing water levels at all the surrounding monitoring bores have been largely stable since 2016. This is consistent with the initial assessment that seepage and groundwater mounding was unlikely to occur due to tailings deposition being limited to an elevation below the ambient water table, allowing the pit to act as a terminal evaporative sink (DWER 2017).
- Total dissolved solid (TDS) concentrations have remained below 1,000 mg/L throughout the monitoring period. However, there has been a gradual increase in TDS that has been notable since 2020. However, this trend does not appear to be correlated to changes in standing water level.
- Sulfate concentrations have remained stable throughout the monitoring period, ranging between 13 mg/L to 108 mg/L. The highest sulfate concentrations were detected at SV1-1, while the lowest concentrations were detected at SV6-1.
- A number of total metal and metalloid concentrations were assessed but did not display any concerning temporal trends. A concentration spike was observed at SV4-1 during the March 2021 monitoring event for arsenic, chromium, cobalt, nickel etc. However, concentrations have returned to their normal ranges in subsequent monitoring events. Only total arsenic concentrations are shown in Figure 5.
- Other metals and metalloids, such as cadmium, selenium, mercury, thallium, were consistently below their respective limits of reporting in all monitoring bores, with the exception of total mercury being detected at the limit of reporting (i.e., 0.0001 mg/L) once at SV6-1 in November 2016.
- Dissolved metal and metalloid concentrations were only measured from 2022 onwards. It is difficult to identify any long-term temporal trends with the limited data available. Further monitoring is required.
- Total and WAD cyanide concentrations have remained below the limit of reporting (0.004 mg/L) throughout the monitoring program.

Aside from the gradual increase in TDS, there are no trends that may indicate seepage from Songvang TSF4 as having impacted the surrounding aquifer. Furthermore, there was no significant changes to standing water level that correlated with the increase in TDS. As such, the cause of this trend is unlikely to be from significant influence of tailings seepage. These findings are consistent with the previous risk assessment (DWER 2017).







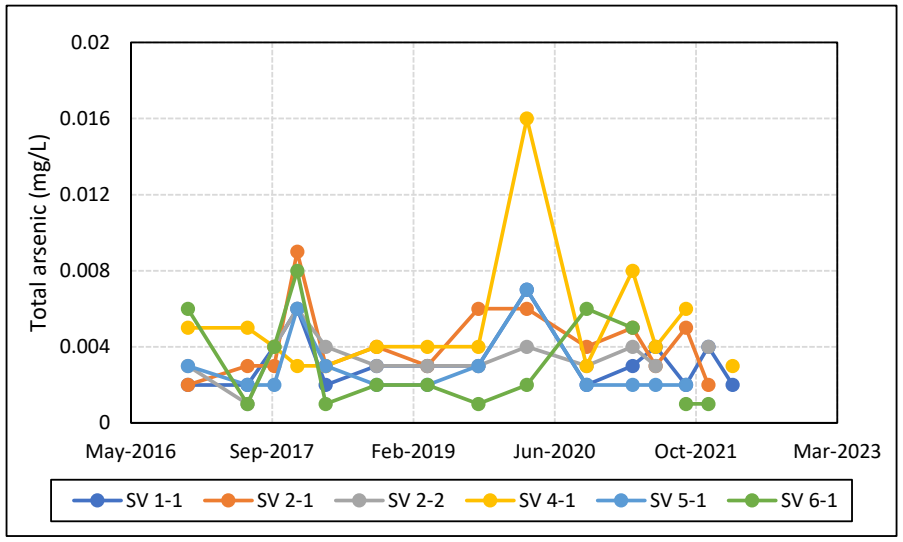


Figure 5: Groundwater monitoring data at Songvang TSF4 for standing water level, total dissolved solids, sulfate and total arsenic

3.3.4 Hydrogeological model assessment

A numerical groundwater model was constructed to model the potential impacts on ambient groundwater if tailings elevation were raised above the existing operating limit of RL 404 m to either RL 422 m (Rockwater 2022). The modelled extent was 8.5 km (east-west) and 9.0 km (north-south), centred on the Songvang TSF4, with pre-mining groundwater elevation assumed to be flat at RL 426.5 m. The model was calibrated against historical pit dewatering data and groundwater monitoring data. It was noted that while modelled groundwater inflows were of the same order of magnitude as observed data, a finer calibration was not attempted as there were several existing sources of potential error and uncertainty in the water balance.

The results of flow-path modelling indicated that, if tailings were to be stored at elevations up to RL 422.0 m, and the supernatant water remained at that level in the pit, the water could initially migrate away from the pit to distances of up to 120 m from the pit walls, primarily to the north and south. After about 20 to 50 years, ambient groundwater elevation outside of Songvang TSF4 pit would rise to above RL 422.0 m and groundwater is expected to flow back towards the pit due to the change in hydraulic gradient.

The model also simulated seepage migration from Songvang TSF4 if the hydraulic conductivity was three times higher than those applied in the model, with seepage migrating up to 160 m north and south of the pit. The assessment concluded that, even under this 'worst case scenario', the seepage-impacted groundwater would not impact on the nearest bore receptor – Hanson Well, located approximately 3.6 km south-west of Songvang TSF4.

