Government of Western Australia
Department of Environment Regulation

Partial Decision Document

Environmental Protection Act 1986, Part V

Proponent: Fox Radio Hill Pty Ltd

Licence: L7922/1989/5

Registered office:	10 Abbotsford Street WEST LEEDERVILLE WA 6008
ACN:	092 493 653
Premises address:	Radio Hill Mine Site Mining Lease M47/161 and M47/337 KARRATHA WA 6714
Issue date:	Thursday, 14 June 2012
Commencement date:	Thursday, 21 June 2012
Expiry date:	Monday, 20 June 2016

Decision

Based on the assessment detailed in this document the Department of Environment Regulation (DER), has decided to issues an amended licence. DER considers that in reaching this decision, it has taken into account all relevant considerations.

Decision Document prepared by:	Ty Hibberd Licensing Officer
Decision Document authorised by:	Alana Kidd Manager Licensing

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1 Purpose of this Document

This decision document explains how DER has assessed and determined the application and provides a record of DER's decision-making process and how relevant factors have been taken into account. Stakeholders should note that this document is limited to DER's assessment and decision making under Part V of the *Environmental Protection Act 1986.* Other approvals may be required for the proposal, and it is the proponent's responsibility to ensure they have all relevant approvals for their Premises.

2 Administrative summary

Administrative details		
Application type	Works Approval ☐ New Licence ☐ Licence amendment ☒ Works Approval amendment ☐	
Activities that cause the premises to become prescribed premises	**Category number(s)**	**Assessed design capacity**
	5	50,000 tonnes per year
	6	50,000 tonnes per year
	85	45 cubic metres per day
Application verified Application fee paid	Date: N/A Date: N/A	
Works Approval has been complied with Compliance Certificate received	Yes☐ No☐ N/A☒ Yes☐ No☐ N/A☒	
Commercial-in-confidence claim	Yes☐ No☒	
Commercial-in-confidence claim outcome		
Is the proposal a Major Resource Project?	Yes☒ No☐	
Was the proposal referred to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986*?	Yes☐ No☒	Referral decision No: Managed under Part V ☐ Assessed under Part IV ☐
Is the proposal subject to Ministerial Conditions?	Yes☐ No☒	Ministerial statement No: EPA Report No:
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the *Environmental Protection Act 1986*)?	Yes☐ No☒ Department of Water consulted Yes ☐ No ☒	
Is the Premises within an Environmental Protection Policy (EPP) Area Yes☐ No☒ If Yes include details of which EPP(s) here.		
Is the Premises subject to any EPP requirements? Yes☐ No☒ If Yes, include details here, eg Site is subject to SO_2 requirements of Kwinana EPP.		

3 Executive summary of proposal and assessment

Fox Radio Hill Pty Ltd (Fox) operates the Radio Hill mine site (Radio Hill) approximately 25km south of Karratha in the West Pilbara region of Western Australia. Radio Hill is an underground mine focussed on the production of medium to low grade nickel and copper sulphide ore. When operational, ore is trucked from the underground mine to the surface and fed through the ore treatment plant. Waste material is placed on the mullock dump or where possible used as slope fill. Ore processing at Radio Hill involves crushing, mechanical floatation, concentrate thickening, filtration and tailings disposal.

The main components of Radio Hill include:

- underground mining operations;
- a mullock dump for the underground waste rock;
- a Run-of-Mine (ROM) ore pad;
- open cut Trial Pit and associated waste dump;
- a processing plant including crushing, grinding, floatation, thickening and filtration units;
- three Tailings Storage Facilities (TSF1, TSF2 and TSF3), of which TSF1 and 2 have been decommissioned;
- a borrow pit;
- a water containment dam (environmental dam);
- water supply from the southern and mine borefields and associated pipelines;
- haul roads and other site access roads;
- a scats stockpile;
- administrative buildings, workshops and laydowns area;
- Radio Hill accommodation camp; and
- Radio Hill Wastewater Treatment Plant (WWTP) and an adjacent 1.7 hectare irrigation field. .

Radio Hill has been in care and maintenance (C&M) since 2008.

This amendment has been initiated to extend the licence duration to 20 June 2016, as licence L7922/1989/5 was due to expire on 20 November 2015. Upon recieval of outstanding information, DER will undertake an evaluation and assessment of the premises in accordance with Part V of the *Environmental Protection Act 1986* with a view to re-issue the licence (version: L7922/1985/6) in June 2016.

As part of this amendment the Licence was converted to version 2.9. In addition, at the request of the Licensee (Form P4 dated 27/10/2014) the monitoring frequency for groundwaters was reduced from quarterly to six-monthly and visual inspections of the TSF from 12-hourly to weekly whilst in C&M. These changes were determined based on a review of the groundwater monitoring report requested of improvement condition 39 of the preceding Licence version, and consideration of the site being in C&M.

The following changes have been made to the licence during this amendment:

- Conversion to the version 2.9 template;
- Addition of definitions;
- Previous conditions 5, 14 and 15 are now covered by L1.3.3 and L1.3.4;
- Previous conditions 6, 7, 8, 9, 10, 13 are now covered by L1.2.2 and L1.2.3;
- Previous conditions 9, 10 and 18 are now covered by L1.3.5;
- Previous conditions 11, 12, 17 and 31 are now covered by conditions L2.2.1 and L2.2.2;

- Previous conditions 19, 20 and 21 are now covered by condition L3.3.1. At the request of the Licensee (Form P4 dated 27/10/2014) the monitoring frequency visual inspections of the TSF was changed from 12-hourly to weekly whilst in C&M;
- Previous conditions 24, 25, 28 and 30 are now covered by condition L3.2.1;
- Previous conditions 32 and 33 are now covered by condition L3.1.1;
- Previous conditions 22, 23, 34, 35 and 36 are now covered by condition L3.4.1. At the request of the Licensee (Form P4 dated 27/10/2014) the monitoring frequency for groundwaters was reduced from quarterly to six-monthly whilst in C&M;
- Previous conditions 37 and 38 are now covered under conditions L4.1.3, L4.1.4 and Table 4.2.1;
- Conditions L1.3.1, L1.3.2, L2.1.1, L3.1.2, L3.1.3, L3.1.4 and L4.2.3 have been added to the licence; and
- Previous conditions 1, 2, 3 , 4, 11, 12, 13, 16, 26, 27, 29 and 39 have been removed

Where conditions have been added or removed from the existing licence these have been justified in Section 4.

4 Decision table

All applications are assessed in line with the *Environmental Protection Act 1986*, the *Environmental Protection Regulations 1987* and DER's Operational Procedure on Assessing Emissions and Discharges from Prescribed Premises. Where other references have been used in making the decision they are detailed in the decision document.

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
General conditions	L1.2.1 – L1.2.3.	Previous conditions 6, 7, 8, 9, 10, 13 are now covered by L1.2.2 and L1.2.3. Previous conditions 11, 12 and 13 relating to the storage of environmentally hazardous liquid chemicals have been removed. Storage of these substances is adequately regulated by the Code of Practice for the Storage and Handling of Dangerous Goods.	General provisions of the *Environmental Protection Act 1986*. *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007*
Premises operation	L1.3.1 – L1.3.5.	L1.3.1 has been added to the licence to ensure Fox record and investigate any exceedances of a descriptive or numerical limit in this section. L1.3.2 had been added to stipulate processing limits for categories 5, 6 and 85. Previous conditions 5, 14 and 15 are now covered by L1.3.3 and L1.3.4 which specify the requirements for containment infrastructure and management of waste onsite. Previous conditions 9, 10 and 18 are now covered by L1.3.5. Previous condition 16 has been removed since the Licence is related to emissions of dewatering water not abstraction.	General provisions of the *Environmental Protection Act 1986*.

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Emissions general	L2.1.1.	L2.1.1 has been added to the licence to ensure Fox record and investigate any descriptive or numerical limit for section 2 of the licence.	N/A.
Point source emissions to air including monitoring	L2.2.1 and L2.2.2.	Previous conditions 11 and 12 are now covered by conditions L2.2.2 and L2.2.1.	General provisions of the *Environmental Protection Act 1986*.
Emissions to land including monitoring	L2.3.1, L2.3.2 and L3.2.1.	Previous conditions 17 and 31 are now covered by conditions L2.2.1 and L2.2.2. Previous conditions 24, 25, 28, 29 and 30 are now covered by condition L3.2.1. Previous conditions 26 and 27 have been removed in line with version 2.9 of the licence template. Irrigation of treated effluent is considered a low risk for Radio Hill given the small size of the WWTP, current occupation of the mine camp (3 personnel whilst in C&M), location of the Premises and distance to the nearest sensitive receptor. As such the irrigation of treated effluent at Radio Hill can be sufficiently regulated under section 49 of the *Environmental Protection Act 1986*.	General provisions of the *Environmental Protection Act 1986*.
Fugitive emissions	N/A.	Previous conditions 1, 2 and 3 have been removed. Fugitive emissions of dust are considered a low risk given the location of the Premises and distance to the nearest sensitive receptor, as such fugitive emissions can be sufficiently regulated under section 49 of the *Environmental Protection Act 1986*.	General provisions of the *Environmental Protection Act 1986.*
Odour	N/A.	Previous condition 4 has been removed. Fugitive emissions of odour are considered a low risk given the location of the Premises and distance to the nearest sensitive receptor, as such fugitive emissions can be sufficiently regulated under section 49 of the *Environmental Protection Act 1986*.	General provisions of the *Environmental Protection Act 1986.*

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Monitoring general	L3.1.1 – L3.1.4	Previous conditions 32 and 33 are now covered by condition L3.1.1. L3.1.2, L3.1.3 and L3.1.4 have been added to the Licence to provide definitions for monitoring frequency and to ensure monitoring equipment are appropriately calibrated.	General provisions of the *Environmental Protection Act 1986.*
Process monitoring	L3.3.1	Previous conditions 19, 20 and 21 are now covered by condition L3.3.1. At the request of the Licensee (Form P4 dated 27/10/2014) the monitoring frequency for visual inspections of the TSF was changed from 12-hourly to weekly. The DER, after visiting the Premises on 13 October 2015, and giving consideration that the TSFs are not in use, has determined that a weekly inspection frequency is adequate to identify any potential environmental concerns.	General provisions of the *Environmental Protection Act 1986.*
Ambient quality monitoring	L3.4.1	Previous conditions 22, 23, 34, 35 and 36 are now covered by condition L3.4.1. At the request of the Licensee (Form P4 dated 27/10/2014) the monitoring frequency for groundwaters was reduced from quarterly to six-monthly. The DER, after review of the groundwater monitoring report requested of improvement condition 39 of the preceding Licence version, has determined that a six-monthly monitoring frequency is adequate to evaluate any change in groundwater quality.	General provisions of the *Environmental Protection Act 1986.* Report on assessment of ground water quality and sources of contamination Radio Hill Nickel Project, WA (Stass Environmental, August 2015)
Improvements	N/A.	Previous condition 39 was removed as this improvement condition was adequately addressed by Fox in a report compiled by Stass Environmental, titled “Report on assessment of ground water quality and sources of contamination Radio Hill Nickel Project, WA” (August 2015).	Report on assessment of ground water quality and sources of contamination Radio Hill Nickel Project, WA (Stass Environmental, August 2015)

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Information	L4.1.1 – L4.1.4, L4.2.1 – 4.2.3 and 4.3.1.	Previous conditions 37 and 38 are now covered under conditions L4.1.3, L4.1.4 and Table 4.2.1. A requirement has been added to condition 4.2.3, Table 4.2.2, requiring the Licensee to prepare and submit an updated groundwater quality report by 20 May 2016. This report should include the most recent monitoring data, and provide a comparison of this data against previous results as detailed in the report compiled by Stass Environmental, titled "*Report on assessment of ground water quality and sources of contamination Radio Hill Nickel Project, WA*" (August 2015). A requirement has been added to notify DER of the intention for the site to recommence normal operations from C&M status to ensure DER has sufficient time to carry-out any required amendments to this Licence.	Report on assessment of ground water quality and sources of contamination Radio Hill Nickel Project, WA (Stass Environmental, August 2015)
Licence Duration	N/A.	The licence has been extended until 20 June 2016. This extension will allow the Licensee to prepare and submit the required reports and DER to then undertake an evaluation for the licence reissue without having the licence lapse.	N/A.

5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
5/11/2015	Proponent sent a copy of draft instrument	Nil comments. Waiver form received 10 November 2015.	N/A.

6 Risk Assessment

Note: This matrix is taken from the DER Corporate Policy Statement No. 07 - Operational Risk Management

Table 1: Emissions Risk Matrix

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

Government of Western Australia
Department of Water and Environmental Regulation

Amendment Notice 1

Licence Number	L7922/1989/5
Licence Holder	Fox Radio Hill Pty Ltd
ACN	092 493 653
File Number:	DER2014/001066
Premises	Radio Hill Mine Site Mining tenements M47/161 and M47/337 KARRATHA WA 6714
Date of Amendment	**16 August 2018**

Amendment

The Chief Executive Officer (CEO) of the Department of Water and Environmental Regulation (DWER) has amended the above Licence in accordance with section 59 of the *Environmental Protection Act 1986* (EP Act) as set out in this Amendment Notice. This Amendment Notice constitutes written notice of the amendment in accordance with section 59B(9) of the EP Act.

Date signed: 16 August 2018

Manager, Resource Industries

an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Definitions and interpretation

Definitions

In this Amendment Notice, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
AACR	Annual Audit Compliance Report
ACN	Australian Company Number
Amendment Notice	refers to this document
Category/ Categories/ Cat.	categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CEO	means Chief Executive Officer. CEO for the purposes of notification means: Director General Department Administering the *Environmental Protection Act 1986* Locked Bag 33 Cloisters Square PERTH WA 6850 info@dwer.wa.gov.au
CS Act	*Contaminated Sites Act 2003* (WA)
Delegated Officer	an officer under section 20 of the EP Act
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
HDPE	High Density Polyethylene
Licence Holder Licensee	Fox Radio Hill Pty Ltd
m^3	cubic metres
mtpa	million tonnes per annum
Occupier	has the same meaning given to that term under the EP Act.
Prescribed Premises	has the same meaning given to that term under the EP Act.
Premises	refers to the premises to which this Decision Report applies, as specified at

	the front of this Decision Report.
Risk Event	as described in *Guidance Statement: Risk Assessment*

Amendment Notice

This amendment is made pursuant to section 59 of the *Environmental Protection Act 1986* (EP Act) to amend the Licence issued under the EP Act for a prescribed premises as set out below. This notice of amendment is given under section 59B(9) of the EP Act.

This notice is limited only to an amendment for Category 5. No changes to the aspects of the original Licence relating to Categories 6 or 85 have been requested by the Licence Holder.

The following guidance statements have informed the decision made on this amendment:

- *Guidance Statement: Regulatory Principles (July 2015)*
- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessment (February 2017)*
- *Guidance Statement: Environmental Siting (November 2016)*

Amendment description

An application for an amendment to Licence L7922/1989/5 was received by the Department of Water and Environmental Regulation (DWER) on 23 April 2018.

Fox Radio Hill Pty Ltd (Licence Holder) is wholly owned by Artemis Resources Ltd. The Licence Holder proposes to construct and commission a new gravity gold circuit as a first stage in the recommencement of operations at the Radio Hill Mine Site. The site has been in care and maintenance since 2008 and formerly produced nickel and copper concentrate.

As part of this amendment, the Licence Holder seeks to increase the approved throughput capacity from 50 000 tonnes per annum (tpa) to 500 000 tpa.

Table 2 below outlines the proposed changes to the Licence.

Table 2: Proposed throughput capacity changes

Category	Current throughput capacity	Proposed throughput capacity	Description of proposed amendment
5	50 000 tonnes per annual period	500 000 tonnes per annual period	The Gekko gold plant has a design capacity of 525 600 tonnes per annual period based on the plant operating 24 hours a day (60 tonnes per hour). The proposed throughput is 500 000 tonnes per annum.

Background

The licence amendment is for the first stage of a two-stage plan for the operations at Fox Radio Hill. The Stage 1 activities include the installation and operation of a modular gravity gold processing unit and associated crushing and milling equipment at the site, to enable to recovery of gold nuggets and coarse free gold.

The infrastructure proposed includes:

- A cone crusher (tertiary crusher)
- A gold gravity concentration circuit (Gekko gold plant) for mechanical removal of gold from up to 500,000 tpa of gold ore
- A gold room to produce gold bars
- Cyclone and dewatering screen for courser gold-bearing intermediate product
- A thickener and geofabric filters (geotubes) for finer gold-bearing intermediate product and to allow water to be recovered.

This infrastructure will be operated with the existing multistage crushing and grinding plant (primary and secondary crushers) which are already approved under Licence L7922/1989/5. The existing flotation circuit and associated infrastructure, including the tailings storage facility are to remain in care and maintenance.

Stage 1 process description

The gravity gold separation process (Stage 1) is to extract gold nuggets and free coarse gold (gold particles sized at 0.04 millimetres (mm) or higher) from crushed ore. The gravity gold plant has two outputs; primary gold concentrate and intermediate gold-bearing product. The intermediate gold-bearing product (sized under 0.04 mm) will be dewatered/filtered prior to being stored for future processing during Stage 2 of the operation, yet to be approved under a future works approval application. No tailings will be produced from the Stage 1 process.

