19/04/2022

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RE: Works Approval Fimiston Processing Plant Revitalisation

Northern Star Resources (NSR) is seeking a Works Approval to allow an revitalisation of the Fimiston Processing Plant. The revitalisation will increase nominal throughput of 'Category 5 - Processing and Beneficiation of Metallic or Non-Metallic Ore' from 14.5 Million tonnes per annum (mtpa) to 23.5mtpa. The Fimiston Processing Plant is located on M26/383, M26/294 and M26/359.

The KCGM Fimiston Processing Plant (Site) has been upgraded and added to several times. The current combined processing rate of Fimiston and Gidji Processing Plant has typically been 13mtpa. The previous upgrades have ultimately resulted in an inefficient facility, as indicated by the relatively high process plant operating costs when compared to similar operations. An internal review of the process flow sheet identified several efficiency opportunities and led to the completion of a Throughput Increase Scoping Study. The study evaluated various industry proven comminution technologies against capital intensity and operating cost benefit. A staged approached was considered to upgrade the plant from 13 to 23.5mtpa, however the Pre-feasibility study identified that direct increase to 23.5mtpa is preferred.

The project includes modernising the following major circuits of the plant:

1. Addition of a new primary crusher and covered coarse ore stockpile;
2. Additional milling capacity with a 18MW SAG Mill and 22MW Ball Mill;
3. Additional Rougher Flotation Cells and re-purposing of existing flotation circuits;
4. Addition of a 60m Pre-Leach Thickener for Flotation Tails;
5. New flotation tails CIL circuit, with dedicated elution and carbon regeneration circuit; and
6. Potential to replace the Gidji flowsheet at Fimiston, repurposing some of the existing CIL circuits

Major new equipment for each phase is summarised in the Table below.

Area	Component
Primary Crusher	54-75 Gyratory
Primary Mill	18 MW SS SAG
Pebble Crushing	2 x 7' Symons
Secondary Mill	22 MW ball
Gravity Circuit	4 x 48" Knelson + CS10000 Acacia
Flotation	7x 630m³ TankCells
Thickening	1 x 60 m diameter
Flotation Tail CIL	8 x 5,100 m³
Concentrate Regrind	2 x M10000 IsaMill
Concentrate CIL	Re-purpose existing IL circuits

[redacted]

The following existing components will be made redundant with the Processing Plant upgrade:

- Existing ball mill gravity circuits
- Existing trash screens
- Existing flotation cells
- Existing 27 m diameter pre-leach thickener
- Existing contract crushing circuit
- Existing Mt Charlotte comminution circuit

The location of the Processing Plant in relation to the premises boundary is shown in Figure 1. There is no change to the existing Processing Plant precinct.

The proposed conceptual layout of the upgraded Processing Plant is shown in Figure 2.

A detailed description of the proposed milling process, emissions to consider and Risk Assessment are included below.

1. Process Description

1.1 Crushing

ROM ore will be crushed in two parallel crushing circuits:

- The existing Fimiston gyratory crushing circuit.
- A new gyratory crushing circuit.

The existing contract crushing circuit will be decommissioned.

The new crushing circuit will consist of a dual-tip ROM bin, apron feeder and 54-75 gyratory crusher. Crushed product with a nominal P80 of 150 mm will be conveyed to a new crushed ore stockpile.

A stick picker (hydraulic grapple) will be included on the apron feeder above the gyratory crusher to allow the operator to remove tramp material from the crusher feed. A root picker (spiked roll) above the 90-degree transfer between the crusher discharge conveyor and stockpile feed conveyor will remove additional tramp material. To assist the root picker performance, tramp metal magnets will be installed at the transfer of the two conveyors and on the feed end of the stockpile feed conveyor.

Fugitive dust will be managed with water sprays.

1.2 Crushed Ore Stockpile

The new crushed ore stockpile will have a live capacity of 12 hours throughput case and will include a stockpile cover to mitigate fugitive dust. Ore will be reclaimed from the stockpile by three apron feeders.