Based on historical monitoring data, WAD cyanide has been detected at concentrations up to around 40 mg/L in the supernatant water at Songvang TSF4 (Figure 6). Therefore, it is likely that seepage from Songvang TSF4 would contain WAD cyanide, though the concentration is expected to decrease significantly with time and distance migrated due to oxidation and degradation processes. The salinity of the supernatant water was also noted to have increased to 4,214 mg/L of TDS at the time of this assessment. While the salinity was observed to be above background levels, it would have minimal impact on overall groundwater quality for stock use.

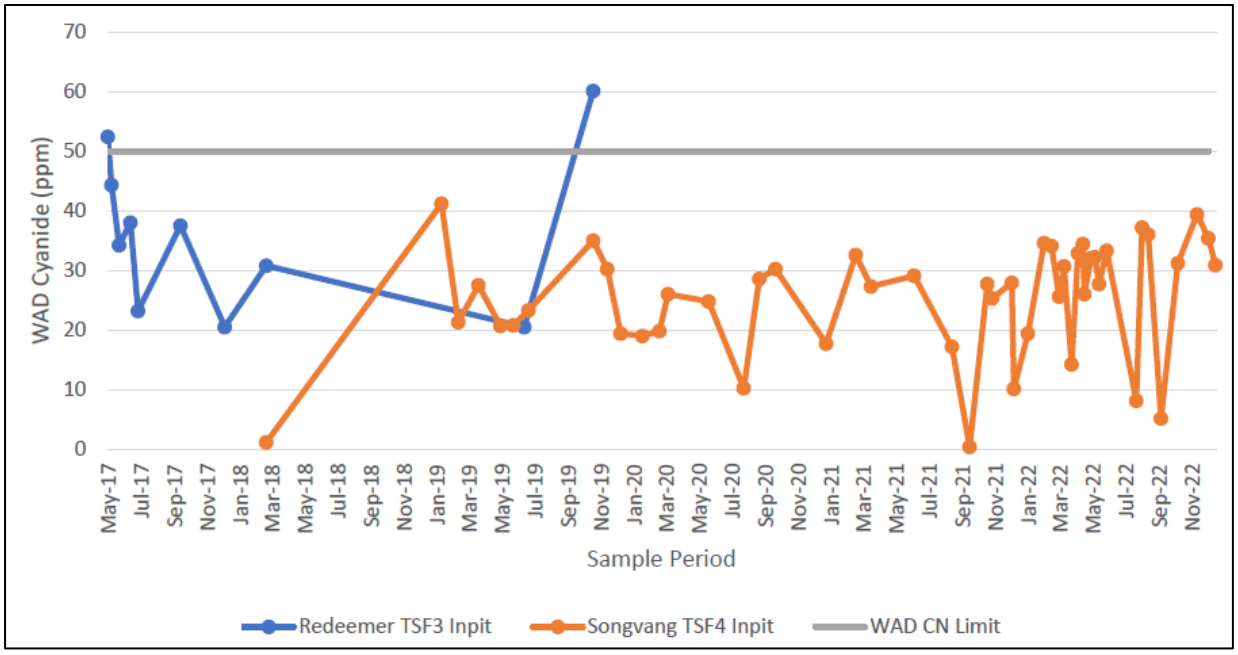


Figure 6: WAD cyanide concentration at Redeemer TSF3 and Songvang TSF4

3.3.5 Risk assessment and additional regulatory control

The current operating limit at Songvang TSF4 was set at RL 404.0 m to minimise the risk of seepage entering the surrounding aquifer. While the risk of tailings deposition up to RL 404.0 m had been shown to be low, the proposed increase in operating limit to RL 422.0 m may result in an increased risk of seepage emissions from the facility. The Delegated Officer has considered the following information in determining the risk rating for this source-pathway-receptor linkage:

- Tailings deposition at operating heights above RL 404.0 m is likely to be at a higher elevation than the surrounding standing water level. This may cause supernatant water at the TSF to flow radially outwards, away from the in-pit TSF into the surrounding aquifer.
- Groundwater modelling has demonstrated that the zone of influence would be limited to approximately 160 m around Songvang TSF4 (Rockwater 2022).
- The zone of influence for seepage from Songvang TSF4 is unlikely to reach the closest regional production bore (i.e., Hanson Bore).
- At a maximum operating height of RL 422.0 m, there is a separation distance of approximately 20 m between the tailings elevation and the pit crest. As such, any potential mounding as a result of seepage would unlikely be impacting the surrounding native vegetation, including deep-rooted species.
- Lawlers Creek runs along the eastern and southern portion of Songvang TSF4, approximately 250 m from the pit crest. Given the model predictions, the zone of influence from seepage is unlikely to reach the creek line.
- The existing groundwater monitoring bore network adequately surrounds the Songvang TSF4 pit, allowing changes in groundwater quality to be detected regardless of the direction of regional groundwater flow. In particular, three monitoring bores are present to the south of the pit, with SV6-1 being hydraulically downgradient of Lawlers Creek (assuming radial groundwater flow due to seepage from Songvang TSF4).
- At the time of this assessment, approval by DMIRS under the *Mining Act 1978* had not been obtained to increase the operating height of Songvang TSF4 from RL 404.0 m to RL 422.0 m (refer to Section 4.1 for further information). While this does not constrain the department from the granting this amendment, the Delegated Officer has considered the lack of necessary approval as a factor in determining the risk rating.

In considering the information present, the Delegated Officer has assigned this risk event with a consequence of **minor** and a likelihood of **possible**, with a resultant risk rating of **medium**.