Stage 1 process overview

The Stage 1 process includes:

- Crushing of ROM gold ore to 20 mm via the existing primary and secondary crushers, and then down to 10 mm via the new tertiary cone crusher.
- Removal of large gold nuggets before milling the ore down to 0.04 mm size.
- Removal of coarse free gold by using a modular gravity gold plant, which is then refined into gold bars in the gold room, along with the large gold nuggets.
- Dewatering/filtering of intermediate gold-bearing product from the gravity gold process.
- Storage of dewatered/filtered intermediate product (fine and coarse) for future processing, when Stage 2 approvals are in place (subject of future works approval application).

Dewatering/filtering of intermediate gold-bearing product

Intermediate gold-bearing product from the gravity gold separation process will report to a dewatering and filtering circuit with 3 parts:

- Part 1 –a hydrocyclone separator and dewatering screen will remove coarse sand to produce a filter cake (coarser intermediate gold-bearing product) which will then be stockpiled and allowed to drain on a concrete pad (coarse intermediate gold-bearing product storage area 1). Drained material that is not saturated will be removed via front-end loader on a regular basis to a stockpile area behind the ROM pad. Any undersized fine gold ore slurry is directed to the thickener.
- Part 2 – dewatering of undersized fine gold ore slurry produced from the hydrocyclone separator and dewatering screen. This slurry is directed to a high rate thickener where flocculent (BASF Magnafloc 155) is added at a rate of 477 kg/month. Water removed is directed to process water tank for reuse in the gravity circuit.

- Part 3 - The thickened fine sand solids report to the thickener underflow and are then pumped to geofabric filter (geotube) system. The geotube filter system consists of 34 geotubes in four layers. 6 geotube filters will be in operation at any one time. Each geotube is filled on rotation to allow the other five geotubes to drain whilst the active unit is being filled. Once the capacity of the tube is reached, the material will remain in the geotubes until Stage 2 infrastructure is in place. Any filtrate (drainage) generated from the geotubes will be captured and directed back to the thickener.

Intermediate product in the geotubes (fine intermediate gold-bearing product) and stockpiled material (coarser intermediate gold-bearing product) will remain in these locations until Stage 2.

The key components of the gravity gold mechanical separation process are illustrated schematically in Figure 1.

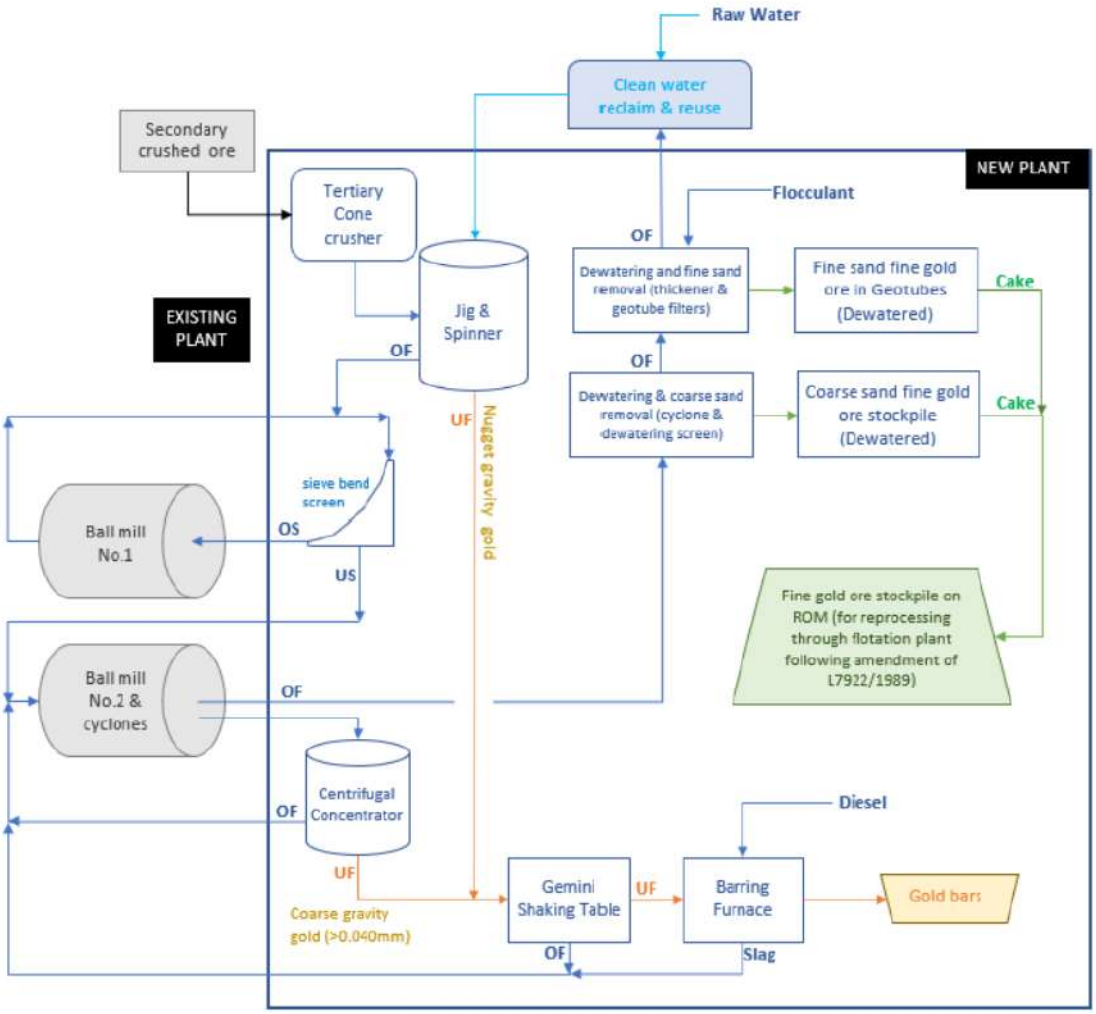


Figure 1: Key components of the gravity gold mechanical separation process

Chemical storage and ancillary infrastructure

The only chemicals reagents used in the process is BASF Magnafloc 155 which is to be used as a flocculent in the thickener at a rate of 477 kg/month. The material safety data sheet provides ecological information on the reagent. It is toxic to fish and invertebrates at concentration of 100 mg/L. It should not be discharged to drains, surface waters or groundwater.

A 20 000 Kilolitre diesel self-bunded storage tank will be located in the existing fuel farm.

Electric power to operate the facility will be sourced from the Horizon Power – North West Interconnected System.

Construction and installation

The location of the infrastructure to be installed is depicted in Figure 2.

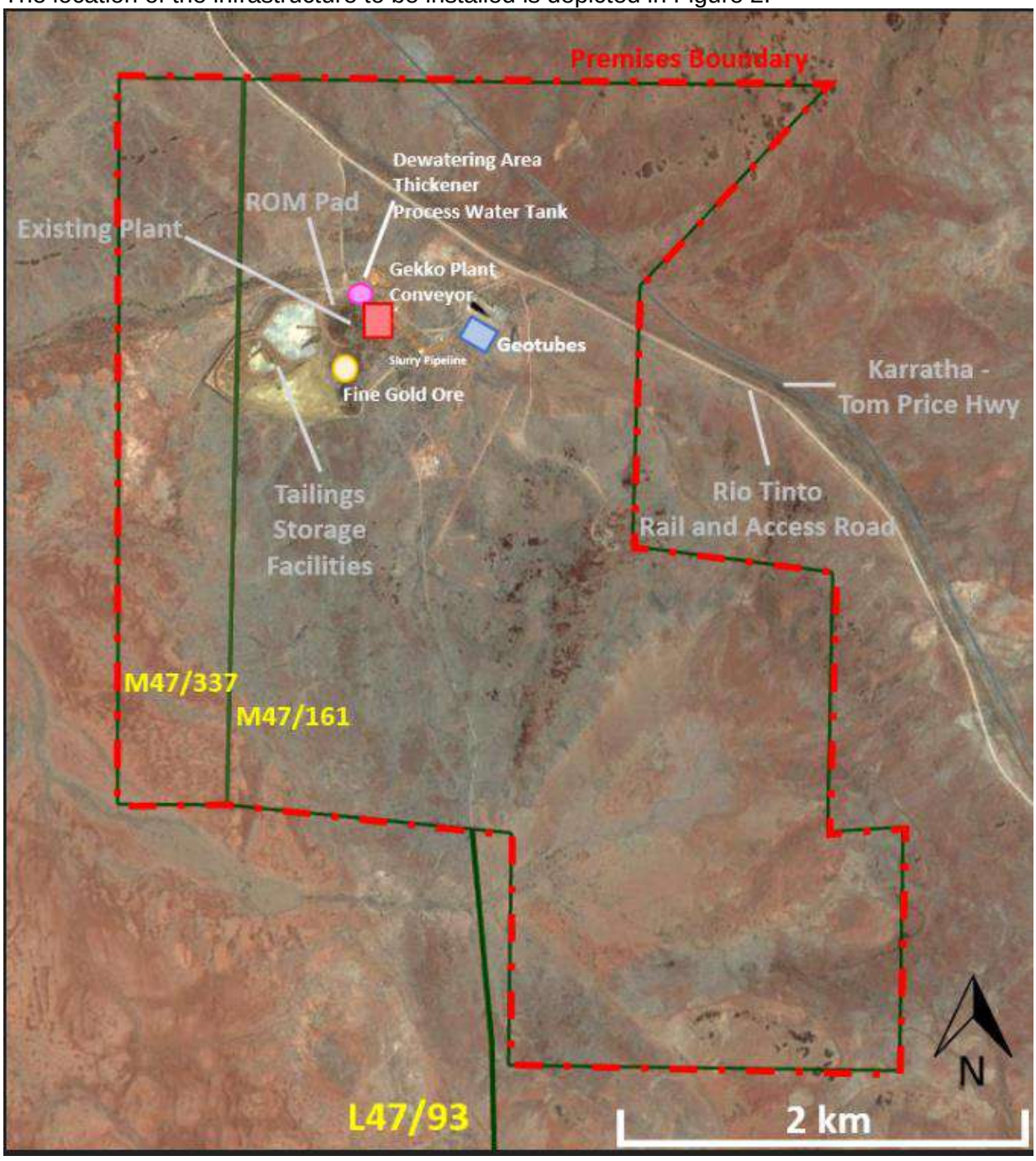


Figure 2: Location of site infrastructure

Cone crusher

The cone crusher will be installed adjacent to the primary and secondary crushers (existing plant in Figure 2).

Gravity gold plant

The gravity gold modular units will be transported as containerized and/or skid mounted units to site and assembled. The gravity gold plant required minimal installation time and is likely to take approximately 4 weeks. The plant will be located within a concrete bunded area. Drainage will be captured via concrete sumps and directed back into the process.

Dewatering infrastructure (hydrocyclone, dewatering screen, thickener and process water tank)

This infrastructure will be transported to site for construction and installation. The equipment will be installed within a concrete bunded area. Drainage will be directed to a concrete lined sump. Any drainage collected will be pumped back into the thickener.

Process water from the thickener that is captured in thickener troughs will be directed to the process water tanks for recycling through the process.

A conveyor will be installed to direct coarse intermediate gold-bearing product from the hydrocyclone and dewatering screen to the coarse intermediate product storage area 1.

Slurry pipeline and return water pipeline

Slurry (from the thickener underflow) pipeline and return water pipeline will be constructed between the thickener and the geofabric filters (geotubes). The HDPE pipeline will be constructed within a v-drain. The return water will be redirected back into the thickener. The v-drain will include sumps sized to contain up to 12 hours of thickener underflow production.

The pipelines will be installed with two flow meters; one immediately at the thickener underflow pump and the other at the geotube filter site which are linked to a differential flow alarm, connected to a control room.

Coarser intermediate gold-bearing product stockpile area 2

A concrete pad (approximately 25m by 25m) will be constructed with drainage directed to a concrete lined sump with drainage pumped back to the thickener.

Coarse intermediate gold-bearing product stockpile area 2

Intermediate product stockpile area is approximately 1.2 ha in size and will be located at the back of the ROM. The base of the stockpile storage area will be compacted and built up with 300 to 500 m of borrow material. The pad will have perimeter drainage and windrows to prevent clean stormwater entering the storage area.

The area will be levelled and graded to slope northwest towards the existing ROM surface water interception drains (unlined). These interception drains report to the existing environmental dam. The environmental dam is HDPE lined.

Geofabric filters (geotubes)

The geotubes will be installed in a flat area approximately 350 m east of the gravity gold plant, adjacent to the old open cut pit (referred to as the box cut in Figure 2). The geofabric filters (geotubes) will be placed on a HDPE base.

The area (200m long by 50 m wide) will be graded to provide drainage to one corner where filtrate from the geotubes will be captured within a concrete lined sump. The filtrate is returned back to the thickener by the return water pipeline.

A 1 metre high windrow will be installed around the facility to divert clean stormwater around the facility.

Diesel and chemical storage

A 20,000 litre self-bunded diesel storage tank will be located at the existing fuel farm.

A 1,000 L self-bunded header tank will be located adjacent to the gold room to directly supply

diesel fuel to the furnace.

Powdered Magnafloc will be delivered in 1 m^3 bulk bags and loaded directly into the 7 m^3 bulk storage hopper at the flocculent plant. The hopper holds approximately 6 months of usage.

Geochemical characterisation of the intermediate coarse fine gold product

A geochemical characterization of a representative sample of the intermediate coarse fine gold product which is to be stored on site has been undertaken. The sample was subject to:

- Mineralogy analysis:
- Acid base accounting;
- ASLP leach testing; and
- LEAF 1313 testing.

Mineralogy

The x-ray diffraction mineralogy analysis has indicated that the material is mostly made of quartz (SiO_2) with 20% muscovite.

Acid base accounting

The acid base accounting (ABA) results are provided in Table 3.

Table 3: Acid base accounting results

Misc. Inorganics in Soil Sample No: Sample Description: Sample Date:	LOR	UNITS	18-03506-A-1 Gold Ore P80 0.106mm WT Tail 8/03/2018
Sulphur	0.05	% w/w	<0.05
Acid Neutralising Capacity BT (19A2)	2	KgH2SO4/t	75
Maximum Potential Acidity	2	kgH2SO4/t	<2
Net Acid Producing Potential	2	kgH2SO4/t	<2
Net Acid Generation to pH 4.5	2	kgH2SO4/t	<2
Net Acid Generation to pH 7.0	2	kgH2SO4/t	<2
NAG pH	0.1	pH units	9.0

The results indicate that this material is likely to be non-acid forming. This is because the potential acid forming potential is less than 2 kg/tonne of sulphuric acid whereas the material has an acid neutralization capacity equivalent to 75kg/ton of sulphuric acid. Furthermore, the NAG pH value after peroxide treatment is 9.

ASLP leach testing

A single representative sample was submitted for leachate testing using the ASLP leaching procedure. The results are provided in Table 4 below. A comparison has been made to the 95% trigger values for freshwaters and livestock drinking water values in ANZECC/ARMCANZ 2000. Any results that exceed the 95% protection level are highlighted in red. No results exceed the livestock drinking water values. DWER notes that the ASLP testing involves using organic

acids at pH 5. The rainwater infiltrating through the material is likely to be pH 6.5.

Table 4: Results of ASLP leachate testing

Parameter	LOR (of laboratory used) (mg/L)	Representative sample (mg/L)	ANZECC/ ARMCANZ freshwater 95% trigger values (mg/L)	ANZECC/ ARMCANZ livestock drinking water values (mg/L)
Aluminium	0.1	<0.1[1]	0.055	5
Arsenic	0.001	<0.001	0.013	0.5
Boron	0.05	0.83	0.37	5
Barium	0.01	0.73	-	-
Beryllium	0.01	<0.01	-	-
Cadmium	0.002	0.004	0.0002	0.01
Cobalt	0.01	<0.01	-	1
Copper	0.01	0.04	0.0014	0.4 (sheep)
Chromium	0.01	<0.01[1]	0.001	1
Lead	0.01	0.01	0.0034	0.1
Mercury	0.0002	<0.0002	0.0006	0.002
Manganese	0.01	1.3	1.9	-
Molybdenum	0.01	<0.01	-	0.15
Nickel	0.01	0.05	0.011	1
Selenium	0.01	<0.01	0.011	0.02
Silver	0.01	<0.01[1]	0.00005	-
Vanadium	0.01	<0.01	-	-
Zinc	0.01	0.04	0.008	20

Note 1: the results provided are not a sufficient detection level to provide a comparison against ANZECC/ARMCANZ 2000 95% trigger values for freshwater ecosystem.

LEAF 1313 leachate testing

The Licence Holder has undertaken a geochemical assessment of the gold ore feedstock. The results at pH 7 are all equal to or below the 95% protection trigger values for freshwater ecosystems in ANZECC/ARMCANZ 2000 with the exception of silver which is not at a sufficient detection level to allow a comparison.

Process water

The gravity gold processing plant will operate as a closed circuit (no discharge of water) with make-up water from abstraction estimated at 6.5 m^3/hr.

Water sourced from bore RHW6D under groundwater licence GWL155914 is to provide the make-up water in addition to water returned from the dewatered stockpiles and geotubes.

The quality of the groundwater is provided in Table 5.