1.3 Grinding Circuit

A new 18 MW dual pinion single-stage SAG mill will be fed from the new crushed ore stockpile. The SAG mill will operate in closed circuit with a new cyclone cluster and gravity circuit fed from the cyclone underflow.

The existing Mt Charlotte comminution circuit (SAG mill, ball mill, trash screens and pre-leach thickener) will become partially redundant, while the existing Fimiston circuit will continue to operate as it is currently.

SAG mill discharge will be discharged onto a vibrating screen, with the screen undersize pumped to a new cyclone cluster. Cyclone underflow will be split and report to the SAG mill and new gravity circuit.

The SAG mill discharge screen oversize will be conveyed to the pebble crushing circuit, consisting of duty/standby cone crushers, each with a feed bin and vibrating feeder. Two magnets and a metal detector will be fitted to the pebble conveyors. On detection of metal, a gate in the top of the crusher feed bin will open to bypass material around the bin. The bypass chute can also accept overflow from the bin if the crushers are offline

Throughput is increased further by converting the new SAG mill from single stage operation (8 Mtpa maximum) to SABC operation (13 Mtpa maximum), resulting in an estimated maximum combined

throughput of 23.5 Mtpa. To support this throughput and achieve the target grind size P80 of 150 µm, a new 23 MW GMD ball mill will be required to process the discharge from both the Fimiston SAG Mill and new SAG mill. The existing Fimiston ball mills will be decommissioned. Mill discharge from the existing Fimiston SAG mill and new SAG mill will be combined with discharge from the new ball mill and pumped by duty/duty pumps to two parallel cyclone clusters.

Cyclone underflow from both cyclone clusters will report to the new ball mill, with a portion from each directed to dedicated gravity circuits (one per cyclone cluster). The ball mill discharge will report to the new cyclone feed hopper. Cyclone overflow will be combined and report to trash screens.

1.4 Gravity Circuit

Two 48” Knelson concentrators are included in the new comminution circuit design, with the Knelson concentrators fed from the new cyclone underflow. The circuit will include two parallel scalping screens, with each screen feeding a single Knelson. The Knelson concentrates will be combined with those from the existing Fimiston ball mill gravity circuits and treated in a new CS10000 Acacia unit.

A new Acacia electrowinning module (heated tank) and electrowinning cell will be included to treat the gravity concentrate.

A second, parallel gravity circuit will be installed with the new ball mill circuit. Operation will be identical to the first phase circuit, except the scalping screen oversize will report to the ball mill feed. Gravity concentrate will report to the Acacia reactor installed in the first phase.

The existing Fimiston ball mill gravity circuits will be made redundant.

1.5 Flotation Feed

Cyclone overflow from the new comminution circuit will gravitate to a new facility housing new linear trash screens. Trash screen undersize will gravitate to a new flotation feed sampler before reporting to the existing flotation circuit. The flotation feed sample will report to a particle size analyser, while trash will be collected in bunkers for disposal.

With the addition of a new flotation circuit, the trash screen underflow will be redirected to gravitate to the new circuit. The flotation feed sample will also be directed to an onstream sulphur analyser.

Additional 40 m² linear trash screens will be installed to meet the demands of the new throughput. The combined cyclone overflow will be split between all screens. Screen underflow will report to the flotation circuit, with trash collected in bunkers for disposal. The existing Fimiston trash screens will be made redundant.

1.6 Flotation

The new comminution circuit product will be treated in a new rougher/scavenger flotation circuit, consisting of new tank flotation cells, with an additional cell installed in a conditioning duty. The selected cells will provide an equivalent residence time at 23.5 Mtpa as the current Mt Charlotte rougher/scavenger circuit at the current throughput rates.

Rougher and scavenger concentrate will be separately pumped to the cleaner circuit, with the rougher concentrate able to be diverted to final concentrate. Scavenger tails will gravitate to a new pre-leach thickener. The existing Fimiston rougher columns and scavenger circuits will remain unchanged.