While existing monitoring data to date does not indicate any significant impact on ambient groundwater as a result of the operation of Songvang TSF4, this may not be the case with tailings deposition up to RL 422.0 m. Continued groundwater monitoring should be undertaken to assess any potential impacts to the groundwater aquifer as a result of this prescribed activity. Limits for week acid dissociable cyanide, TDS and pH already exist for groundwater monitoring bores that surround Songvang TSF4. In the event that one of these limits are exceeded the licence holder is required to implement a groundwater recovery plan as per existing condition 17. These existing conditions have been deemed sufficient in managing this risk event and no additional regulatory controls are required.

3.4 Detailed risk assessment of wildlife ingestion of supernatant water at Songvang TSF4

3.4.1 Background

Wildlife may access the supernatant pond at the Songvang TSF4 for a variety of reasons, including as a drinking water source. While the structure of an in-pit TSF makes it difficult for most terrestrial wildlife to access, birds can access the supernatant pond more easily due to flight. At the supernatant pond, they are exposed to the supernatant through drinking, feeding on aquatic organisms at the pond (if they are present) and/or through dermal contact with supernatant water.

The risk of wildlife interactions at Songvang TSF4 have previously been considered and assessed under licence L4611/1987/11. Conditions are present in the existing licence to inspect for any wildlife presence and mortality at the TSFs and their supernatant ponds. In particular, measures have been implemented to prevent wildlife exposure to cyanide and ensure compliance with the International Cyanide Code requirements. A cyanide detoxification unit was installed in 2017 to ensure WAD CN concentrations at the supernatant pond remained below 50 ppm at all times, with pond water monitoring undertaken monthly to verify this.

While arsenic-driven wildlife deaths had not been previously recorded, the repeated incidents over two summer periods suggests that they might become more common in the future and need to be considered in an updated risk assessment. Since investigating the issue, the Licence Holder have proposed several controls to manage the likelihood of these risk events.

3.4.2 Source-pathway-receptor linkage

Source

With arsenic as the primary contaminant of concern, the source of this exposure pathway is the supernatant pond water at Songvang TSF4, which is the supernatant of tailings slurry discharged to the TSF. The tailings supernatant is highly enriched in arsenic, with dissolved arsenic concentrations ranging between 16 mg/L to 31 mg/L at the time of the January 2022 incidents. While dissolved concentrations at the supernatant pond has decreased since then, to between 8.6 mg/L to 11.0 mg/L during daily monitoring undertaken in July 2023, this is still significantly higher than the safe drinking water level for livestock (i.e., 0.5 mg/L).

The source of this risk event is not isolated to the Songvang TSF4 supernatant pond. Between December and January 2023, hardhead deaths were also reported at the other TSFs (i.e., TSF2 and Redeemer TSF3) as well as return water ponds, which stored return water pumped from their respective TSF's supernatant ponds. As such, any open water-holding infrastructure containing tailings supernatant should be considered.

Receptor

The receptor of concern is birdlife, who can easily access supernatant ponds and return water ponds. Specifically, hardheads, as a diving duck, are at risk due to their relatively unique exposure pathways. Nevertheless, the sighting of a grey teal carcass in February 2023 demonstrates that even more common non-diving duck species may be at risk of arsenic poisoning.

Pathway

Birds are able to easily access and rest on waterbodies. The most common and direct method of arsenic uptake is by drinking supernatant pond water. Exposure may increase during hot summer months, where birds feel stressed and are more likely to access the supernatant pond as a drinking water source. This is supported by the repeated instances where arsenic-related wildlife deaths occurred only during summer months.

While limited in some birds, duck species are able to rest on water, increasing residence time

(and exposure) at the supernatant pond and return water ponds. As diving ducks, hardheads are especially exposed to arsenic poisoning, as they tend to dive into a waterbody for prolonged periods. To reduce buoyancy and remain submerged, they absorb water through their feathers, representing significant dermal uptake of arsenic.

It is currently not known whether any of the supernatant ponds at the TSFs are biotic. If aquatic macroinvertebrates are present in these waterbodies, the hardhead may also be diving extensively to feed on them, representing another exposure pathway for arsenic.

3.4.3 Proposed controls

Source removal

The most effective way to eliminate a source-pathway-receptor linkage is to remove, as best as possible, the source of impact (i.e., arsenic in water). Between February and May 2023, the Licence Holder undertook a trial, where a total of 15,000 kg of ferrous sulfate was deposited at Songvang TSF4 over discrete periods. The ferrous sulfate was thought to remove arsenic in the supernatant pond water via precipitation. While dissolved arsenic concentrations had declined over time (Figure 7), the dispersal of ferrous sulfate via boat had given sporadic results. Currently, the ferrous sulfate trial at TSF4 had ceased.