Table 5: Water quality of process water sourced from groundwater bore RHW 6D.

RHW 6D						
Parameter	**ANZECC (2000) Livestock**	**23-Mar-16**	**21-Nov-16**	**20-Mar-17**	**19-Jul-17**	**21-Mar-18**
pH	N/A	6.3	8.2	7.7	7.7	7.5
EC (uS/cm)	N/A	1100	910	670	1100	1300
TDS (mg/L)	5000	670	550	400	650	750
SO4 (mg/L)	1,000	270	8	25	42	48
Ag (mg/L)	N/A	<0.001	<0.01	<0.001	<0.001	<0.01
Al (mg/L)	5	<0.01	<0.1	<0.01	<0.01	<0.1
As (mg/L)	0.5	<0.001	<0.05	<0.001	<0.001	<0.05
Cd (mg/L)	0.01	<0.0001	<0.01	<0.0001	<0.0001	<0.01
Co (mg/L)	1	<0.001	<0.01	<0.001	<0.001	<0.01
Cr (mg/L)	1	<0.001	<0.01	<0.001	<0.001	<0.01
Cu (mg/L)	0.4	<0.001	<0.01	0.001	0.003	0.01
Fe (mg/L)	N/A	46	0.06	0.17	0.4	<0.02
Pb (mg/L)	0.1	<0.001	<0.03	<0.001	<0.001	<0.03
Mg (mg/L)	N/A	31	24	27	54	59
Mn (mg/L)	N/A	0.4	0.11	0.041	0.068	<0.01
Hg (mg/L)	0.002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Ni (mg/L)	1	0.009	<0.02	<0.001	0.001	<0.02
Se (mg/L)	0.02	<0.001	<0.12	<0.001	<0.001	<0.1
Zn (mg/L)	20	0.008	<0.02	0.009	0.015	0.05

The process water sourced from RHW 6D is equal to or less than the 95% protection level where available, and the livestock drinking water guidelines in ANZECC/ARMCANZ 2000.

Contaminated sites

Mining tenement M47/161 is classified as possible *contaminated – investigation required* under the *Contaminated Sites Act 2003*. The nature and extent of the contamination is nickel and sulphate plume over the majority of the mining area.

In accordance with Department of Health advice, if groundwater is being or is proposed to be abstracted, it is recommended that analytical testing should be carried out to determine whether the groundwater is suitable for its intended use.

Other approvals

The Licence Holder has provided the following information relating to other approvals as outlined in Table 6.

Table 6: Relevant approvals

Legislation	Number	Approval
Rights in Water and Irrigation Act 1914.	GWL 155914	Abstraction of up to 470,000 kilolitres from the mine site borefield and Southern borefield. Licence expired 6 December 2022. Process water is sourced from bore RHW 6D.
Mining Act 1978	-	Mining Proposal ID 75362 for Radio Hill Project Miniing Proposal Revision B approved by the Department of Mines Industry Regulation and Safety (DMIRS) including project management plan PM-093-

		300691 for the construction work. A project management plan for the operation of radio Hill plant is under preparation for approval by DMIRS

Amendment history

Table 7 provides the amendment history for L7922/1989/5.

Table 7: Licence amendments.

Instrument	Issued	Amendment
L7922/1989/5	11 June 2015	Licence amendment to extend the expiry date from 20 June 2015 until 20 November 2015,
L7922/1989/5	12 November 2015	Licence amendment to extend the expiry date from November 2015 until 20 June 2016. Conversion to template vs 2.9. Monitoring frequency for groundwater was reduced from quarterly to six-monthly and visual inspections of the TSF from 12 hourly to weekly whilst in care and maintenance.
L7922/1989/5	16 August 2018	Amendment Notice 1 Installation and operation of: •A cone crusher; •A gold gravity concentration circuit (Gekko Gold plant) for mechanical removal of gold from up to 500,000 tpa of gold ore; •A gold room to produce gold bars; •Dewatering and storage of intermediate gold product from the gravity gold separation circuit; and •A thickener and geofilters for reclaiming and reusing process water.

Location and receptors

The site is located approximately 30 km south of Karratha. Figure 3 depicts the regional location of the Premises.

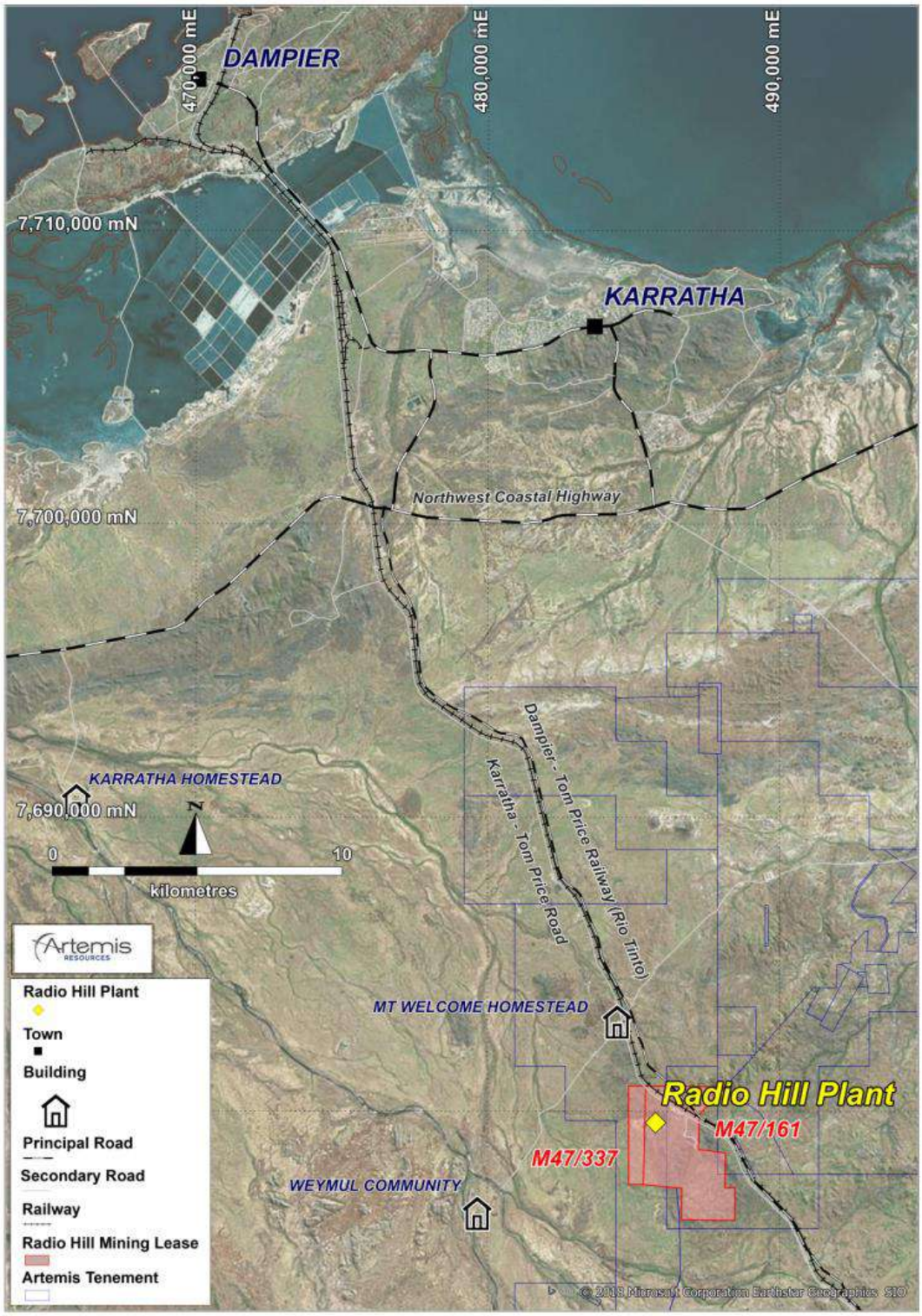


Figure 3: Radio Hill Regional Location

Table 8 below lists the relevant sensitive land uses in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 8: Receptors and distance from activity boundary

Residential and sensitive premises	Distance from Prescribed Premises
Weymul community	Approximately 6.8 km to the southwest
Mt Welcome pastoral station	Approximately 3 km north-northwest
Karratha	Approximately 17 km north

Table 9 below lists the relevant environmental receptors in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 9: Environmental receptors and distance from activity boundary

Environmental receptors	Distance from Prescribed Premises
Threatened and priority flora	None located within the premises boundary
Threatened and priority fauna	The lined soil-crevice skink (reptile) (P4) is certain to be located within the premises boundary. This is located near the railway line away from the operational areas of the Gekko plant and supporting infrastructure.
Horseflat land system Threatened Ecosystem Buffer	The premise is located within the buffer

Table 10 below lists the relevant groundwater and surface water receptors in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 10: Groundwater and surface water receptors

Water receptors	Distance from Prescribed Premises
Groundwater	Based on the latest water levels in on site bores, the depth to water ranges from 2.79 to 14.66 metres below ground level. The groundwater is fresh/marginal salinity with TDS levels of approximately 600 mg/L. The site is located within the Pilbara Groundwater Area proclaimed under the *Rights in Water and Irrigation Act 1914* (RiWI Act)
Ephemeral surface water systems	Two ephemeral surface water system are located on site. One surface water system is located north between the geotubes and the pit. The other surface water system is located north of the environmental dam. The site is located within the Pilbara Surface Water Area proclaimed under the RiWI Act.

Risk assessment

Tables 11 and 12 below describe the Risk Events associated with the amendment consistent with the *Guidance Statement: Risk Assessments*. Both tables identify whether the emissions present a material risk to public health or the environment, requiring regulatory controls.

Table 11: Risk assessment for proposed amendments during construction

Risk Event						Consequence rating	Likelihood rating	Risk	Reasoning
Source/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**				
Cat 5 Processing or beneficiation of metallic or non-metallic ore	Construction of Gekko plant and supporting infrastructure	**Dust**: associated with construction activities	No residential receptors in close proximity	Air: Transport through air then deposition	Health and amenity impacts	Slight	Rare	Low	The closest residential receptor is located approximately 3 km from the Premises. Noting the lack of receptors, the risk of dust impacts during construction has been determined as low.
			No threatened or priority flora on site No Priority Ecological Community 'Horseflat land system of the Roebourne Plains' have been recorded on site		Impact to vegetation health	Slight	Rare	Low	No vegetation units associated with the Priority Ecological Community 'Horseflat land system of the Roebourne Plains' have been recorded on site Noting the lack of receptors, the risk of dust impacts during construction has been determined as low.
		Noise: associated with construction activities	No residential receptors in close proximity	Air: Noise within the frequency range of the human ear	Health and amenity impacts	Slight	Rare	Low	The closest residential receptor is located approximately 3 km from the Premises. Noting the lack of receptors, the risk of noise impacts during construction has been determined as low.

Table 12: Risk assessment for proposed amendments during operation

Risk Event						Consequence rating	Likelihood rating	Risk	Reasoning
Source/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**				
Cat 5 Processing or beneficiation of metallic or non-metallic ore	Operation of crushing infrastructure and gecko gold plant. Movement of ore and product stockpiles	Dust: associated with ore handling and processing	No residential receptors in close proximity	Air: Transport through air then deposition	Health and amenity impacts	Slight	Rare	Low	The closest residential receptor is located approximately 3 km from the Premises. Noting the lack of receptors, the risk of dust impacts during operation has been determined as low.
			No threatened or priority flora on site No vegetation units associated with the Priority Ecological Community 'Horseflat land system of the Roebourne Plains' have been recorded on site		Impact to vegetation health	Slight	Rare	Low	No vegetation units associated with the Priority Ecological Community 'Horseflat land system of the Roebourne Plains' have been recorded on site. Noting the lack of receptors, the risk of dust impacts during construction has been determined as low.
		Noise: associated with the operation of machinery	No residential receptors in close proximity	Air: Noise within the frequency range of the human ear	Health and amenity impacts	Slight	Rare	Low	The closest residential receptor is located approximately 3 km from the Premises. Noting the lack of receptors, the risk of noise impacts during operation has been determined as low.
		Waste: Seepage of leachate from product stockpiles Seepage of	Underlying groundwater	Seepage of leachate containing elevated metal contaminants	Impacts to groundwater quality	Moderate	Rare	Low	The processing infrastructure and dewatering infrastructure is located concrete bunded areas. The exception is the geofabric filter (geotubes) which are located on HDPE lining. The drainage sump for the Geotubes is concrete

		process water containing metals and other contaminants							lined. Noting that seepage will be contained, the risk has been determined as low.
		Waste: Contaminated stormwater	Surface water systems and groundwater with beneficial use	Run-off during storm events.	Impacts on the quality of surface water systems and freshwater ecosystems	Slight	Rare	Low	All processing and dewatering infrastructure is contained within concrete bunding. Infrastructure located outside The geofabric filters (geotubes) will be located on HDPE and surrounding by a 1m windrow to divert clean stormwater around the facility. Any stormwater generated within the processing and dewatering areas will be captured and directed back into the process. Water generated in the coarse intermediate product storage area 2 will be directed to the HDPE lined environmental dam. Noting the information above, the risk has been determined as low.
		Waste: Leaks and spills of slurry/process water due to pipeline failure	Surface water systems and groundwater with beneficial use Localized soils and vegetation	Run-off during storm events. Seepage through the soil profile to groundwater	Discharge of slurry/return water containing elevated metal contaminants	Moderate	rare	low	The slurry pipeline and return water pipelines between the thickener and the geofabric filters are located within v-drains with instrumentation to detect leaks. Noting the Licence Holders controls, the risk has been determined as low.

Decision

The Licence Holder's registered business address has been amended. The prescribed premises approved production/design capacity has been increased to 500 000 tonnes per annual period.

Conditions 1.3.6 to 1.39 have been inserted into the Licence. These conditions relate to the construction and reporting requirements for the newly installed infrastructure.

Condition 1.3.10 has been inserted into the Licence to verify the integrity of the HDPE lining system within the environmental dam.

Licence Holder's comments

The Licence Holder was provided with the draft Amendment Notice on 3 August 2018. Comments received from the Licence Holder have been considered by the Delegated Officer as shown in Appendix 2.

Amendment

1. The Licence Holder's registered business address is amended from the address below:

   10 Abbotsford Street
   WEST LEEDERVILLE WA 6008

   To the new address below:

   Fox Radio Hill Pty Ltd
   Suite 1, Ground Floor, 11 Ventnor Avenue
   West Perth WA 6005

2. The prescribed premises category of the Licence is amended by the deletion of the text shown in strikethrough and the insertion of the bold text shown in underline below.

Prescribed premises category
Schedule 1 of the *Environmental Protection Regulations 1987*

Category number	Category description	Category production or design capacity	Approved Premises production or design capacity
5	Processing or beneficiation of metallic or non-metallic ore: premises on which – (a) metallic or non-metallic ore is crushed, ground, milled or otherwise processed; (b) tailings from metallic or non-metallic ore are reprocessed; or (c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam.	50,000 tonnes per annual period	~~50,000~~ **500 000** tonnes per annual period
6	Mine dewatering	50,000 tonnes or more per annual period	50,000 tonnes per annual period
85	Sewage facility premises – (a) on which sewage is treated (excluding septic tanks); or (b) from which treated sewage is discharged onto land or into waters.	More than 20 but less than 100 cubic metres per day	45 cubic metres per day

3. The Licence is amended by the insertion of condition 1.3.6 to 1.3.10 below.

Infrastructure and equipment

1.3.6 The Licence Holder must install and undertake the Works for the infrastructure and equipment:

specified in Column 1;

to the requirements specified in Column 2; and

at the location specified in Column 3

of Table 1.3.4 below.

1.3.7 The Licence Holder must not depart from the requirements specified in Column 2 of table 1.3.4 except:

a) where such departure does not increase risks to public health, public amenity or the environment; and

b) all other Conditions in this Licence are still satisfied.

1.3.8 Subject to Condition 1.3.7, within 30 days of the completion of the Works specified in Column 1 of Table 1.3.4, the Licence Holder must provide to the CEO engineering certification from a suitably qualified professional confirming each item of infrastructure or component of infrastructure specified in Column 1 of Table 1.3.4 below has been constructed with no material defects and to the requirements specified in Column 2.

1.3.9 Where a departure from the requirements specified in Column 2 of Table 1.3.4 occurs and is of a type allowed by Condition 1.3.7, the Licence Holder must provide to the CEO a description of, and explanation for, the departure along with the certification required by Condition 1.3.8.