Cleaner-scavenger concentrate will be pumped to the existing regrind mill, while cleaner scavenger tail will report to the existing pre-leach thickeners. Regrind cyclone overflow will report to the cleaner circuit. The regrind mill currently processes the cleaner tail.

Reagents for the new flotation circuit will be provided by dedicated storage and dosing facilities.

A second train of tank flotation cells operating in parallel with the first train will also be installed to provide sufficient residence time for the throughput requirements.

All flotation concentrates from both trains will be pumped to the cleaner circuit. Each scavenger tail will gravitate to a respective pre-leach thickener

The existing Fimiston rougher columns will be made redundant and the existing parallel scavenger circuits will be configured in cleaner and cleaner-scavenger duties. All other flotation existing flotation cells will be made redundant.

[redacted]

Cleaner concentrate will be pumped to final concentrate. Cleaner tail will be pumped to the cleaner scavenger circuit. Cleaner scavenger concentrate will be reground and returned to the cleaner feed, while cleaner-scavenger tail will report to the pre-leach thickener.

1.7 Pre-Leach Thickening

A new 60 m diameter thickener will be installed. The new scavenger flotation tails will gravitate to the thickener. Thickener underflow will be combined with the existing CIL 2/3 tails in a new tailings tank and pumped to the TSF.

The thickener underflow will be pumped to a new CIL circuit. The existing pre-leach thickeners will continue to treat the Fimiston scavenger tails and cleaner-scavenger tails.

In all cases, thickener overflow will gravitate to a new process water tank, which will provide process water to the new facilities. Top-up water for the process water tank will be provided by new pumps fed from the existing saline water ponds.

A dedicated flocculant mixing facility will be included for the new thickener. This will include a storage silo for bulk flocculant delivery, flocculant mixing tank and flocculant storage tank.

1.8 Flotation Tailings Leaching

Underflow from the new pre-leach thickener will be pumped to a new CIL circuit ("CIL 4). Loaded carbon from the circuit will be treated in a new dedicated elution circuit.

Tails from the CIL circuit will be screened over a 40 m² linear screen to recover any undersize carbon, with the screen undersize reporting to a tailings tank where it will be combined with the CIL2/3 tailings before being pumped to the TSF.

A second, parallel 40 m² linear screen will be added in the carbon safety screen duty for CIL 4.

Additional leach tanks will be added to the head of the CIL2/3 circuit to increase residence time to approximately 20 hours. The existing CIL 2 and CIL 3 leach tanks will be converted to adsorption tanks.

1.9 Concentrate Processing

Flotation concentrate will be pumped to the first of two storage tanks, before being pumped to a new deslime cyclone cluster. Cyclone underflow will gravitate to the second storage tank, with cyclone overflow reporting to the slimes flotation circuit.

Slimes flotation concentrate will be returned to the second concentrate storage tank, while flotation tails will be pumped to the concentrate thickener.

Deslimed concentrate from the second storage tank will be pumped to the concentrate filters for dewatering before being trucked to Gidji for further processing. In addition, some material from the second concentrate storage tank will be pumped to the UFG feed preparation cyclones. Cyclone underflow will be returned to the tank, while the overflow will gravitate to the UFG feed tank.

Feed to the UFG circuit will be pumped to the regrind mill discharge hopper, before being pumped to the regrind mill cyclones. Cyclone underflow will gravitate to the regrind mill feed hopper, before being pumped to the regrind mill. Cyclone overflow will be pumped to the concentrate thickener. One of the pre-leach thickeners made redundant will be used for this duty as the existing thickener has insufficient capacity.

A new M10000 IsaMill (3,000 kW) regrind mill and associated pumps, hoppers and cyclones will be installed to meet the requirements of the concentrate production.

The existing concentrate loading area will be relocated to facilitate the regrind mill circuit installation, while continuing to be fed from the existing concentrate filters.

To facilitate processing all of the flotation concentrate at Fimiston, further upgrades and reconfiguration of the concentrate handling circuit will be required, including the addition of a second regrind mill.