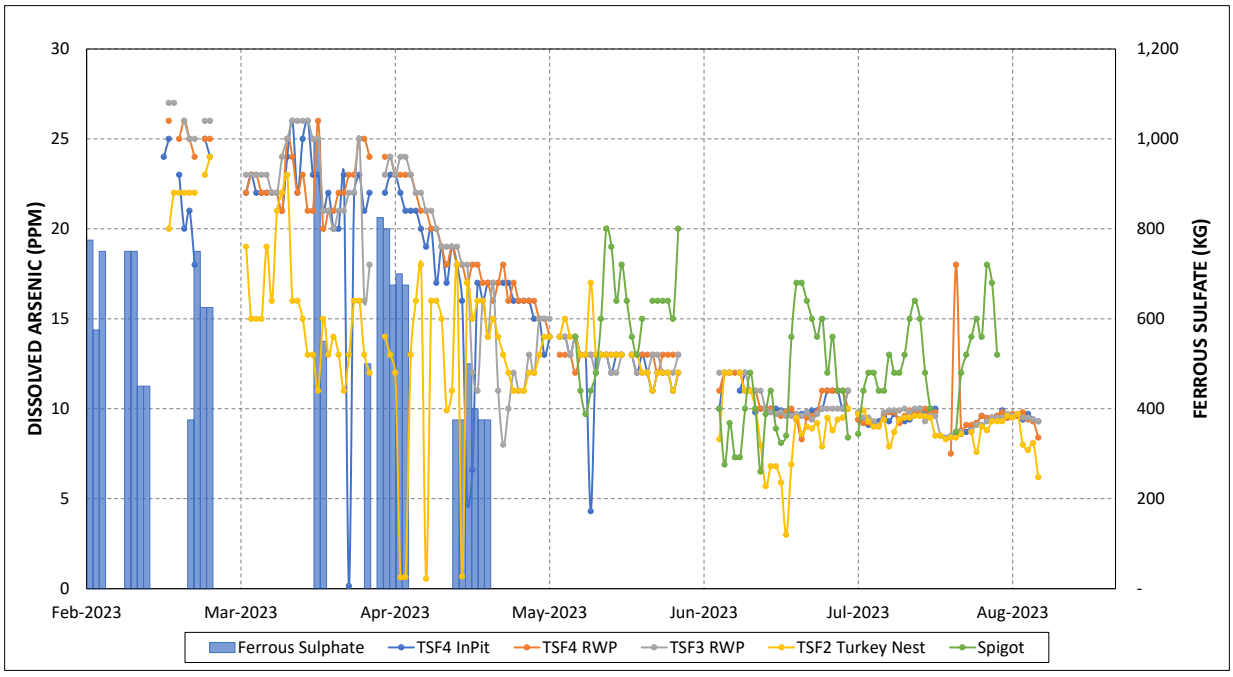


Figure 7: Dissolved arsenic concentrations at Songvang TSF4 and return water ponds and ferrous sulfate input

Instead, the Licence Holder is investigating direct input of ferrous sulfate into the tails hopper at the EMU processing plant, which could provide a more even, distributed dosage. The trial was completed in August 2023, where approximately 100 kg of ferrous sulfate was inputted and dosed at 16 L/min. Samples were taken at various stages of processing to understand arsenic concentrations in tailings slurry prior to being dosed with ferrous sulfate, immediately after being dosed, while in transit from the EMU processing plant and Songvang TSF4 and right before being discharged into the TSF. While the samples are being analysed at the time of this assessment, the data is expected to inform the required ferrous sulfate dosing rates, the kinetics and reaction rate for arsenic reduction, in time for the upcoming summer period.

Between the December 2022 and July 2023 survey, the supernatant pond size has increased by approximately 5%, from 45,471 m^2 to 61,060 m^2. In response, the Licence Holder is looking to reduce the footprint of the supernatant pond at Songvang TSF4 via upgrades to the impeller and suction line of the return water pump. While the current return water rate is approximately

220 m^3/hour, the targeted rate is 280 m^3/hour. The footprint of the supernatant pond will be surveyed quarterly for comparative purposes.

Pathway removal

The Licence Holder has proposed several measures to limit the access of birdlife from arsenic-enriched supernatant water. At the Songvang TSF4, the use of gas cannons was proposed as bird deterrents. Currently, gas cannons are proposed to be installed: at the pontoon station, pit ramp and return water pond. The locations were selected to give the best accessible coverage over the TSF and can be moved around, if required. The location of the gas cannons will be reviewed based on findings from wildlife sightings and inspections.

Access to the return water ponds at TSF2, TSF3 and TSF4 will be limited through the installation of netting.

It is likely that birdlife is exposed to arsenic poisoning through pathways such as dermal contact and/or ingestion of supernatant pond water at Songvang TSF4. However, it is not known whether the waterbody hosts macroinvertebrates that birds feed on, which may be another exposure pathway to consider.

To determine whether the supernatant pond is abiotic and whether there is limited arsenic build-up in the lower trophic levels, the Licence Holder will undertake a macroinvertebrate sampling program in 2023. Sediment grab samples will also be collected at Songvang TSF4 and Redeemer TSF3, where shallow and accessible, to consider the presence of sediment fauna.

Monitoring

Since February 2023, the Licence Holder has conducted daily sampling at the Songvang TSF4 supernatant pond, as well as the return water ponds at TSF2, TSF3 and TSF4. Parameters being analysed include arsenic, cadmium, copper, iron, lead, mercury, nickel and zinc. Daily monitoring for these parameters. If dissolved arsenic concentrations are detected below 5 mg/L, sampling for arsenic(III) and arsenic(V) speciation will be undertaken. The daily monitoring program provided the necessary monitoring data to inform the outcomes of the ferrous sulfate trial at Songvang TSF4.

While licence L4611/1987/11 requires TSF infrastructure to be inspected at least daily while operational, the Licence Holder have proposed to undertake wildlife monitoring twice a day. In 2023, additional personnel have been allocated to tasks such as refilling and repositioning the gas cannons and undertaking the ferrous sulfate trial. Overall, this has increased the frequency and time spent at the Songvang TSF4.