Table 1.3.4: Infrastructure and equipment requirements table

Column 1	Column 2	Column 3
Infrastructure/ Equipment	**Requirements (design and construction)**	**Site plan reference**
Cone crusher (tertiary crusher)	Installed adjacent to existing primary and secondary crusher on a flat stable pad	Map of Stage 1 infrastructure in Schedule 1
Gekko gravity gold plant and slurry pipeline	Installed within a concrete bunded area with all drainage directed to a concrete lined sump Sump pump installed to direct drainage back into the gravity gold processing plant. HDPE pipeline to direct slurry into dewatering infrastructure.	Map of Stage 1 infrastructure in Schedule 1

Column 1	Column 2	Column 3
Infrastructure/ Equipment	**Requirements (design and construction)**	**Site plan reference**
Hydrocyclone and dewatering screen Thickener Conveyor Process Water Tank	All infrastructure to be located within a concrete bunded area adjacent to the gravity gold plant concrete area. Drainage within the concrete bunded area to be directed to a concrete lined sump. Sump pump installed to direct drainage in the sump back to the gravity plant or thickener. Conveyor installed to direct coarser intermediate gold-bearing product from the hydrocyclone and dewatering screen to the adjacent coarse intermediate product storage area 1. HDPE pipeline installed to direct process water from the thickener to the process water tank. Process water tank with a minimum capacity of 113 kilolitres Level control installed within the process water tank, linked to the make-up water valve and geofabric filters (geotubes) sump pump.	
Slurry and return water pipelines	HDPE PN 10 pipelines installed between the thickener and the geofabric filters (geotubes) Slurry pipeline to be installed with two flow meters; one immediately at the thickener underflow pump discharge, and the other at the geofabric filters (geotubes) linked to a differential flow alarm connected to the control room). Slurry pipeline and return water pipeline installed in V-drain, which includes sumps that have been sized to collectively contain up to 12 hours of thickener underflow production	
Coarse intermediate product storage area 1 (wet)	Concrete bunded area located adjacent to the gravity plant and dewatering infrastructure concrete areas. Drainage within the concrete area to be directed to a concrete lined sump. Sump to be equipped with a sump pump (float on/off) and 63 mm poly pipe (PN12) to direct drainage back to the thickener.	

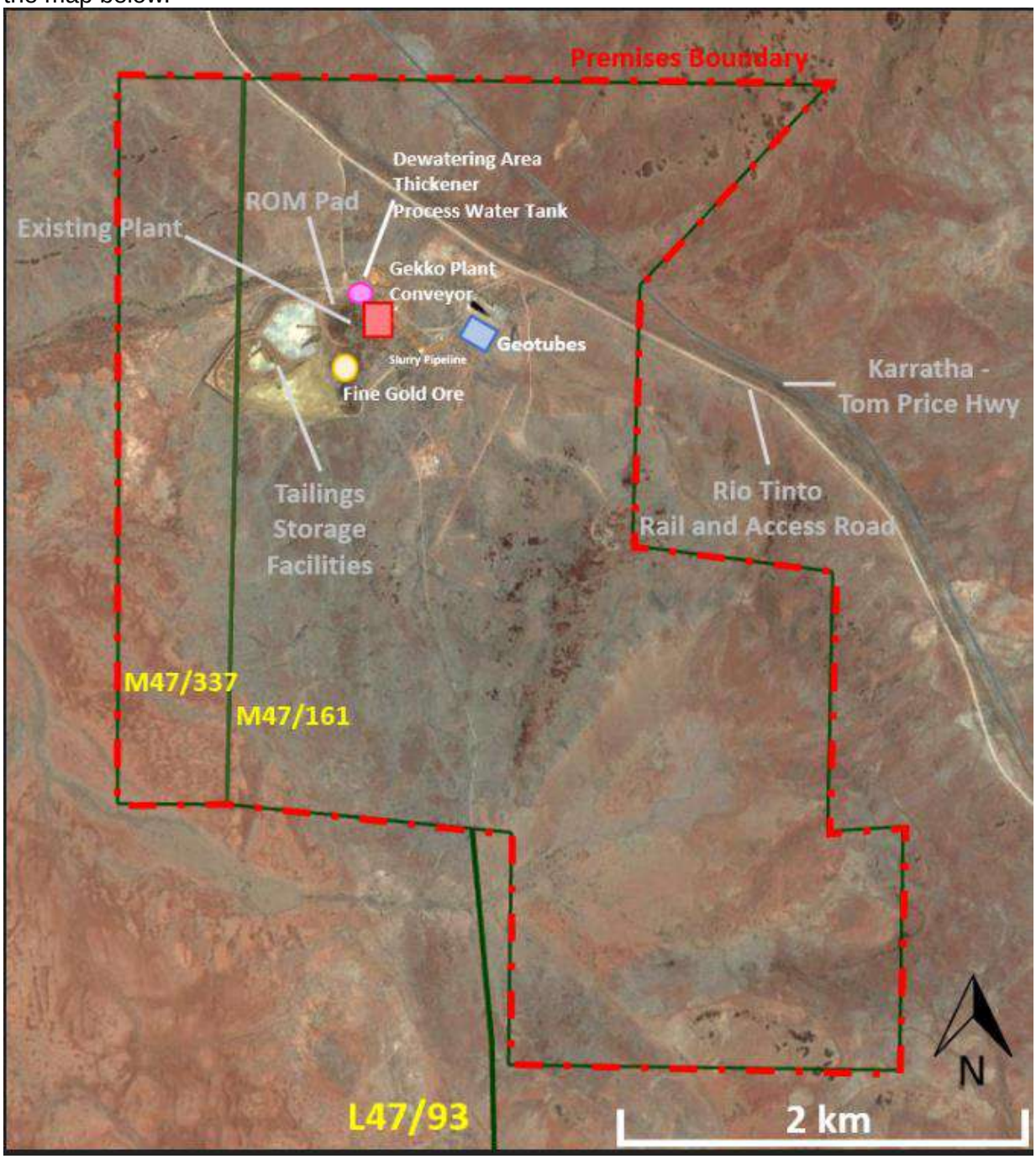
Column 1	Column 2	Column 3
Infrastructure/ Equipment	**Requirements (design and construction)**	**Site plan reference**
Coarse intermediate product storage area 2 (dry)	Compacted base constructed with borrow material (300 to 500 mm thick). Perimeter drainage and windrows to divert clean stormwater around the storage area. Area to be levelled and graded to slope to the northwest towards the existing ROM surface water interception drains (unlined) that report to the Environmental Dam.	
Geofabric filters (geotubes)	Installed on a HDPE lining system. Site graded so that drainage is directed to a concrete lined sump. Sump pump to direct return water back to the thickener via the return water pipelines. 1m windrow to be installed to divert clean stormwater around the facility.	

1.3.10 Prior to the commencement of operations, the Licence Holder must provide to the CEO engineering certification from a suitably qualified professional confirming the integrity of the environmental Dam's HDPE lining system as suitable for containment.

4. The Licence is amended by the insertion of the Map of Stage 1 infrastructure below.

Map of Stage 1 infrastructure

The location of the stage 1 infrastructure in relation to existing site infrastructure is depicted in the map below.



Appendix 1: Key documents

	Document title	In text ref	Availability
1	Licence L7922/1989/5 – Radio Hill Mine Site	L7922/1989/5	accessed at www.dwer.wa.gov.au
2	Licence amendment application and supporting documentation	-	DWER records: A1662392 A1662391 A1662390 A1662389 A1662388 A1662387
3	Licence amendment further information	-	DWER records: A170474
4	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	-	accessed at www.dwer.wa.gov.au
5	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.	-	
6	DER, November 2016. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	-	
7	DER, November 2016. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.	-	

Appendix 2: Summary of Licence Holder comments

The Licence Holder was provided with the draft Amendment Notice on 03/08/2018 for review and comment. The Licence Holder responded on 06/08/2018, the following comments were received on the draft Amendment Notice:

Condition	Summary of Licence Holder comment	DWER response
Condition: 1.3.6 – 1.3.9 Table: 1.3.4	*"Process water tank with a minimum capacity of 113,000 kilolitres"* This was a mistake in the Artemis submission, it should have been litres not kilolitres, ie 113kL (or 113,000L). Sorry for this mistake with the units.	Noted. Amendment made.
Condition: 1.3.6 – 1.3.9 Table: 1.3.4	*"Slurry pipeline and return water pipeline installed in V-drain which includes sumps sized to contain up to 12 hours of thickener underflow production"* We need to clarify, that the collective total of the v-drains and sumps will contain the 12-hour production (not each individual sump / v-drain).	Noted. Text amended to clarify. The new text reads: "*Slurry pipeline and return water pipeline installed in V-drain, which includes sumps that have been sized to collectively contain up to 12 hours of thickener underflow production"*
Page 7	*"The V-drain will include sumps sized to contain up to 24 hours of thickener underflow production"* This should be **12-hour capacity**, as we have in Table 1.3.4, for Condition 1.3.7 - 1.3.9	Noted. Text on page 7 amended by changing "24" to "12".
Page 9	Should we add 'freshwater' to Column 4 of Table 4 to "ANZECC/ARMCANZ 95% **<freshwater>** trigger values (mg/L)" ?	Noted. Column 4 amended to include the word "freshwater"
Page 10	We have submitted a Mining Proposal to the DMIRS for the construction/operation of the Gekko plant, this is **Reg ID 75362**. We have an approved Project Management Plan (PMP) for the construction work, this is **Reg ID: PM-093-300691**. We are preparing the PMP for the operation of the Radio Hill plant (including the Gekko Gold Plant) and this PMP will be submitted soon	Noted. Text amended accordingly. "Mining Proposal ID 75362 for Radio Hill Project Miniing Proposal Revision B approved by the Department of Mines Industry Regulation and Safety (DMIRS) including project management plan PM-093-300691 for the construction work. A project management plan for the operation of radio Hill plant is under preparation for approval by DMIRS."
Page 11	Will this new Licence become v6 or remain as v5...the 'Instrument' column has L7922/1989/**5**	It will remain as V 5. The numbering is updated when the licence is re-assessed.
Page 14	Table 11, Cat 5 / Dust / Potential receptors: should state that **no PECs have been recorded on site**, this is what the 'Reasoning' column states. On the Page 15, the discussion of PECs on this risk event is correct, therefore please use this wording for Page 14.	Noted. Text on page 14 amended to state that no PECs have been recorded on site.

Page 17	We requested the address be changed to "Suite 1, 11 Ventnor Avenue - West Perth, 6005, WA" via emails between Michael Williams (Artemis) and Shelley Bee (DWER) in Feb 2018, could we please correct this... the address was instead changed to a Sydney address, therefore - could we amend this to our West Perth address? Our correct address is on the front page of your DWER letter.	Noted. Address on page 17 amended. Fox Radio Hill Pty Ltd Suite 1, Ground Floor, 11 Ventnor Avenue West Perth WA 6005

Government of Western Australia
Department of Water and Environmental Regulation

Amendment Notice #2

Licence Number	L7922/1989/5
Licence Holder	Fox Radio Hill Pty Ltd
ACN	092 493 653
File Number:	DER2014/001066
Premises	Radio Hill Mine Site Mining tenements M47/161 and M47/337 KARRATHA WA 6714
Date of Amendment	**13/06/2019**

Amendment

The Chief Executive Officer (CEO) of the Department of Water and Environmental Regulation (DWER) has amended the above Licence in accordance with section 59 of the *Environmental Protection Act 1986* (EP Act) as set out in this Amendment Notice. This Amendment Notice constitutes written notice of the amendment in accordance with section 59B(9) of the EP Act.

Alana Kidd

Digitally signed by Alana Kidd
Date: 2019.06.13 14:27:37 +08'00'

Alana Kidd

Manager, Resource Industries

an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Definitions and interpretation

Definitions

In this Amendment Notice, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
AACR	Annual Audit Compliance Report
ACN	Australian Company Number
AER	Annual Environment Report
Amendment Notice	refers to this document
Category/ Categories/ Cat.	categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CEO	means Chief Executive Officer. CEO for the purposes of notification means: Director General Department Administering the *Environmental Protection Act 1986* Locked Bag 10, JOONDALUP DC WA 6919 info@dwer.wa.gov.au
CS Act	*Contaminated Sites Act 2003* (WA)
Delegated Officer	an officer under section 20 of the EP Act
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
Existing Licence	The Licence issued under Part V, Division 3 of the EP Act and in force prior to the commencement of and during this Review
Licence Holder Licensee	Fox Radio Hill Pty Ltd
m^3	cubic metres

mtpa	million tonnes per annum
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
Occupier	has the same meaning given to that term under the EP Act.
Prescribed Premises	has the same meaning given to that term under the EP Act.
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report.
Risk Event	as described in *Guidance Statement: Risk Assessment*

Amendment Notice

This amendment is made pursuant to section 59 of the *Environmental Protection Act 1986* (EP Act) to amend the Licence issued under the EP Act for a prescribed premises as set out below. This notice of amendment is given under section 59B(9) of the EP Act.

This notice is limited only to an amendment for Category 5. No changes to the aspects of the original Licence relating to Categories 6 or 85 have been requested by the Licence Holder.

The following guidance statements have informed the decision made on this amendment*:*

- *Guidance Statement: Regulatory Principles (July 2015)*
- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessment (February 2017)*

Amendment description

On 30 October 2018 Fox Radio Hill Pty Ltd (the Licence Holder) submitted an application to amend the Radio Hill Mine Licence L7922/1989/5. The Licence Holder has requested the following amendments to the licence:

1. Construction works to recommission the Tailing Storage Facility 3 (TSF3) for the storage of intermediate gold product from the gravity gold separation plant. Recommissioning of TSF3 will involve:
    - Excavation of up to 230,000 m^3 of tailings from TSF3 and the transfer of the recovered tailings (by truck) to the surface of TSF1 and TSF2 (which are not operational);
    - Paddock dumping of the recovered tailings over existing residual tailings at TSF1 and TSF2 to achieve the pre-capping contours (nominal cover thickness of approximately 2m), then track rolling, shaping and grading of the redistributed tailings, in preparation for final decommissioning and rehabilitation of TSF1 and TSF2. (Works to cap and rehabilitate TSF1 and TSF2 are being conducted in accordance with approved mine closure plan DMIRS reg ID 52721 (approved 12 May 2016). This works will not be assessed by DWER;
    - Construction and commissioning of a new tailings slurry pipeline and return water pipeline;
    - Reinstatement of decant at TSF3 and installation of a new return water pump;
    - Establishment of a new tailings discharge system at TSF3; and
    - Inspection and if required refurbishment of TSF3 monitoring bores and establishment of additional monitoring bores RHW56 and RHW57 south of TSF3 and RHW58 north of the environmental dam.
2. Approval to operate the TSF3 as a storage facility for intermediate gold product.

Since the submission of this amendment application the Licence Holder has notified DWER that the plans to recommence operations at Radio Hill site are now on hold and that the site has now gone back into Care and Maintenance. There are now no plans for production to begin during the entire 2019/2020 annual period. The Licence Holder wishes for this amendment to be finalised so deposition into TSF3 can begin once operations restart. The Licence L7922/1989/5 has a condition that requires the Licence Holder to notify DWER 60 calendar days prior to the site recommencing operations.

Background

The Licence Holder (Fox Radio Hill Pty Ltd) is wholly owned by Artemis Resources Ltd. The Premises is an underground mine and has been in care and maintenance since 2008 and

formally produced nickel and copper concentrate. The Radio Hill mine site contains three existing tailing storage facilities (TSF); TSF1, TSF2 and TSF3, each with a footprint of approximately six hectares. All three are currently not operational. The layout of the TSF cells is shown below in Figure 1. The location of TSF3, relative to other parts of the Radio Hill site is shown below in Figure 2.

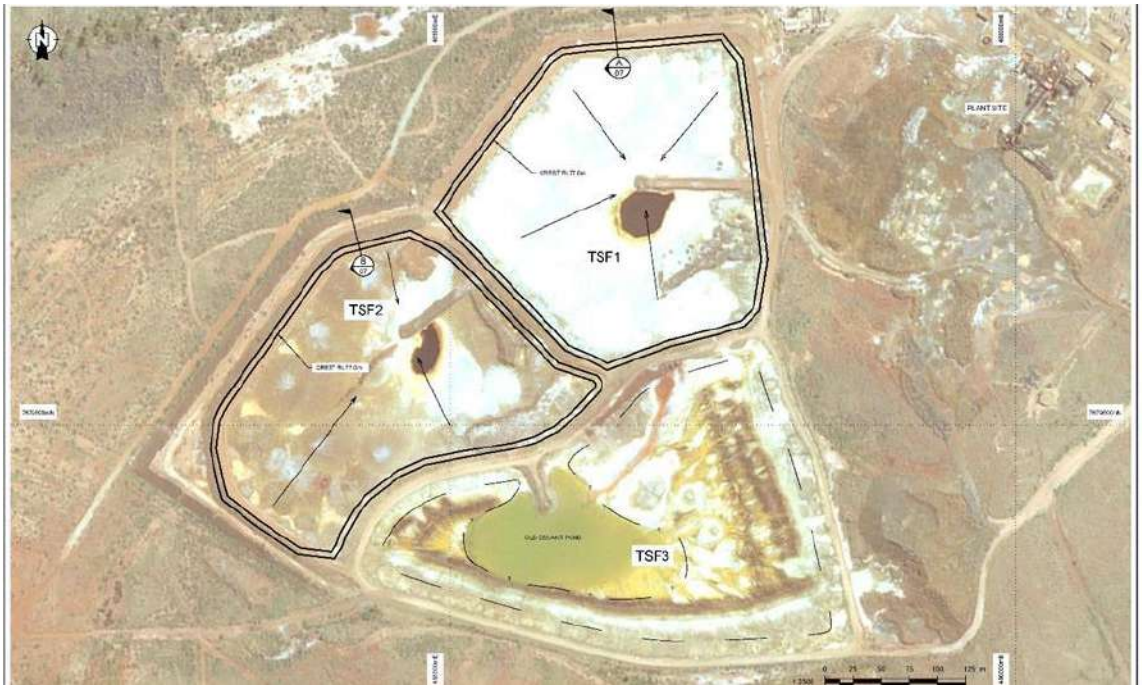


Figure 1 – Layout of tailing storage facilities at Radio Hill mine site.