Flotation concentrate will be pumped to the two existing concentrate storage tanks. From here, the concentrate will be pumped to two parallel regrind mill circuits, each consisting of an M10000 IsaMill operating in closed circuit with a set of 24 x 100 mm diameter cyclones.

Regrind circuit product (cyclone overflow) will report to the concentrate thickener.

[redacted]

The concentrate deslime cyclones, UFG feed preparation cyclones, UFG feed storage tank, concentrate belt filters and concentrate loadout facility will be made redundant.

1.10 Concentrate Leaching

Concentrate thickener underflow will be pumped to the existing CIL 1 circuit. Loaded carbon from the circuit will be treated in the existing elution circuits. CIL 1 tails will be pumped to either CIL 2 or CIL 3, with the CIL 1 tails pumps upgraded to meet the new duty.

To meet the throughput requirements, a new CIL circuit ("CIL 5") has been allowed. This will consist of new leach and absorption tanks, to give an overall residence time of approximately 300 hours. The tank sizing has been selected to provide commonality with the new CIL 4.

Each adsorption tank will be fitted with a pumped interstage screen, while carbon will be transferred by recessed impeller vertical spindle pumps.

1.11 Elution

New dedicated elution circuits will be included to treat carbon from CIL 4 and CIL 5. The circuits will be identically sized to the existing circuits, with a acid wash column and elution column. Pregnant eluate from each circuit will be transferred to new electrowinning circuits.

Dedicated regeneration kilns have been allowed for each elution circuit to process barren carbon from the new elution circuit. Allowance has been included for mercury scrubbers to treat kiln off gasses. Downstream mercury treatment facilities have sufficient capacity to treat the scrubber discharge.

1.12 Electrowinning

A new dedicated electrowinning circuit for the gravity eluate will be installed. This will include a vendor-supplied eluate tank and electrowinning cell. Barren eluate will be returned to the CIL circuits.

To facilitate the increased production, two new electrowinning circuits have been allowed:

- Two parallel electrowinning cells
- Three parallel electrowinning cells

1.13 Lime Slaking

A new lime slaking facility has been allowed to replace the existing facilities. This will include:

- 600 t quicklime storage silo and associated dust collector and silo discharge feeders.
- 7 t/h capacity lime slaking mill and ancillaries operating in closed circuit with a hydrocyclone.
- Milk of lime storage tank.

[redacted]