3.4.4 Risk assessment and additional regulatory controls

In considering the previous incidents and proposed controls, the Delegated Officer has assessed the consequence of this risk event to be **major**. The most direct method for reducing the consequence (i.e., wildlife death) is to minimise the amount of arsenic being ingested or absorbed. This will be dependent on the ferrous sulfate hopper trial, of which the results must still be analysed and implementation designed. While reducing the supernatant pond size may also contribute, this process will take time. It will not be feasible to remove all water from the supernatant pond, though it may reduce the attractiveness of the pond as a water source (i.e., reducing likelihood of risk event).

The likelihood of this risk event is **possible**, given the previous two summer periods. Measures put in place to limit access may reduce the likelihood of this risk event (i.e., increased inspections, gas cannon, pond netting etc.), though their efficacy has yet to be determined.

Overall, the risk rating for this risk event is **high**. While the Licence Holder has proposed various controls to mitigate wildlife mortality in the future, there is still a level of uncertainty in the efficacy of these controls. As such, the department has taken a conservative approach in this risk assessment.

The Delegated Officer has conditioned the controls proposed by the Licence Holder (as detailed in Section 3.4.3). These include the operation of gas cannons, increased wildlife monitoring at TSF infrastructure andarsenic monitoring at the Songvang TSF4 supernatant pond. The ongoing investigations proposed, such as the ferrous sulfate plant trial and macroinvertebrate sampling, as well as return water pump upgrades have been conditioned as specified actions. In addition to these, the Delegated Officer has included the following additional regulatory requirements:

- **Condition 28 – Specified actions (Item 1 to Item 4):** The Licence Holder must provide to the CEO a report on the outcomes of each specified action undertaken, with requirements specified for what the report should include.
- **Condition 28 – Specified actions (Item 5):** Based on the summer between December 2023 and April 2024, the Licence Holder must provide an overall review of wildlife incidents that had occurred and undertake an assessment of the effectiveness of each of the controls implemented, how they may be improved and a revised strategy for how those controls will be implemented in the following summer period.

4. Consultation

Table 8 provides a summary of the consultation undertaken by the department.

Table 8: Consultation

Consultation method	Comments received	Department response
Shire of Leonora advised of proposal on 26 May 2023.	No comments received.	None.
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal on 26 May 2023.	Refer to Section 4.1.	Refer to Section 4.1.
Licence Holder was provided with draft amendment on 20 July 2023.	Refer to Appendix 1.	Refer to Appendix 1.
Licence Holder was provided with second draft amendment on 15 September 2023.	Refer to Appendix 1.	Refer to Appendix 1.

4.1 Comments received from DMIRS

On 30 May 2023, DMIRS provided comments, noting that certain parts of the scope of this amendment did not have a corresponding approved Mining Proposal. These included:

- Mining Proposal Reg ID 93561 only approved ore processing throughput up to 1.4 mtpa, which is the existing authorised production capacity. The Mining Proposal did not approve ore processing up to 1.5 mtpa.
- Mining Proposal Reg ID 93561 approved the addition of the crushing circuit but did not include the installation and operation of the upgraded tailings pipeline from the EMU processing plant to Songvang TSF4.

- Mining Proposal 63802 only approved tailings deposition into Songvang TSF4 up to the RL 404.0 m. The Mining Proposal did not approve tailings deposition above that height (i.e., up to RL 422.0 m).

On 12 June 2023, the department requested further information from the Licence Holder on the reasoning behind the lack of approval under the *Mining Act 1978*. The response from the Licence Holder and the department's subsequent actions are detailed in Table 9.

Table 9: Scope of amendment without *Mining Act 1978* approval

Scope of amendment	Licence Holder rationale	Department response
Increase of ore processing capacity from 1.4 mtpa to 1.5 mtpa.	Currently investigating, at the time of assessment.	The department has considered this in the risk assessment.
Upgrade of tailings delivery pipeline	Provided the wrong Mining Proposal. The works were approved under Mining Proposal Reg ID 114042, not Reg ID 93561.	No issue.
Increase operating height of Songvang TSF4 from RL 404.0 m to RL 422.0 m.	Mining Proposal 118700 was submitted to DMIRS on 23 May 2023 and is currently under assessment.	On 17 July 2023, the department confirmed with DMIRS that the scope of Mining Proposal 118700 aligns with the scope of this amendment. However no further comments on the adequacy of the proposal have been provided. The department has considered this in the risk assessment.

While the lack of necessary approval by other decision-making authorities does not constrain the department from granting this amendment to licence L4611/1987/11, the Delegated Officer has to consider the effect this has on the consequence of any potential impact of emissions and discharges from a prescribed activity to the environment. The resultant risk rating in Table 7 has been derived with this in mind.

5. Conclusion

Based on the assessment in this Amendment Report, the Delegated Officer has determined that a Revised Licence will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

5.1 Summary of amendments

Table 10 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Licence as part of the amendment process.

Table 10: Summary of licence amendments

Condition no.	Proposed amendments
----	Updated cover page to reflect increase in Category 5 activity production capacity from 1,400,000 tonnes per annual period to 1,500,000 tonnes per annual period. Updated *Licence history* table to include this amendment.