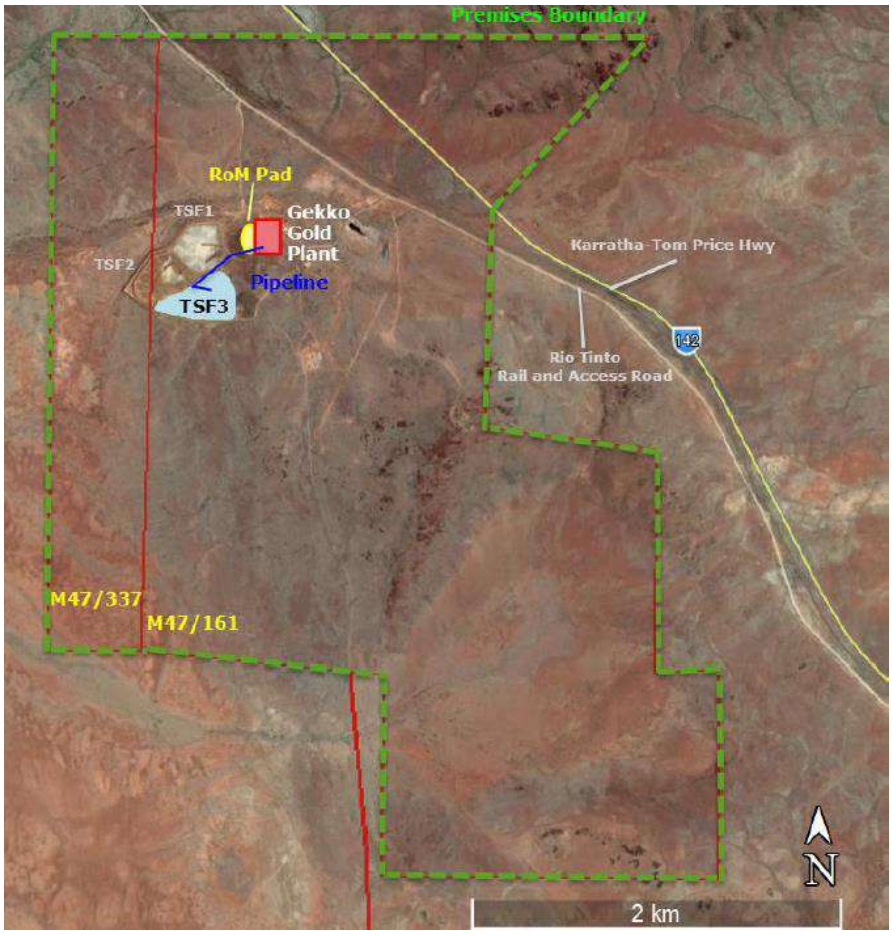


Figure 2 – location of TSF3 in relation to the gold plant at Radio Hill mine site.

In August 2018 the Licence was amended to allow for the construction and operation of a new gravity gold circuit as a first stage in a two stage plan to recommence operations at the Radio Hill Mine Site (Amendment Notice 1). The refurbishment and upgrade to the plant will transform the plant into a multiple commodity processing facility, making it possible to treat a variety of ore types – starting with gold.

The Stage 1 amendment includes the construction and operation of a modular gravity gold processing unit and associated crushing and milling equipment at the site. This infrastructure will be operated with the existing multistage crushing and grinding plant (primary and secondary crushers) which were already approved under Licence L7922/1989/5. Construction of the new gravity gold circuit is currently underway at the time of this amendment.

The gravity gold separation process (Stage 1) is to extract gold nuggets and free coarse gold (gold particles sized at 0.04 millimetres (mm) or higher) from crushed ore. The gravity gold plant has two outputs; primary gold concentrate and intermediate gold-bearing product. Under Amendment Notice 1 (AN1) the intermediate gold product was to undergo dewatering / filtering into two streams; coarse intermediate product to be stored within a designated area near the run-of mine (ROM) stockpile and fine intermediate product to be stored within a geofabric filter (geotube) system. The intermediate product in the geotubes (fine intermediate gold-bearing product) and stockpiled material (coarser intermediate gold-bearing product) were to remain in these locations until Stage 2 was constructed.

New Stage 1 process description

Since the granting of AN1 the Licence Holder has reviewed options for the storage of the intermediate gold product that was to be generated by the new gravity gold separation process. Instead of stockpiling via the geotube farm, the Licence Holder is proposing to recommission TSF3 for the purpose of storing intermediate gold product. The Licence Holder believes this is a more cost effective option and provides more secure short-term storage of the intermediate product. This proposal would also result in a single combined fine and coarse intermediate gold product stream (instead of two) and will simplify water management on site.

The new Stage 1 process includes:

- Crushing of ROM gold ore to 20 mm via the existing primary and secondary crushers, and then down to 10 mm via the new tertiary cone crusher (no change to what was assessed under AN1).
- Removal of large gold nuggets before milling the ore down to 0.04 mm size (no change to what was assessed under AN1).
- Removal of coarse free gold by using a modular gravity gold plant, which is then refined into gold bars in the gold room, along with the large gold nuggets (no change to what was assessed under AN1).
- Intermediate gold-bearing product from the gravity gold process will be directed to a high rate thickener where flocculent (BASF Magnafloc 155) is added at a rate of 477 kg/month. Water removed is directed to process water tank for reuse in the gravity circuit.
- Slurry from the thickener will then be discharged sub-aerially and cyclically into the TSF3 for short term storage.

The intermediate gold product stored in TSF3 will eventually be reclaimed and fed into the Stage 2 flotation plant once it has been constructed and is operational (Stage 2 will be implemented under a separate licence amendment). A decision on the timing of the float plant upgrade at Radio Hill will be made in 2019, following the completion of feasibility studies. The studies include but are not limited to the merits of a cyanide leach circuit to improve gold recovery; requiring additional DWER approvals. Should Stage 2 not proceed in 2019 than any intermediate product in TSF3 will be included in an updated TSF closure and rehabilitation plan.

The key components of the gravity gold mechanical separation process are illustrated below in Figure 3.

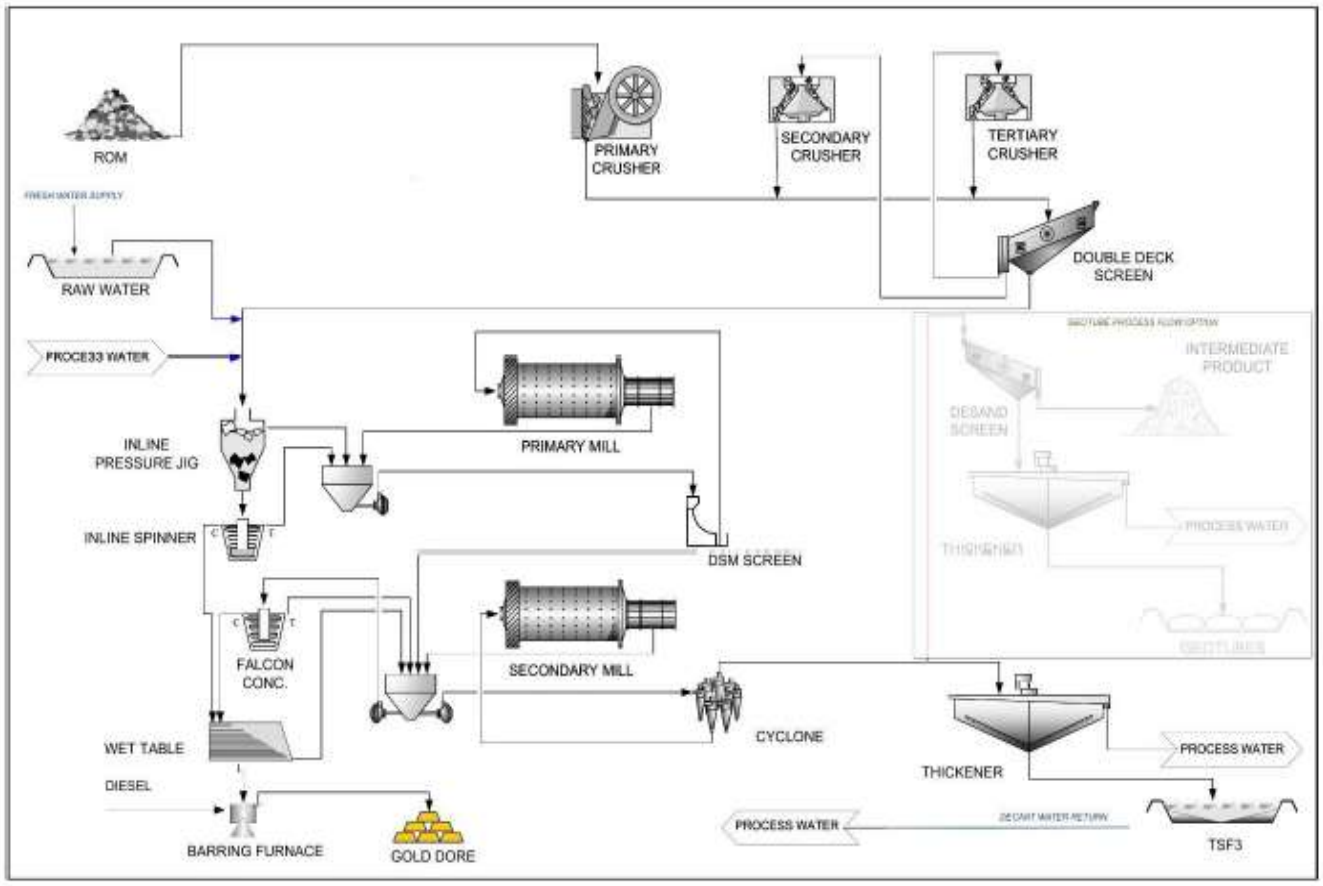


Figure 3: Gravity gold process diagram, showing change to storage of intermediate product at TSF3.

Tailings storage Facility 3

TSF3 comprises of a starter embankment and raise. The starter embankment was constructed in 2006. The upstream raise to the embankment was constructed in 2007. TSF3 is directly adjacent to both TSF1 and TSF2 and shares its western embankment with these facilities.

The TSF3 basin is provided with a minimum 0.3m thick compacted clay liner. Laboratory testing conducted on soils underlying the proposed TSF3 location (cited in Mining Proposal Reg ID:5398) ranged from $2x10^{-9}$ m/s to $1x10^{-7}$ m/s. The licence Holder has adopted an average permeability value of 1x10-8 m/s for the saturated hydraulic conductivity of the TSF3 clay liner.

Water management infrastructure includes a decant tower, a sand filter with a single outlet pipe, a surface water drain (backfilled with rock and covered with a geotextile) along the downstream toe of the western embankment and a downstream, seepage control bund. A surface water toe drain was constructed along the southern and northern embankment to direct surface water runoff away from the embankments. The raise to TSF3 was designed and constructed as a centreline raise. A new embankment along the eastern extent separates TSF3 from a waste rock dump to the east of the TSF. Surface water toe drains were modified as part of the raise design to maintain run-off away from the embankments.

The Licence Holder commissioned AECOM to conduct a systematic inspection of the Radio Hill TSF complex in February 2018. Table 2 below outlines a summary of AECOM's observations.

Table 2: AECOM's observations of the TSF3

Element	Observations (AECOM, February 2018)
Tailings surface	• The tailings have been deposited to a level near to the crest of the embankment across the majority of the facility (i.e. little to no beach freeboard exists) • The tailings beach is very steep within the central portion of the facility which is indicative of the extent of the decant pond during operation. • The low point within the basin is offset to the south of the decant structure. • Localised low points exist where surface water can pond near the embankment crest. • The majority of the tailings surface is characterised by the oxidised tailings with some area covered by a thick precipitate crust. The thin precipitate crust is located near the decant and areas where water has ponded in the past.
Embankment condition	• The downstream batter of the southerly embankment is generally covered with a fine sand/silt and light vegetation. • No substantial erosion was observed on the embankment batters. • Windrows are not fully formed in all locations. • Vegetation exists within some parts of the downstream surface water toe drain, which reduces the capacity of the drain. • No signs of seepage were observed. • The embankments appear to be in good condition.
Decant and infrastructure	• The decant structure appears to be intact and suitable as a pumping point. Water was observed within the structure (likely as a result of recent rainfalls). • No pond was present on the tailings surface at the time of the inspection. • Pipework and valving are present at the decant structure, but no pumps. • No windrows were present along the decant causeway. • The sand filter drainage pipe and seepage control bund could not be located in February 2018. The drainage pipe has since been located and will need to be reinstated. • Tailings deposition pipes and spigots have been disconnected and pipework generally left in place. • Deposition spigots were extended on to the tailings surface which is indicated by either localised mounding of oxidised tailings and/or visible spigot pipes.

Construction works

Preparation of TSF3 for storage of product

The proposed recommissioning of TSF3 involves excavation and removal of up to 230,000m^3 of the existing tailings and placement of the tailings in the adjacent TSF1 and TSF2. The tailings to be moved have undergone testing (static acid-base analysis) to determine if they have the potential to generate acidity on oxidation. Test results provided by the Licence Holder indicate that the tailings are classified as potentially acid forming (PAF).

Once the tailings are removed from TSF3, the basal clay liner will be inspected by a suitably qualified person before partitioning off an area for storage of intermediate gold product. The base of the cell will be graded / shaped to remove any high spots and to direct seepage towards the decant system. An internal partition will be constructed between the remaining tailings and the storage area to ensure tailings do not come into contact with the stored gold product (due to its potential for generating acidic leachate). Figure 4 below shows a schematic drawing of the partition.

The decant tower and surrounding rock filter will be inspected for blockages and maintained if required. The TSF3 sand filter pipe and the external capture sump will be reinstated.

Figure 4 – Schematic drawing of partition to segregate from existing tailings pipelines.

Construction and commissioning of a new tailings slurry pipeline and return water pipeline is proposed. A nominal 150 mm (6 inch) HDPE pipeline will be used to transfer intermediate gold product slurry from the thickener at the processing plant to TSF3. The pipeline specification is yet to be finalised subject to viscosity testwork, but will most likely be PE100 SDR 13. (PN12.5) poly pipe. The pump discharge pressure is not expected to exceed 800kPa. The thickener underflow pipeline which carries intermediate gold product slurry from the thickener underflow to TSF3 will have two flow meters installed: one immediately after the thickener underflow pump discharge and the other at ring main at TSF3. Additionally, the slurry pipe and return water pipe will be installed within V-trenches. The trenches will be furnished with sumps sized to contain up to 6 hours of thickener underflow production. The pipe alignment will be inspected regularly (at least once per shift) for evidence of leaks.

The return water from the TSF3 decant will use the same pipeline corridor and likely a PN10 4 inch poly line. The tailings decant pump will operate in a fully automatic mode controlled by level sensors and pressure switch cut-off in the decant well. The pump will be serviced by a fully bunded diesel genset.

Discharge system

A new tailings discharge system is proposed to be established at the TSF3. Discharge spigots will be installed around the perimeter embankment of TSF3 to allow for sub-aerial discharge of intermediate gold product slurry.

TSF3 operation

Following completion of refurbishment works at TSF3, the facility will be operated as follows:

- Intermediate product in the form of slurry will be discharged sub-aerially and cyclically into the facility in thin discrete layers, not exceeding 300mm thickness, in order to allow optimum density and strength gain by subjecting each layer to a drying cycle. It is estimated that the recommissioned TSF3 will accommodate up to 230,000 m^3 of intermediate product.
- Deposition will take place via multiple spigots from around the TSF3 perimeter embankment.

- Spigotting is to be carried out such that the supernatant pond is maintained around the decant. The pond will be maintained away from the perimeter embankments at all times.
- The decant pond area will be maintained at no more than 15% of the TSF surface area. This approach is intended to reduce the area where elevated hydraulic loadings are present on the clay liner.
- Water will be removed from the decant pond and pumped back to the process plant using a new decant pump located within the decant structure.

TSF3 water balance

The detailed water balance is shown below. Most, if not all, of the water shall be collected via the decant pump, to be sent back to the Process Water Tank for use in the process plant. Seepage is estimated at 1.08 m^3/hr, with a seepage loss percentage of 1.95%. A water balance diagram is shown below (Figure 5).