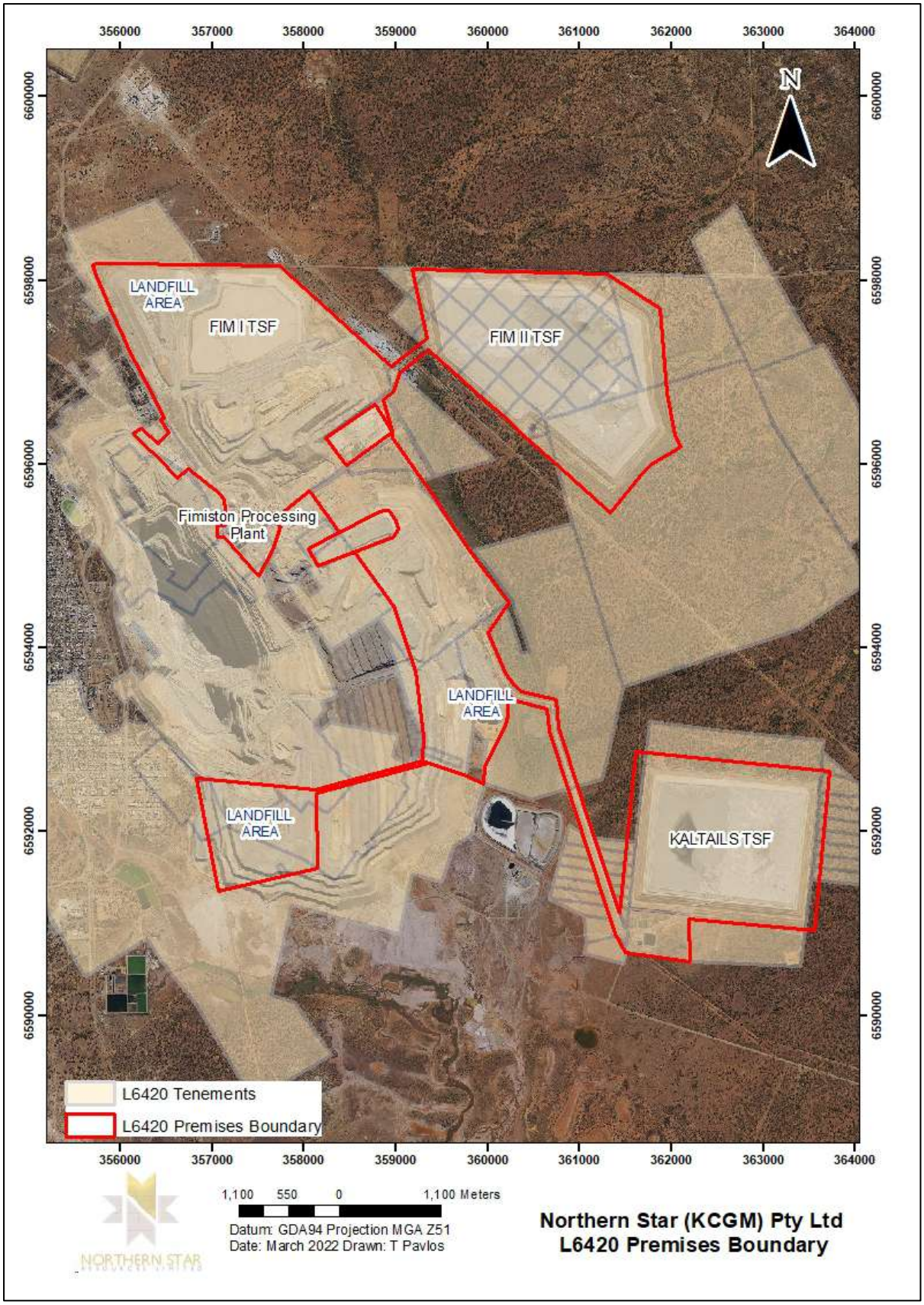

Figure 1: Location of the Fimiston Processing Plant in relation prescribed premises boundary