Condition 1	Updated Table 1 to: • Include operational requirements for Tristar Sequential Batch Reactor WWTP; and • Amend irrigation area for the Waroonga Irrigation Sprayfield to '*at least*' four hectares.
Condition 2	Updated Table 2 to: • Increase operating height of Songvang In-pit TSF from RL 404.0 m to RL 422.0 m, and the use of bird deterrents from December to March; and • Include Barren Lands turkeys nest.
Condition 3	Updated Table 3 to: • Increase inspection frequency for bird or wildlife mortality from daily to twice daily during operation or during summer period (i.e., between December and March), with weekly inspection only permitted when infrastructure is not operating and during non-summer months (i.e., between March and December); • Include bird or wildlife mortality inspection at decant ponds and return water ponds.
Condition 10	Updated *Discharge point reference* and *Source including abatement* in Table 7 to reflect name of irrigation sprayfield.
Condition 11	Updated *Discharge point* in Table 8 to reflect name of irrigation sprayfield.
Condition 13	Updated *Discharge point reference* in Table 9 to reflect name of irrigation sprayfield.
Condition 14	Updated *Input/Output* in Table 10 to reflect name of irrigation sprayfield.
Condition 15	Updated Table 11 to: • Include weekly monitoring of dissolved arsenic at the decant (supernatant) pond of the Songvang in-pit TSF4; • Added *Note 6* to specify weekly monitoring frequency; and • Updated *Note 7* to specify requirement to monitoring metal and metalloid parameters in dissolved/filtered form, rather than total.
Condition 22	Updated Table 12 to: • Include summary of bird deterrents utilised, as required under condition 2.
Condition 25	Updated condition text to improve clarity. • Included Tristar Sequential Batch Reactor WWTP and construction/installation requirements in Table 14. • Removed Stage 1 – Tertiary crusher from Table 14 as it has been constructed and compliance has been demonstrated.
Condition 26	Updated condition text to improve clarity.
Condition 27	Updated condition text to improve clarity.
Condition 28	New condition and Table 15 to require specified actions for the implementation of proposed controls to manage birdlife death at the TSF, including: • Item 1: Undertake and complete pilot plant trial for ferrous sulfate addition to the tailings stream at the EMU processing plant; • Item 2: Upgrade Songvang TSF4 return water pump upgrade; • Item 3: Undertake aquatic macroinvertebrate sampling program at Redeemer TSF3 and Songvang TSF4 supernatant ponds; • Item 4: Submit wildlife monitoring report;

	• Item 5: Undertake a review of controls implemented to minimise or prevent wildlife death at the Songvang TSF4.
----	Updated Figure 6 in Schedule 1 to include the Tristar Sequential Batch Reactor WWTP. Removed figure in Schedule 2 to tertiary crusher infrastructure as it has been constructed and compliance has been demonstrated. Included Figure 8 in Schedule 2 to show design layout of Tristar Sequential Batch Reactor WWTP.

References

1. AECOM Australia Pty Ltd (AECOM) 2023, *Life of Mine Water Strategy Update – to 2029 Agnew Gold Operation*, 60678996_ENV_RPT_001v5, Perth, Western Australia.
2. ANZG 2018, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Governments and Australian state and territory governments, Canberra, Australian Capital Territory.
3. CMW Geosciences Pty Ltd (CMW) 2022, *Songvang TSF4 Geotechnical Assessment – Agnew Gold Mine, WA Study Report*, PER2018-0051AT Rev 2, Wembley, Western Australia.
4. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
5. Department of Health (DoH) 2006,
6. Department of Water (DoW) 2008, *Water Quality Protection Notice 22: Irrigation with nutrient-rich wastewater*, Perth, Western Australia.
7. Department of Water and Environmental Regulation (DWER) 2017, *Licence L4611/1987/11 Amendment Notice 1*, Perth, Western Australia.
8. DWER 2019, *Landfill Waste Classification and Waste Defitniions 1996 (as amended 2019)*, Perth, Western Australia.
9. DWER 2020a, *Guideline: Environmental Siting*, Perth, Western Australia.
10. DWER 2020b, *Guideline: Risk Assessments*, Perth, Western Australia.
11. DWER 2022, *Licence L4611/1987/11 Amendment Report*, Perth, Western Australia.
12. Golder Associates 2016, *Agnew Gold Mine – Design Report for In-pit Tailings Disposal at Songvang,* 1650018-001-R-Rev0, Perth, Western Australia.
13. Golder Associates 2018, *Gold Fields Australia: Stability Review of Songvang Open Pit for In-Pit Tailings Disposal*, Perth, Western Australia.
14. Gold Fields Australia 2022, *Tailings Storage Facility Operations Manual (TSF3 and 4) Version No. 10.0*, AGO-PRO-TRN016, Perth, Western Australia.
15. Mintrex 2023, *Agnew Tails Piping Bund Review*, Subiaco, Western Australia.
16. Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, Australian Health Ministers Conference (NRMMC) 2006, *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks*, National Water Quality Management Strategy, Canberra.
17. Rockwater Pty Ltd (Rockwater) 2022, *Agnew Gold Mine Songvang Pit – Assessment of Potential Impacts of In-Pit Tailings Disposal*, Report No. 549-0/22/01, Jolimont, Western Australia.
18. Wilson HM, Petersen MR & Troy 2004, *Concentrations of metals and trace elements in blood of Spectacled and King Eiders in northern Alaska, USA*, Environmental Toxicology and Chemistry, 23(2), pp. 408-414.