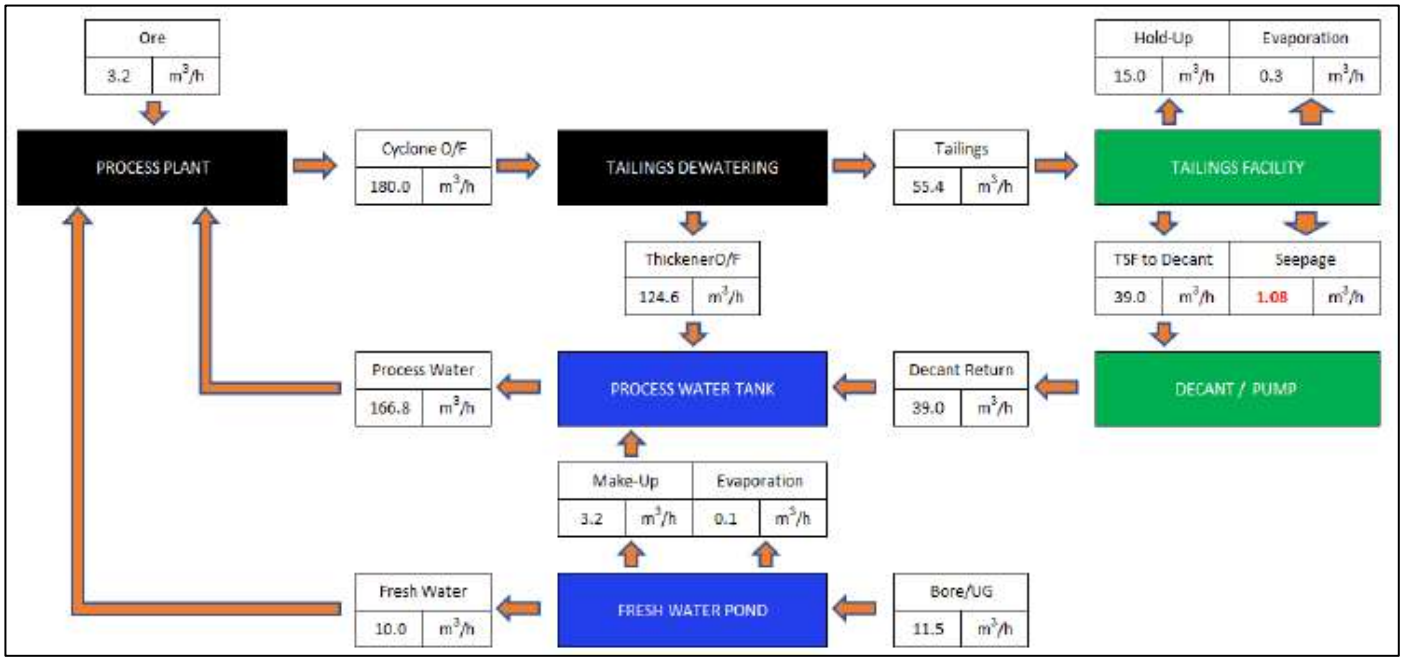


Figure 5 – Water balance for Radio Hill gold processing.

Monitoring

The site currently has a network of monitoring bores surrounding the TSFs and process areas. Six monthly monitoring of groundwater currently occurs under the sites existing licence. As part of recommissioning TSF3 the TSF bores will be inspected and if required refurbished. Two additional monitoring bores have already been installed south of TSF3 and these will be added to the licence (RHW56 and RHW57). Figure 6 below shows the location of the monitoring bores surrounding the TSF complex.

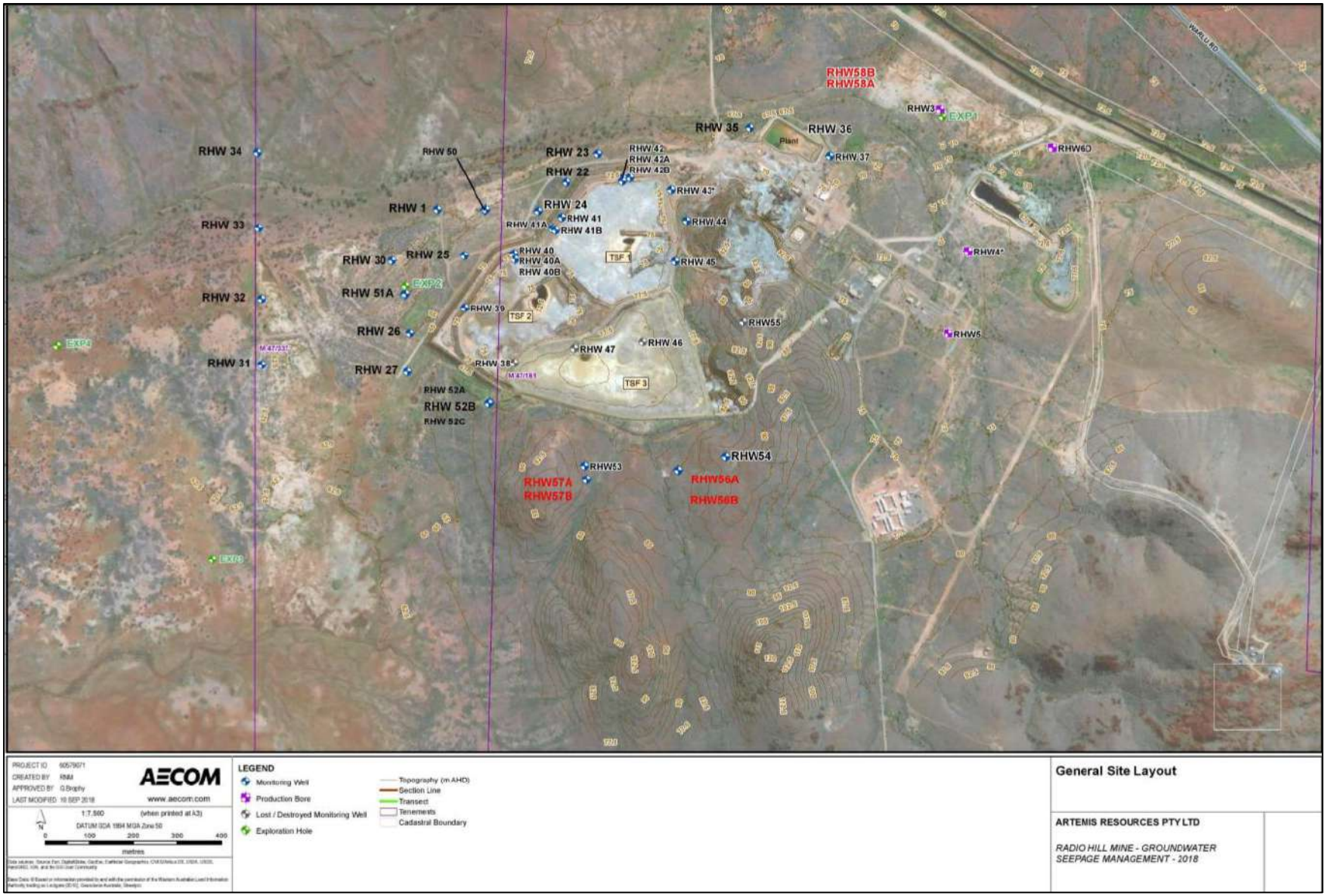


Figure 6: Location of monitoring bores.

Geochemical characterisation of the intermediate coarse fine gold product

A geochemical characterisation of a representative sample of the intermediate coarse fine gold product which is to be stored on site has been undertaken. The sample was subject to:

- Mineralogy analysis:
- Acid base accounting;
- ASLP leach testing; and
- LEAF 1313 testing.

Mineralogy

The x-ray diffraction mineralogy analysis has indicated that the Silica Hills Gold ore from which the intermediate gold product is derived mostly made of quartz (SiO2) with 20% muscovite.

Table 3 Mineral components of Silica Hills Gold ore (Application, 2018)

Mineral phase	Concentration (%)
Quartz = SiO_2	70
Muscovite = $KAl_2 (AlSi_3O_{10}) (F,OH)_2$	20
Calcite = $CaCO_3$	4
Clinochlore, ferroan = $((Mg, Fe)_6 (Si ,Al)_4 O_{10} (OH)_8)$	4
Microcline, ordered = $K(AlSi_3O_8)$	2

Acid base accounting

The acid base accounting (ABA) results for the intermediate gold product are provided in Table 4.

Table 4: Acid base accounting results (Application, 2018)

Parameter	Units	Limit of reporting	Silica Hills ore
Total sulphur	%, w/w	0.05	<0.05
Acid Neutralising Capacity (ANC)	kg H_2SO_4 / t	2	75
Maximum Potential Acidity (MPA)	kg H_2SO_4 / t	2	<2
Net Acid Producing Potential (NAPP)	kg H_2SO_4 / t		<2
ANC / MPA ratio	---	calculation	>35
Net Acid Generation (NAG) pH	---	0.1	9.0

The Licence Holder's application supporting documents state that the results indicate that this material is likely to be non-acid forming. This is because the potential acid forming potential is less than 2 kg/tonne of sulphuric acid whereas the material has an acid neutralization capacity equivalent to 75kg/tonne of sulphuric acid. Furthermore, the NAG pH value after peroxide treatment is 9.

ASLP leach testing

A single representative sample was submitted for leachate testing using the ASLP leaching procedure. The results are provided in Table 5 below. A comparison has been made to the 95% trigger values for freshwaters and livestock drinking water values in ANZECC/ARMCANZ 2000. Any results that exceed the 95% protection level are highlighted in red (Table 5). No results exceed the livestock drinking water values. DWER notes that the ASLP testing involves using organic acids at pH 5.

Table 5: Results of ASLP Leachate testing

Parameter	LOR (of laboratory used) (mg/L)	Representative sample (mg/L)	ANZECC/ ARMCANZ freshwater 95% trigger values (mg/L)	ANZECC/ ARMCANZ livestock drinking water values (mg/L)
Aluminium	0.1	<0.1[1]	0.055	5
Arsenic	0.001	<0.001	0.013	0.5
Boron	0.05	0.83	0.37	5
Barium	0.01	0.73	-	-
Beryllium	0.01	<0.01	-	-
Cadmium	0.002	0.004	0.0002	0.01
Cobalt	0.01	<0.01	-	1
Copper	0.01	0.04	0.0014	0.4 (sheep)
Chromium	0.01	<0.01[1]	0.001	1
Lead	0.01	0.01	0.0034	0.1
Mercury	0.0002	<0.0002	0.0006	0.002
Manganese	0.01	1.3	1.9	-
Molybdenum	0.01	<0.01	-	0.15
Nickel	0.01	0.05	0.011	1
Selenium	0.01	<0.01	0.011	0.02
Silver	0.01	<0.01[1]	0.00005	-
Vanadium	0.01	<0.01	-	-
Zinc	0.01	0.04	0.008	20

Note 1: the results provided are not a sufficient detection level to provide a comparison against ANZECC/ARMCANZ 2000 95% trigger values for freshwater ecosystem.

LEAF 1313 leachate testing

The Licence Holder has undertaken additional leachate testing for metal leachability from gravity gold intermediate product under a range of pH conditions. Tests were conducted on samples ground to less than 106µm. A comparison has been made to the 95% trigger values for freshwaters and livestock drinking water values in ANZECC/ARMCANZ 2000. Any results that exceed the 95% protection level are highlighted in red (Table 6). The results at pH 7 are all equal to or below the 95% protection trigger values for freshwater ecosystems in ANZECC/ARMCANZ 2000 with the exception of silver which is not at a sufficient detection level to allow a comparison.

Under acidic conditions (pH below 5.5) or extremely alkaline conditions (pH above 11), some metals concentrations in the test leachate solutions exceeded ANZECC guideline values for ecosystem protection (95$_{th}$ percentile protection level). The main constituents of concern under conditions which could plausibly occur at Radio Hill are manganese, copper, nickel and cadmium (and to a lesser extent, lead and zinc). These metals have the potential to be mobilized under acidic leaching conditions.

Table 6. Results of LEAF leachate testing

Parameter	LOR (mg/L)	pH13 (mg/L)	pH12 (mg/L)	pH10.5 (mg/L)	pH9 (mg/L)	pH8 (mg/L)	pH7 (mg/L)	pH5.5 (mg/L)	pH4 (mg/L)	pH2 (mg/L)	ANZECC/ARMCANZ freshwater 95% trigger values	ANZECC/ARMCANZ livestock drinking water values
Aluminium	0.01	8.1	3.9	0.89	0.17	0.04	<0.01	0.03	1.8	23	0.055	5
Arsenic	0.001	0.077	0.04	0.013	0.004	0.003	<0.001	0.001	0.001	0.009	0.13	0.5
Boron	0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.37	5
Barium	0.001	0.11	0.022	0.018	0.021	0.091	0.28	1.8	2.9	4.9		
Beryllium	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0007	0.0032		
Cadmium	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.03	0.057	0.1	0.0002	0.01
Cobalt	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.021	0.054	0.11		1
Copper	0.001	0.056	0.009	0.007	<0.001	<0.001	0.001	0.033	0.29	1.4	0.0014	0.4
Chromium	0.001	0.005	0.002	<0.001	<0.001	<0.001	<0.001	0.008	0.011	<0.001	0.001	1
Lead	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006	0.43	0.0034	0.1
Mercury	0.00005	0.00006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	6	0.002
Manganese	0.005	<0.005	<0.005	0.019	0.008	0.052	0.26	4.7	8.7	23	1.9	
Molybdenum	0.001	0.007	0.006	0.003	0.002	0.002	0.002	0.001	<0.001	0.002		0.15
Nickel	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.11	0.17	0.58	0.011	1
Selenium	0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.011	0.02
Silver	0.001	<0.001[1]	<0.001[1]	<0.001[1]	<0.001[1]	<0.001[1]	<0.001[1]	<0.001[1]	<0.001[1]	<0.001[1]	0.00005	
Vanadium	0.001	0.024	0.02	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	0.012		
Zinc	0.001	0.027	0.005	0.014	0.006	0.005	0.006	0.69	1.5	4.6	0.008	20

Note 1: the results provided are not at sufficent detection level to provdide a comparison against ANZECC/ARMCANZ 2000 95% trigger values for freshwater ecosystem

Contaminated sites

Mining tenement M47/161 is classified as possible '*contaminated – investigation required'* under the Contaminated Sites Act 2003. The contamination is a result of a nickel and sulphate plume which extends over the majority of the mining area.

Other approvals

The Licence Holder has provided the following information relating to other approvals as outlined in Table 7.

Table 7: Relevant approvals

Legislation	Approval	
Rights in Water and Irrigation Act 1914	GWL 155914	Abstraction of up to 470,000 kiloliters from the mine site borefield and Southern borefield. Licence expires 6 December 2022. Process water is sourced from bore RHW 6D.
Mining Act 1978	-	Mining Proposal ID 75362 for Radio Hill Project Mining Proposal Revision B approved by the Department of Mines Industry Regulation and Safety (DMIRS). A Mining Proposal of the recommissioning of TSF3 for product storage has been submitted to DMIRS in January 2019. It has yet to be approved.

Amendment history

Table 8 provides the amendment history for L7922/1989/5.

Table 8: Licence amendments

Instrument	Issued	Amendment
L7922/1989/5	11 June 2015	Licence amendment to extend the expiry date from 20 June 2015 until 20 November 2015,
L7922/1989/5	12 November 2015	Licence amendment to extend the expiry date from November 2015 until 20 June 2016. Conversion to template vs 2.9. Monitoring frequency for groundwater was reduced from quarterly to six-monthly and visual inspections of the TSF from 12 hourly to weekly whilst in care and maintenance.
L7922/1989/5	16 August 2018	Amendment Notice 1 Installation and operation of: • A cone crusher; • A gold gravity concentration circuit (Gekko Gold plant) for mechanical removal of gold from up to 500,000 tpa of gold ore; • A gold room to produce gold bars; • Dewatering and storage of intermediate gold product from the gravity gold separation circuit; and • A thickener and geofilters for reclaiming and reusing process water.
L7922/1989/5	13/06/2019	Amendment Notice 2: recommissioning of TSF3 and the deposition of intermediate gold product into TSF3 instead of stored into geo-tubes as per Amendment Notice 1.

Location and receptors

Table 9 below lists the relevant sensitive land uses in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 9: Receptors and distance from activity boundary

Residential and sensitive premises	Distance from Prescribed Premises
Weymul community	Approximately 6.8 km to the southwest
Mt Welcome pastoral station	Approximately 3 km north-northwest
Karratha	Approximately 17 km north

Table 10 below lists the relevant environmental receptors in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 10: Environmental receptors and distance from activity boundary

Environmental receptors	Distance from Prescribed Premises
Threatened and priority flora	None located within the premises boundary
Threatened and priority fauna	The lined soil-crevice skink (reptile) (P4) is certain to be located within the premises boundary. This is located near the railway line away from the operational areas of the Gekko plant and supporting infrastructure (DWER GIS layer).
Horseflat land system Threatened Ecosystem Buffer	The premise is located within the buffer.
Groundwater	Groundwater depths at bore RHW24 (which is downgradient of the TSF complex) have recorded depths to water in the order of 4.9

	mbgl (end of wet season, 2014) and 5.9 mbgl (end of dry season, 2015). The groundwater in the area of the Radio Hill mine site is fresh/marginal salinity with TDS levels of approximately 600 mg/L. A review of the historic groundwater quality monitoring data indicates that groundwater at the site continues to be impacted by the historic mine site operations. It appears that down hydraulic gradient (west and north-west) groundwater exhibits elevated electro conductivity (EC), total dissolved solids (TDS) and sulfate. The average EC in up hydraulic gradient production bore RHW 5 was approximately 1000µS/cm between 2004 and 2018, whereas the average EC in down hydraulic gradient monitoring bore RHW 24 was approximately 6000 µS/cm. A similar trend was seen with an increased concentration of sulfate in down hydraulic gradient wells. The average sulfate concentration in up hydraulic gradient production bore RHW 5 was approximately 50mg/L between 2004 and 2018, whereas the average sulfate concentration in down hydraulic gradient monitoring bore RHW 24 was approximately 3500mg/L. The site is located within the Pilbara Groundwater Area proclaimed under the *Rights in Water and Irrigation Act 1914* (RiWI Act).
Ephemeral surface water systems	Two ephemeral surface water drainage lines are located on site. One surface water drainage line is located within the northern section of the premises between the processing plant and the pit. The other surface water drainage line runs along the northern edge of the TSFs and north of the environmental dam. These minor watercourses combine to form a tributary to Cockatoo Creek which located west of the site. Cockatoo Creek drains north-westerly and joins the Maitland River near Miaree Pool, approximately 30 km northwest of the site.

Risk assessment

Tables 11 and 12 below describe the Risk Events associated with the amendment consistent with the *Guidance Statement: Risk Assessments*. Both tables identify whether the emissions present a material risk to public health or the environment, requiring regulatory controls.

Table 11: Risk assessment for proposed amendments during construction

Risk Event						Consequence rating	Likelihood rating	Risk	Reasoning
Source/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**				
Cat 5 Processing or beneficiation of metallic or non-metallic ore	Removal and dumping of tailings from TSF3 to TSF1 & TSF2 Construction of partition within TSF3	**Dust**: associated with construction activities	Nearest residential receptor is 3km away.	Air: Transport through air then deposition	Health and amenity impacts	N/A	N/A	N/A	The distance to residential receptors is considered to be too great for dust impacts from construction activities to occur. It is considered that a pathway between dust emissions and residential receptors does not exist. Potential dust emissions can be regulated by section 49 of the EP Act.
			Native vegetation near TSFs No threatened or priority flora on site No Priority Ecological Community 'Horseflat land system of the Roebourne Plains' have been recorded on site		Impact to vegetation health	Slight	Unlikely	Low	Some dust will be generated during the removal and dumping of old tailings from TSF3 to TSF1 and TSF2. The Licence Holder has stated that the main mass of historic tailings is moist and should not generate much dust. A water truck will be used to dampen down material if required. Noting the Licence Holders controls and lack of high risk receptors (priority flora etc.) the risk of dust impacts during construction has been determined to be **low**.
		Noise: associated with construction activities	No residential receptors in close proximity. Nearest receptor is 3km away.	Air: Noise within the frequency range of the human ear	Health and amenity impacts	Slight	Rare	Low	Some Noise emissions will be generated during preparation of the TSF floor and partition. Noise emissions will be minimal and occur over a short period. Onsite impact will be slight and due to the distance to sensitive receptors the risk of impacts during construction from noise emissions has been determined to be low. The provisions of the *Environmental Protection (Noise) Regulations 1997* are applicable

Table 12: Risk assessment for proposed amendments during operation

Risk Event						Consequence rating	Likelihood rating	Risk	Reasoning
Source/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**				
Cat 5 Processing or beneficiation of metallic or non-metallic ore	Operation / deposition of intermediate gold product within TSF3	**Waste:** Seepage of leachate from stored intermediate product within TSF3	Underlying soils and groundwater Ephemeral surface water systems (closest located <400m north of TSF3)	Infiltration through underlying soils to groundwater. Potential hydraulic interactions between groundwater and surface water systems.	Contamination of groundwater capable of beneficial use Impacts to surface water quality and aquatic fauna	Moderate	Possible	**Medium**	1. Refer to detailed risk assessment (risk event 1) below.
			Native vegetation	Groundwater mounding	Inundation of vegetation root zones.	Minor	Unlikely	**Medium**	Groundwater depths near the TSF bore RHW24 (which is downgradient of the TSF complex) are around 4.9 mbgl (end of wet season, 2014) and 5.9 mbgl (end of dry season, 2015). Seepage from the TSF has the potential to cause mounding of the water table. The TSF is located within a cleared area impacted by mining activities resulting in minimal vegetation being present in the area. No threatened or priority flora have been identified within the premises. The Licence Holder has committed to the following controls to minimize seepage from the intermediate gold product: • Decant pond area will be maintained at no more than 15% of the TSF surface area to reduce hydraulic loading on the clay liner; • Water will be removed from the decant pond and pumped back to the processing plant

									using a new decant pump located within the decant structure; and • Groundwater levels are currently monitored on a six monthly basis to monitor changes in water level. Mounding of the water table could result in low level onsite impacts and therefore the consequence rating has been determined to be minor. Noting the Licence Holder's controls the likelihood of groundwater mounding event occurring has been determined to be unlikely. The risk is therefore determined to be low. Monitoring conditions will be updated to ensure quarterly SWL monitoring is undertaken in bores surrounding the TSF complex.
		Waste: Leaks/ rupture of slurry/decant water pipelines	Surface water systems and groundwater with beneficial use Terrestrial ecosystems surrounding pipelines	Direct discharge to land and infiltration to soil. Also Run-off during storm events to surface water systems.	Soil and/ or groundwater contamination	Minor	Rare	Low	HDPE pipelines will be used to transfer intermediate gold product slurry from the thickener at the processing plant to TSF3. The return water from the TSF3 decant will use the same pipeline corridor and will likely by a PN10 4" poly line. The Licence Holder has committed to the following controls to prevent pipeline leaks: • Two flow meters will be installed: one immediately after the thickener underflow pump discharge and the other at the ring main at the TSF3 to help detect leaks; • The slurry pipe and return water pipe will be installed within V-trenches furnished with sumps sized to contain up to 6hrs of thickener underflow production; and • The pipelines will be inspected minimum once per shift for evidence of leaks. A pipeline leak could result in low level onsite impacts and therefore the consequence rating has been determined to be minor. Noting the Licence holder's controls the likelihood of a pipeline leak has been determined to be rare. The risk is therefore determined to be **low.**

		Waste: Overtopping of TSF3	Terrestrial ecosystems adjacent to the TSF	Direct discharges to land and infiltration to soil	Soil contamination inhibiting vegetation growth and survival	Minor	Rare	Low	Approximately 230,000 m^3 of intermediate product will be stored within the recommissioned TSF3. The Licence holder has committed to operating the TSF with a minimum operational freeboard of 0.5m plus an additional allowance for temporary storage of the 1% average exceedance probability (AEP) (previously the 1 in 100 yr average recurrence interval (ARI)) 72 hour storm event (372mm). The TSF will also be inspected on a daily basis. Overtopping of the TSF could result in low level onsite impacts and therefore the consequence rating has been determined to be minor. Noting the Licence Holder's controls the likelihood of an overtopping event occurring has been determined to be rare. The risk is therefore determined to be **low.** Conditions already exist on the licence requiring a minimum freeboard of 300 mm to be maintained at all times and for the TSF to be inspected weekly. This will be updated to require daily inspections of the TSF.

Detailed Risk Assessment

1. Risk Event: Discharge of intermediate gold product into TSF3

Description of Risk Event

The discharge of approximately 230,000 m^3 of intermediate gold product (tailings) into the recommissioned TSF3 resulting in potential leachate impacting soils, groundwater and hydraulically connected surface water systems.

Identification and general characterisation of emission

ABA tests indicate that the intermediate gold product is likely to be non-acid forming (see Table 4). Leachate tests carried out on the intermediate gold product indicate that under neutral conditions (ph of 6.0 -7.5) metal concentrations within leachate are all equal to or below the 95% protection trigger values for freshwater ecosystems in ANZECC/ARMCANZ 2000 with the exception of silver which is not at a sufficient detection level to allow a comparison. The Licence Holder has indicated within the supporting documents that pH of rainwater is expected to be between 5.5-6.5pH.

Under acidic conditions (pH below 5.5) or extremely alkaline conditions (pH above 11), some metals concentrations in the test leachate solutions exceeded ANZECC guideline values for ecosystem protection (95th percentile protection level). The main constituents of concern are manganese, copper, nickel and cadmium (and to a lesser extent, lead and zinc). These metals have the potential to be mobilized under acidic leaching conditions.

Despite leachate tests carried out by the applicant indicating that the intermediate product should not leach metals under neutral conditions there is still the possibility of the intermediate product to begin to leach nickel in pore-water that may seep from the facility into groundwater. This is because the partial weathering of tailings and waste rock materials similar to those from the Radio Hill deposit is known to lead to the formation of nickel adsorption sites on the surfaces of these mine wastes (Plante *et al*., 2010a) which can then progressively leach nickel into solution over a prolonged period of time (for years to decades). Predicting this release of nickel is difficult using conventional kinetic testing because it may take more than 20 years for adsorption sites on the surfaces of rock particles to become saturated with nickel and for the release of this metal into solution to take place (Plante *et al.*, 2010b).

ABA tests carried out on the old tailings currently stored within TSF3 indicate that the material is potentially acid forming. There is a possible risk of acidic seepage from the residual tailings currently stored at TSF3 coming into contact with the intermediate gold product. This could result in the leaching of metals from the tailings into groundwater.

Description of impacts from the increased emission

Groundwater is approximately 5-6 mbgl in the TSF area and is classed as fresh with a TDS of approximately 600mg/L. Historical groundwater monitoring data have indicated that groundwater near the TSFs at the mine site has been contaminated by seepage from these facilities. This is most evident near TSF1 where groundwater monitoring has indicated a rising trend of sulfate and manganese concentrations since 2010. Manganese concentrations near TSF1 are particularly high (commonly >10 mg/L) and greatly exceed the ANZECC livestock water quality criterion. Similarly, elevated nickel concentrations (>1 mg/L) are found in groundwater near TSF3. Therefore there is the potential for seepage from TSF3 to further impact groundwater quality.

As seepage from the sites TSFs have historically caused groundwater contamination, there is a risk that further deposition of tailings into TSF3 may increase or contribute to further contamination of groundwater. There is a risk that this contaminated groundwater could reach

and impact on the ephemeral creek located approximately 400m north of TSF3. The most sensitive receptors within this creek are likely to be macroinvertebrates that live in the hyporheic zone (i.e. stygofauna) in sand and gravels beneath the creek bed. Stgofauna in river gravels have been found to be environmentally significant in the region (Eberhard *et al*., 2005).

A preliminary assessment of the effects of groundwater advection and dispersion on nickel concentrations at this creek using the Domenico analytical solution suggests that nickel concentrations have the potential to exceed the ANZECC aquatic ecosystem concentration criteria when groundwater flow from TSF3 arrives at this creek. Concentrations of sulfate and magnesium in groundwater that flows from the TSFs to the creek are also likely to be sufficiently elevated to cause harm to stygofauna beneath the creek bed (van Dam *et al*., 2009).

Criteria for assessment

Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 2 20 L7798/1993/6 IR-T06 Licence Template v2.0 (July 2017).

Aquatic Ecosystems — Rationale and Background Information (Chapter 8) October 2000, Australian and New Zealand Environment and Conservation Council.

Licensee controls

TSF3 was constructed with a 0.3m compacted clay liner. Water management infrastructure includes a decant, a sand filter with a single outlet pipe, a surface water drain (backfilled with rock and covered with a geotextile) along the downstream toe of the western embankment and a downstream, seepage control bund.

The Licence Holder has developed a water balance which has indicated that the majority of seepage will be collected via the decant pump and sent back to the process plant. Seepage is estimated at 1.08m^3/hr, with a seepage loss percentage of 1.95% (see figure 5). This is based on the TSF base and sides having a permeability of 1x10^{-8} m/s. Seepage will be minimized by maintaining the decant pond area to 15% of the TSF surface to reduce hydraulic loading on the liner. Water will be removed from the pond and pumped back to the processing plant via a decant pump. Key trenches in the base of the walls of TSF3 will also capture seepage (Application, 2018).

To address the risk of historical tailings coming into contact with the stored intermediate product the Licence Holder is proposing to construct an internal partition between any remaining tailings at TSF3 and the stockpile of intermediate product. The floor of the stockpile area within TSF3 will be inspected to ensure all residual tailings have been removed prior to deposition of the intermediate gold product.

The site currently has a network of monitoring bores surrounding the TSFs and process areas. Six monthly monitoring of groundwater currently occurs under the sites existing licence. Parameters measured are as follows - Major ions and metals - Aluminium (Al), Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu) Cobalt (Co), Lead (Pb), Selenium (Se), Silver (Ag), Sulphate (SO4), Zinc (Zn), Manganese (Mn), Mercury (Hg), Iron (Fe), Magnesium (Mg) and Nickel (Ni). Standing water level, pH and TDS. As part of recommissioning TSF3 the TSF bores will be inspected and if required refurbished. Three additional monitoring bores have already been installed and these will be added to the licence (RHW56, RHW57 and RHW58).

Inspections of the TSF currently occur weekly during care and maintenance. The Licence Holder has proposed daily inspections of the TSF pipelines, freeboard and decant pond size during commissioning and operation.

Consequence

The consequence of discharging intermediate Gold Project (tailings) into the recommissioned TSF3 is considered **moderate** due to the potential for further contamination of the local groundwater due to seepage from the TSF3. This could further impact the future use of the groundwater and further contribute to the contamination of the groundwater below the TSF complex. This contamination also has the potential to reach and impact on the ephemeral creek north of the TSF complex.

Likelihood of Risk Event

The Likelihood of an occurrence of this event is **unlikely** if the Licence Holder's proposed management measures are satisfactorily carried out.

Historical groundwater monitoring results have indicated that seepage from the sites TSF complex has caused contamination of the groundwater. This is potentially due to poor management of seepage and decant pond size in the past.

Overall rating of Risk Event

The risk rating for the recommissioning of TSF3 and the discharge of intermediate gold product into TSF3 is therefore considered to be **medium.**

Decision

The Delegated Officer has determined that the key emissions associated with the construction works and operation of the recommissioned TSF3 are; seepage containing elevated metal concentrations, rupture of slurry/decant pipelines and overtopping of the TSF.

Based on the information provided by the Licence Holder, the Delegated Officer has determined that the operation of the recommissioned TSF3 for the storage of intermediate gold product presents a **medium** risk to the environment.

In accordance with *Guidance statement: Risk Assessments (February 2017*) the Licence Holder's controls have been formalized as conditions. The Delegated Officer has made the following changes to the licence:

- Condition 1.3.3 has been updated to make it clear that TSF1 and TSF2 have been decommissioned and will store relocated tailings from TSF3.
- Condition 1.3.4 has been updated to only allow deposition of tailings (Intermediate gold product) into TSF3 as TSF1 & TSF2 are decommissioned.
- Condition 1.3.9 has been updated to allow for the construction of new slurry and return water pipelines from the processing plant to the TSF3 and the recommissioning of TSF3. Details of the geo-tube proposal have also been deleted.

  A requirement has been set in Condition 1.3.9 for the Licence Holder to engage a suitably qualified individual to confirm and certify that the sides and base of the recommissioned TSF3 meet an average permeability of $1x10^{-8}$ m/s as per the Licence Holder's water balance.
- Condition 3.3.1 has been updated so inspections of the TSF complex occur daily during operations.
- Condition 3.4.1, Table 3.4.2 has been updated to include the three new groundwater monitoring bores that were constructed in 2018. The list of TSF monitoring bores has also been amended as a result of a review of the functioning bores onsite as provided by the Licence Holder. Frequency of groundwater monitoring has also been changed to quarterly (from six monthly), which is consistent with similar sites. It will also allow better management of impacts and identification of trends in water quality.

- Infrastructure map and groundwater monitoring map have also been updated.

Given that the site is classified as *contaminated – investigation required,* and that the Licence Holders plan to recommence operation after a period of care and maintenance involving the recommissioning of TSF3 the Delegated Officer has determined that it is necessary to establish the current health of the ephemeral creek located north of TSF3 and the impact that groundwater contamination is having on the creek and any stygofauna habituating the hydropic zone (saturated zone beneath the gravel bed) (due to the environmental significance of stygofauna in the Pilbara region (Eberhard *et al*., 2005).

As there is a risk of elevated metal concentration impacting macroinvertebrates within the creek a specified action condition will be added to the licence requesting the Licence Holder to undertake an assessment of the creek and to install a representative number of monitoring bores within the hyporheic zone to determine the presence of any stygofauna and establish some data on the system.

Surface water quality monitoring points already exist along the creek and monitoring at these points are required during discharge of mine dewater as per condition 3.4.1, table 3.4.1 of the licence. Monitoring of water quality at these location have not occurred since 2006. Therefore as part of this condition water quality samples will also be required to be taken to determine current quality of the creek water.

Since the submission of this amendment application the Licence Holder has notified DWER that the plans to recommence operations at Radio Hill site are now on hold and that the site has now gone back into Care and Maintenance. There are now no plans for production to begin during the entire 2019/2020 annual period. The Licence Holder wishes for this amendment to be finalised so deposition into TSF3 can begin once operations restart. The Licence L7922/1989/5 has a condition that requires the Licence Holder to notify DWER 60 calendar days prior to the site recommencing operations.

Licence Holder's comments

The Licence Holder was provided with the draft Amendment Notice on 15 May 2019. Comments received from the Licence Holder have been considered by the Delegated Officer as shown in Appendix 2.