Appendix 1: Summary of Licence Holder's comments on risk assessment and draft conditions

Condition	Summary of Licence Holder's comment	Department's response
First draft amendment, provided on 20 July 2023		
Condition 1	Review of application information revealed an error in that the proposed replacement Tristar WWTP will service 250 personnel, not 550. Licence Holder requested this be amended in the licence and Amendment Report, where applicable. Licence Holder also confirmed that, while design throughput of the proposed WWTP system was based on a conservative allowance of 35,000 litres per day), the historical metre readings showed that the actual throughput has been significantly lower at 24,000 litres per day. As such, the system would have adequate holding capacity of at least two days in the smallest tank of the treatment train. The Licence Holder also specified the relevant tanks in the replacement Tristar WWTP system.	The department has specified the relevant tank infrastructure in Table 1 (i.e., *Infrastructure and equipment requirements*) and Table 14 (i.e., *Infrastructure construction requirements*). The department has also amended the Amendment Report text to specify this new information.
	The Licence Holder clarified that no sludge removal was required as the sludge will be dewatered and compressed into a spadable sludge cake. Licence Holder noted that this was not clear in the application information. Further information on the process of sludge treatment was provided, including proposed disposal at the Class II putrescible landfill site at the premises as a 'biosolids other than those categorised for unrestricted use'. Licence Holder requested that the existing requirement that '*sludge is contained within sealed sludge tanks prior to removal by a licensed waste contractor for disposal at an appropriately authorised facility*' be removed from the licence.	The department has replaced the existing requirement for offsite landfill disposal with the requirement to dewater the sludge and dispose at an appropriately licensed facility to provide flexibility on disposal locations. The department has also amended the Amendment Report text to specify this new information.
	The Licence Holder requested to amend the requirement to maintain four hectares for the Waroonga irrigation sprayfield, citing that while the four hectares are adequate for current usage, the sprayfield area may need to be	The department amended the requirement for the Waroonga irrigation sprayfield in Table 1 such that the irrigation area must be *'at least'* four hectares.

Condition	Summary of Licence Holder's comment	Department's response
	increased if the full design capacity of the replacement WWTP was used. The irrigation area may need to be increased in order to remain compliant with the loading rates for total nitrogen and phosphorus outlined in *Water Quality Protection Note 22* (DoW 2006).	The department has no significant concerns with the expansion of the irrigation sprayfield area to meet the requirements of the *Water Quality Protection Note 22*. However, the department notes that the loading rate limit is unlikely to be exceeded under the current maximum authorised throughput of 80 m^3/day.
Condition 2	The Licence Holder requested Table 2 be modified to remove reference to '*open pit operations'* at the Barren Lands Turkeys Nest in order to allow the infrastructure to also receive mine dewater from the Barren Lands underground operations.	The department has specified that the Barren Lands Turkeys Nest is authorised to accept mine dewater from both the open pit and underground operations at Barren Lands.
	The Licence Holder requested that requirements for bird deterrents at the Songvang in-pit TSF4 be added to Table 2.	The department has added the operation of gas cannons as bird deterrents in Table 2.
Condition 3	The Licence Holder requested the bird deterrents at the Songvang in-pit TSF2 be added as an inspection item in Table 3.	The department has specified the inspection of gas cannons in Table 3.
Condition 25	The Licence Holder requested that Table 14 be updated with the updated tank infrastructure components for the Waroonga WWTP.	The department has specified the relevant tank infrastructure in Table 14 (i.e., *Infrastructure construction requirements*). The department has also amended the Amendment Report text to specify this new information.
----	As requested by the department, the Licence Holder provided an updated Figure 6 and clarified infrastructure labels.	The department has replaced Figure 6 with the updated figure provided. The figure does not include new infrastructure and only clarifies infrastructure names.
----	The Licence Holder requested the removal of the following proposed controls from Table 4 of the Amendment Report: • Extraction boreholes may be commissioned to manage groundwater mounding, if standing water level rises above the trigger values; and • On temporary decommissioning, dust emissions will be managed using either water carts for dust suppression or hydromulching.	The department has removed these proposed controls from Table 4. The removal of these proposed controls did not alter the outcome of the risk assessment in Table 6.
Second draft amendment, provided on 15 September 2023		
Condition 2	In Table 2, the Licence Holder suggested alternative wording for requirements at the Songvang in-pit TSF, replacing 'gas cannons' with 'bird deterrents' and specifying daily monitoring period between December and	The department has amended the wording of the requirements, acknowledging that there may be other types of bird deterrents that could be utilised, in addition to gas cannons.

Condition	Summary of Licence Holder's comment	Department's response
	March.	Furthermore, the monitoring period has been specified in the requirements, such that bird deterrents are only required under the licence during the period of highest risk (i.e., when wildlife mortality has been recorded to date). In amending condition 2, the department has also amended condition 22 to require a summary of bird deterrents utilised during the annual period.
Condition 15	The Licence Holder requested the weekly monitoring of dissolved arsenic at the Songvang TSF4 supernatant pond be replaced with arsenic(V) as it is considered more soluble and toxic compared to arsenic(III).	The department sought clarification from the Licence Holder about this comment and proposed change was not consistent with the proposed control provided to the department previously. The Licence Holder responded with no issues to the inclusion of weekly dissolved arsenic monitoring at the Songvang TSF4 supernatant pond. Therefore, no changes were made.
Condition 28	For Item 2 of Table 15, the Licence Holder indicated that maintaining a specific pumping rate at a supernatant pond is not operationally practicable or safe during certain conditions. Understanding the intent of the specified action to reduce the supernatant pond size at Songvang TSF4, the Licence Holder proposed alternative reporting requirements.	The department replaced the draft reporting requirements with those proposed by the Licence Holder. The timeframe for the specified action has also been amended accordingly.
	For Item 5 of Table 15, the Licence Holder requested 'gas cannon' be changed to 'bird deterrent' to reflect changes made to condition 2. Furthermore, the Licence Holder proposed alternative wording for the third requirement, requiring a review of the overall effectiveness of the implemented program of controls, rather than individual controls, as the latter is difficult to assess when all controls are operational simultaneously.	The department has replaced the draft reporting requirements with those proposed by the Licence Holder.