Amendment

1. Condition 1.3.3 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

Table 1.3.2: Containment infrastructure		
Storage vessel or compound as shown on the Premises map in Schedule 1	**Material**	**Requirements**
Tailings storage facility (TSF) **3**	Tailings and slurry	The Licensee must: (i) maintain all installed toe drains and associated cut offs along the external toe of the TSF perimeter embankments, so that any liquid matter resulting from seepage or breach of the TSF embankments may be contained and recovered; (ii) ensure that pipelines carrying process waters to the TSF are contained within an appropriately sized bund to ensure leaks or spillage from pipeline are contained; and (iii) maintain a minimum top of embankment freeboard of 300 mm.
TSF1 and 2	**Old tailings**	**Decommissioned TSF cells. Storage of historical tailings and old tailings relocated from TSF3.**
Environmental dam	Potentially contaminated stormwater and wash water	A HDPE lined pond containing un-treated water, with a minimum freeboard of 300 mm maintained.

2. Condition 1.3.4 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

1.3.4 The Licensee shall ensure that where wastes produced on the Premises are not taken off-site for lawful use or disposal, they are managed according with the requirements in Table 1.3.3.

Table 1.3.3: Management of Waste			
Facility as shown on the Premises map in Schedule 1	**Waste type**	**Management Strategy**	**Requirements[1,2]**
TSF**3**	Tailings **and intermediate gold product** slurry	Containment in ~~the~~ TSF**3**	Disposal of waste shall only take place within ~~the~~ TSF**3**.
Wastewater treatment plant (WWTP) and irrigation field	Sewage	Biological, physical and chemical treatment	Treated wastewater will only be irrigated to the adjacent 1.7 hectare irrigation field.
	Sewage sludge	Drying and Storage	None specified
Environmental dam	Potentially contaminated stormwater and wash water	Drying and Storage	A HDPE lined pond containing un-treated water, with a minimum freeboard of 300 mm maintained.

Note 1: Requirements for landfilling tyres are set out in Part 6 of the *Environmental Protection Regulations1987*.
Note 2: Additional requirements for the acceptance and landfilling of Controlled waste (including asbestos and tyres) are set out in the *Environmental Protection (Controlled Waste) Regulations 2004*.

3. Condition 1.3.9 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

1.3.9 Where a departure from the requirements specified in Column 2 of Table 1.3.4 occurs and is of a type allowed by Condition 1.3.7, the Licence Holder must provide to the CEO a description of, and explanation for, the departure along with the certification required by Condition 1.3.8

Table 1.3.4: Infrastructure and equipment requirements table

Column 1	**Column 2**	**Column 3**
Infrastructure/Equipment	**Requirements (design and construction)**	**Site plan reference**
Cone crusher (tertiary crusher)	Installed adjacent to existing primary and secondary crusher on a flat stable pad	Map of Stage 1**b** infrastructure in Schedule 1 ~~Map of Stage 1**b** infrastructure in Schedule 1~~
Gekko gravity gold plant ~~and slurry~~	Installed within a concrete bunded area with all drainage directed to a concrete lined sump Sump pump installed to direct drainage back into the gravity gold processing plant. ~~HDPE pipeline to direct slurry from processing plant to dewatering infrastructure.~~	
~~Hydrocyclone and dewatering screen~~ Thickener ~~Conveyor~~ Process Water Tank	All infrastructure to be located within a concrete bunded area adjacent to the gravity gold plant concrete area. Drainage within the concrete bunded area to be directed to a concrete lined sump. Sump pump installed to direct drainage in the sump back to the gravity plant or thickener. ~~Conveyor installed to direct coarser intermediate gold-bearing product from the hydrocyclone and dewatering screen to the adjacent coarse intermediate product storage area 1.~~ HDPE pipeline installed to direct process water from the thickener to the process water tank. Process water tank with a minimum capacity of 113 kilolitres. Level control installed within the process water tank, ~~linked to the make-up water valve and geofabric filters (geotubes) sump pump.~~	
Slurry and return water pipelines	HDPE PN 10 pipelines installed between the thickener **at the processing plant** and **TSF3**~~the geofabric filters (geotubes)~~ **for slurry and return water from the decant pond.** Slurry pipeline to be installed with two flow meters; one immediately at the thickener underflow pump discharge, and the other at the **ring main at TSF3** ~~geofabric filters (geotubes)~~	

	(linked to a differential flow alarm connected to the control room). Slurry pipeline and return water pipeline installed in V-drain, which includes sumps that have been sized to collectively contain up to 12 hours of thickener underflow production	
~~Coarse intermediate product storage area 1 (wet)~~	~~Concrete bunded area located adjacent to the gravity plant and dewatering infrastructure concrete areas.~~ ~~Drainage within the concrete area to be directed to a concrete lined sump.~~ ~~Sump to be equipped with a sump pump (float on/off) and 63 mm poly pipe (PN12) to direct drainage back to the thickener.~~	
~~Coarse intermediate product storage area 2 (dry)~~	~~Compacted base constructed with borrow material (300 to 500 mm thick).~~ ~~Perimeter drainage and windrows to divert clean stormwater around the storage area.~~ ~~Area to be levelled and graded to slope to the northwest towards the existing ROM surface water interception drains (unlined) that report to the Environmental Dam~~	
~~Geofabric filters (geotubes)~~	~~Installed on a HDPE lining system.~~ ~~Site graded so that drainage is directed to a concrete lined sump.~~ ~~Sump pump to direct return water back to the thickener via the return water pipelines.~~ ~~1m windrow to be installed to divert clean stormwater around the facility.~~	
Recommissioning of TSF3	**Partition between residual tailings and intermediate product storage area within TSF3 to be constructed.** **Base of TSF3 cell to be graded/ shaped to direct any seepage towards the decant.** **Basal clay liner of TSF3 to be inspected and tested by a suitably qualified professional to confirm the average saturated hydraulic conductivity of the clay liner meets 1x 10^{-8} m/s** **Restore decant tower and surrounding rock filter. Reinstate TSF3 sand filter pipe and external capture sump.** **Install new return water pump** **Construct a new tailings discharge system**	

4. The Licence is amended by the insertion of specified action condition 1.3.10 outlined below:

1.3.10 **Three (3) months prior to operations at the Premises recommencing, the Licence Holder must provide to the CEO a report on the status of the surface water creek located approximately 200m north of the TSF complex which must include;**

(a) Determine and provide the baseline surface water conditions of the creek. Provide information on the concentrations of Aluminum, Iron, Copper, Zinc, Silver, Arsenic, Chromium, Lead, Cadmium, Mercury, Nickel, Selenium, Manganese, Magnesium, Sulphate, total dissolved solids, pH and electrical conductivity; and

(b) Determine the presence and composition of stygofauna present within the hyporheic zone of the creek by installing and sampling a representative number of monitoring bores within the creek.

5. Condition 3.3.1 of the Licence is amended by the deletion of the text shown in strikethrough below and the insertion of the bold text shown in underline below:

3.3.1 The Licensee shall undertake the monitoring in Table 3.3.1 according to the specifications in that table

Table 3.3.1: Process monitoring

Monitoring point reference	Process description	Requirements	Frequency	Method
TSF	Tailings and slurry containment in TSF for drying and storage	Inspection of the following infrastructure: (i) the tailings storage facility embankments; (ii) tailings delivery pipelines; (iii) return water pipelines; (iv) pumping facilities; and (v) ponding on the surface of the tailings storage facility. The Licence must maintain a log of the TSF inspections, which shall contain the following: (i) the date and time of the inspection, and the name and signature of the person undertaking the inspection; (ii) any seepage, spills or leaks resulting from failures, including the date, approximate time, volume and area extent of land affected by seepage, spills or leakages; and (iii) record corrective measures undertaken to rectify any issues identified.	~~Weekly~~ **Daily**	Visual inspection

6. Condition 3.4.1, Table 3.4.2 of the Licence is amended by the deletion of the text shown in strikethrough and the insertion of the bold text shown in underline below.

3.4.1 The Licensee shall undertake the monitoring in Tables 3.4.1 to 3.4.3 according to the specifications in those tables and record and investigate results that do not meet any limit specified.

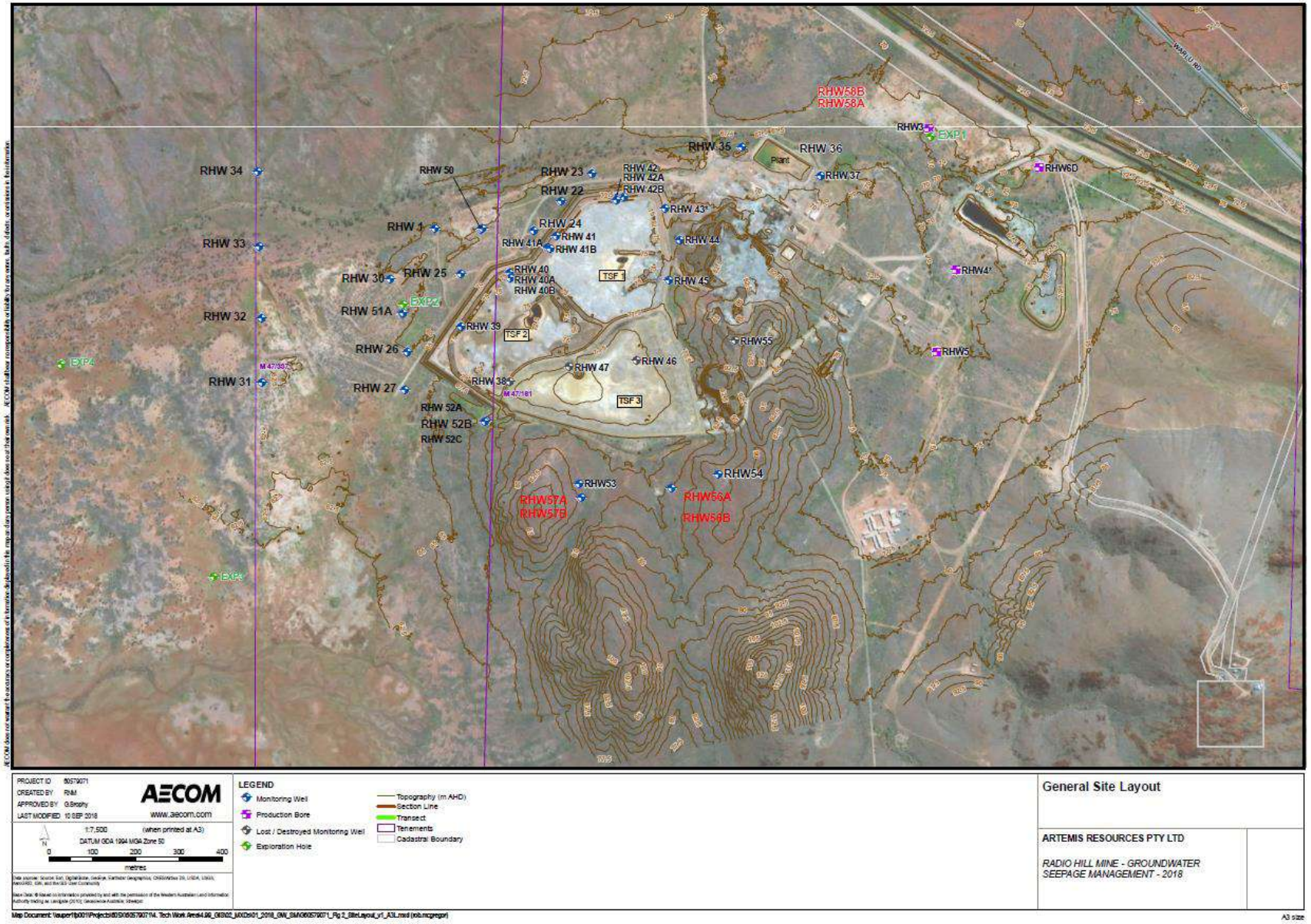
Table 3.4.2: Monitoring of ambient groundwater quality

Monitoring point reference and location as depicted in Schedule 1	Parameter	Units	Averaging period	Frequency
Environmental Dam RHW35, RWH36, RHW37, **RHW58** **TSF** RHW1 and RHW22, **RHW23, RHW24, RHW25, RHW26, RHW27, RHW30, RHW31, RHW32, RHW33, RHW34, RHW39, RHW40,** ~~to~~ ~~RHW42~~, **RHW50**, **RHW 51, RHW52, RHW53, RHW 54, RHW56 and RHW57** **Production/ Observation** ~~RHW3,~~ RHW4, RHW5, RHW6D	Standing Water Level (SWL)	m(AHD)	Spot sample	~~Six Monthly~~ **Quarterly**
	pH1	pH units		
	Total Dissolved Solids (TDS)	Mg/L		
	Electrical Conductivity (EC)	**uS/cm**		
	Major Ions and metals - Aluminum (Al), Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu) Cobalt (Co), Lead (Pb), Selenium (Se), Silver (Ag), Sulphate (SO4), Zinc (Zn), Manganese (Mn), Mercury (Hg), Iron (Fe), Magnesium (Mg) and Nickel (Ni)			

Note 1: Infield non-NATA accredited analysis permitted

7. The Licence is amended by the deletion of the Map of Stage 1 infrastructure and the insertion of the Map of Stage 1b infrastructure below.

8. The Licence is amended by the deletion of the locations of the groundwater monitoring point map in Schedule 1 and the insertion of the groundwater monitoring points map below.


RHW58B
RHW58A
RHW3
EXP1
RHW 35
RHW 36
Plant
RHW6D
RHW 34
RHW 50
RHW 23
RHW 42
RHW 42A
RHW 42B
RHW 37
RHW 22
RHW 43*
RHW 1
RHW 24
RHW 41
RHW 41A
RHW 41B
RHW 44
RHW 33
RHW 30
RHW 25
RHW 40
RHW 40A
RHW 40B
TSF 1
RHW 45
RHW4*
RHW 51A
EXP2
RHW 32
RHW 39
TSF 2
RHW55
RHW5
RHW 26
EXP4
RHW 47
RHW 46
RHW 31
RHW 38
RHW 27
TSF 3
RHW 52A
RHW 52B
RHW 52C
RHW54
RHW53
RHW57A
RHW57B
RHW56A
RHW56B
EXP3
PROJECT ID 60579071
CREATED BY RNM
APPROVED BY G.Brophy
LAST MODIFIED 10 SEP 2018
AECOM
www.aecom.com
1:7,500 (when printed at A3)
DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
metres
LEGEND
Monitoring Well
Production Bore
Lost / Destroyed Monitoring Well
Exploration Hole
Topography (m AHD)
Section Line
Transect
Tenements
Cadastral Boundary
General Site Layout
ARTEMIS RESOURCES PTY LTD
RADIO HILL MINE - GROUNDWATER SEEPAGE MANAGEMENT - 2018
A3 size

Appendix 1: Key documents

	Document title	In text ref	Availability
1	Amendment application form and attachments, L7922 Radio Hill Gold Operations Project – stage 1B Submission, Artemis Resources, 30/10/2018.	Application, 2018	DWER records (A1733736, A1733882, A1733886, A1733887, A1733889, A1733891, A1733893)
2	Email correspondence received 14/2/2019 2:56PM, Radio Hill – Stage 1B submission – DWER request for additional information, Michael Williams, Environmental & Heritage Advisor, Artemis Resources.	Application, 2018	DWER records (A1771348)
3	Email correspondence received 26/3/2019 1:02PM, Artemis Resources – Radio Hill update, Michael Williams, Environmental & Heritage Advisor, Artemis Resources.	Application 2018	DWER records (A1775773)
4	Eberhard, S.M., Halse, S.A. and Humphreys, W.F., 2005. Stygofauna in the Pilbara region, north-west Western Australia: a review. *Journal of the Royal Society of Western Australia*, **88**, 167-176	*Eberhard et al,* 2005	Acessed at https://www.rswa.org.au/publications/Journal/88(4)/vol88pt4eberhardetal167-176.pdf.
5	Plante B., Benzaazoua, M., Bussiere, B., Biesinger, M.C. and Pratt, A.R., 2010a. Study of Ni sorption onto Tio mine waste rock surfaces. *Applied Geochemistry*, **25**, 1830-1844. The paper is available from web site https://pdfs.semanticscholar.org/1c78/851dd1c099a04f36835c330b526b87d42eac.pdf.	*Plante et al*, 2010a	Accessed at https://pdfs.semanticscholar.org/1c78/851dd1c099a04f36835c330b526b87d42eac.pdf.
6	Plante B., Benzaazoua, M., Bussiere, B., 2010b. Predicting Geochemical Behaviour of Waste Rock with Low Acid Generating Potential Using Laboratory Kinetic Tests. *Mine Water and the Environment*, **30**, 2-21.	*Plante et al*, 2010b	
7	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	N/A	accessed at www.dwer.wa.gov.au
8	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.		
9	DER, November 2016. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.		

Appendix 2: Summary of Licence Holder comments

The Licence Holder was provided with the draft Amendment Notice on 15/05/2019 for review and comment. The Licence Holder responded on 5/6/2019 and 7/6/2019 with the following comment on the draft Amendment Notice.

Condition	Summary of Licence Holder comment	DWER response
1.3.10	With regards to the creek monitoring, could we please amend to a new timeframe? We agree with the need for the survey, but can we make this report required prior to operations - such as "three months prior to operating the plant" as opposed to the current "three months since the issue of this Amendment Notice"?	This request has been accepted. Condition 1.3.10 has been updated to allow for submission of the survey report 3 months prior to operation recommencing.