Appendix 2: Application validation summary

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)					
Application type					
Works approval	☐				
Licence	☐	Relevant works approval number:		None	☐
		Has the works approval been complied with?		Yes ☐ No ☐	
		Has time limited operations under the works approval demonstrated acceptable operations?		Yes ☐ No ☐ N/A ☐	
		Environmental Compliance Report / Critical Containment Infrastructure Report submitted?		Yes ☐ No ☐	
		Date Report received:			
Renewal	☐	Current licence number:			
Amendment to works approval	☐	Current works approval number:			
Amendment to licence	☒	Current licence number:	L4611/1987/11		
		Relevant works approval number:		N/A	☒
Registration	☐	Current works approval number:		None	☐
Date application received		30 January 2023			
Applicant and Premises details					
Applicant name/s (full legal name/s)		Agnew Gold Mining Company Pty Ltd (AGMC)			
Premises name		Agnew Gold Mine			
Premises location		Leinster WA 6437 Mining tenements: 1. M36/27 2. M36/32 3. M36/53 4. M36/55 5. M36/65 6. M36/150 7. M36/174 8. M36/248 9. M36/314 10. M36/450 No change in premises boundary was requested in this application.			

Local Government Authority	Shire of Leonora
Application documents	
HPCM file reference number:	2012/006836-1
Key application documents (additional to application form):	• Prescribed Premise Category Changes Licence L4611/1987/11 Amendment Application Attachments • Lone Star Survey – Remaining Capacity Volume (Songvang In-Pit TSF4) • Rockwater Assessment of Potential Impacts of In-Pit Tailings Disposal
Scope of application/assessment	
Summary of proposed activities or changes to existing operations.	***Licence amendment*** Category 5: • Increase Category 5 production capacity from 1.4 mtpa to 1.5 mtpa; • Operation of tertiary crushing circuit and upgraded tailings pipeline; • Increase operating height of Songvang TSF4 from RL 404.0 m to RL 422.0 m. Category 6: • Increase Category 6 production capacity from 2.0 mtpa to 3.5 mtpa; • Operate Barren Lands turkeys nest to store mine dewater from Barren Lands open pit; • Construct and operate dewatering pipeline from Barren Lands turkeys nest to Crusader Complex pits. Category 52: • Addition of Category 52: Electric power generation to the licence; • Operate Agnew Power Station, constructed under W6757/2022/1. Category 85: • Construct and operate new Tristar Sequential Batch Reactor WWTP, to replace existing Biomax WWTP *Greyed text indicates that this activity was removed from the scope of the amendment during assessment.

Category number/s (activities that cause the premises to become prescribed premises)

Table 1: Prescribed premises categories

Prescribed premises category and description	Assessed production or design capacity	Proposed changes to the production or design capacity (amendments only)
Category 5: Processing or beneficiation of metallic or non-metallic ore	1,400,000 tpa	1,500,000 tpa
Category 6: Mine dewatering	2,000,000 tpa	3,500,000 tpa[1]
Category 52: Electric power generation	Not authorised under existing licence	26 MW[1]
Category 85: Sewage facility	80 m^3/day	No change
Category 89: Putrescible landfill site	4,000 tpa	No change

Note 1: These proposed changes to the production capacity were subsequently removed from the scope of the amendment during assessment.

Legislative context and other approvals

Has the applicant referred, or do they intend to refer, their proposal to the EPA under Part IV of the EP Act as a significant proposal?	Yes ☐ No ☒	N/A
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes ☐ No ☒	N/A
Has the proposal been referred and/or assessed under the EPBC Act?	Yes ☐ No ☒	N/A
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes ☐ No ☒	Not required for amendment. No new tenements added to the licence.
Has the applicant obtained all relevant planning approvals?	Yes ☐ No ☐ N/A ☒	Approvals are managed by DMIRS under the *Mining Act 1978*.
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes ☐ No ☒	No clearing is proposed.
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes ☐ No ☒	No clearing is proposed.

Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes ☒ No ☐	Licence/permit No: GWL64335, GWL55840, GWL151398, GWL63840
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes ☒ No ☐	Name: Goldfields Groundwater Area Type: Proclaimed Groundwater Area Has Regulatory Services (Water) been consulted? Yes ☐ No ☒ N/A ☐
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes ☐ No ☒	N/A
Is the Premises subject to any other Acts or subsidiary regulations?	Yes ☒ No ☐	• Mining Act 1978 • Mine Safety and Inspection Act 1994 • Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974 • Dangerous Goods Safety Act 2004
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes ☐ No ☒	N/A
Is the Premises subject to any EPP requirements?	Yes ☐ No ☒	N/A
Is the Premises a known or suspected contaminated site under the *Contaminated Sites Act 2003*?	Yes ☐ No ☒	N/A