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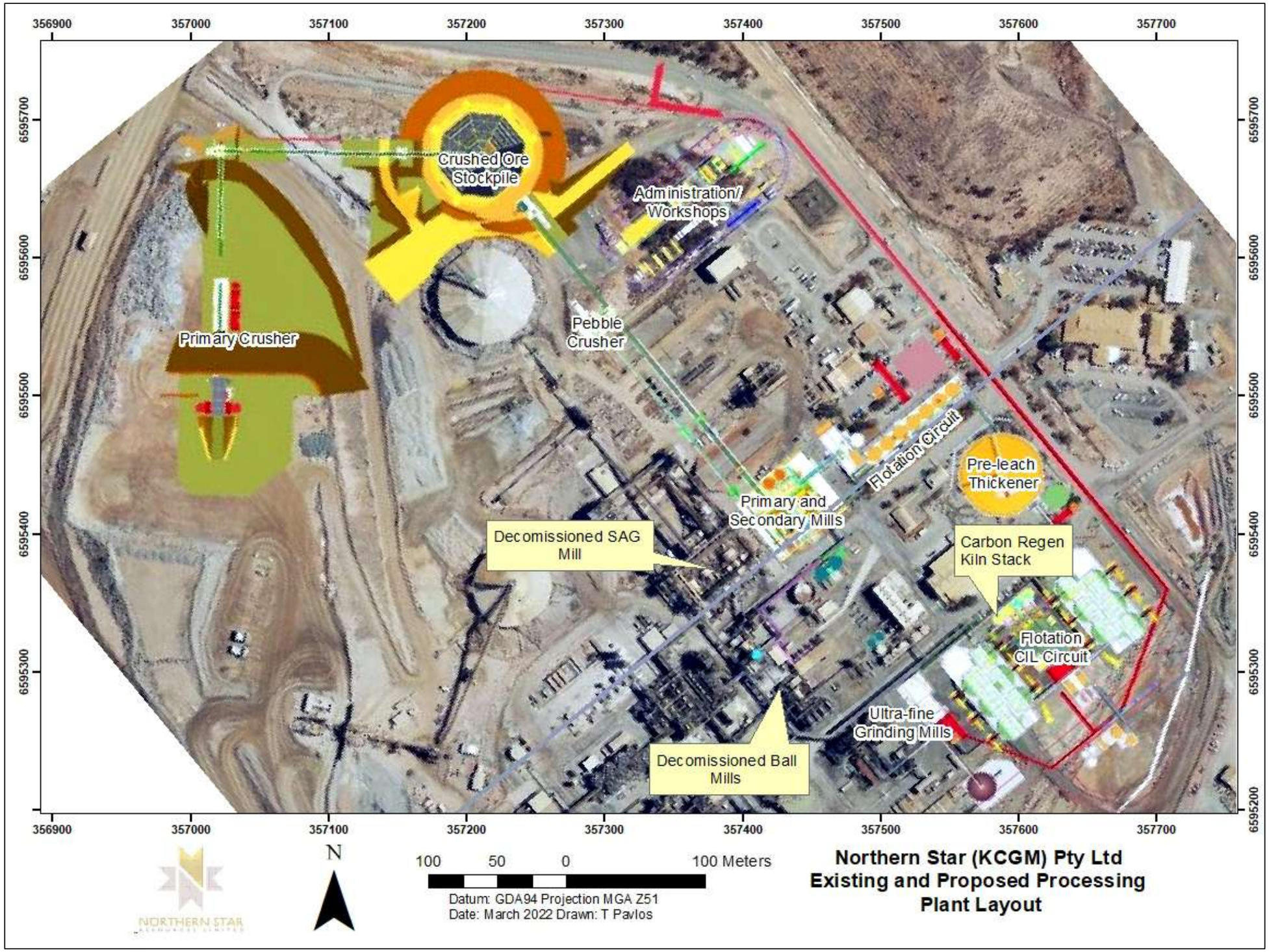

Figure 2: Proposed Conceptual Processing Plant Layout

[redacted]

2.0 Emissions to consider

2.1 Emissions to Air

KCGM engaged specialists to undertake an air quality assessment to assess the impact of the operation of the expanded Processing Plant, in conjunction with existing operations, using several emissions treatments configurations and stack heights.

The compounds assessed as part of the study include:

- Total mercury; and
- A number of speciated VOC's of concern.

Four scenarios were assessed as part of the study.

- Scenario 0 – Reflective of current operations and includes the operation of the existing KOGCC based on a nominal loaded carbon regeneration rate of 30 tpd of mixed carbon from the concentrate and flotation tails leach trains.
- Scenario 1 - Operations of existing and proposed Kiln Off-Gas Cleaning Circuit (KOGCC), both with a Regenerative Thermal Oxidiser (RTO). This is based on a nominal loaded carbon regeneration rate of 20 tpd of carbon from the concentrate leach train treated through the existing KOGCC, and 30 tpd of carbon from the flotation tails leach train treated through the proposed KOGCC.
- Scenario 2 - Operations of existing KOGCC with RTO and proposed KOGCC with no RTO. This is based on a nominal loaded carbon regeneration rate of 20 tpd of carbon from the concentrate leach train treated through the existing KOGCC and 30 tpd of carbon from the flotation tails leach train treated through the proposed KOGCC. This scenario was also run using a number of nominal stack heights (20.65m, 30m and 35m) to assess the impacts of adjusting the stack heights.
- Scenario 3 - Operations of existing KOGCC with RTO and proposed KOGCC with no RTO, but the use of an electric arc furnace instead of a gas fired furnace in the proposed KOGCC. This is based on a nominal loaded carbon regeneration rate of 20 tpd of carbon from the concentrate leach train treated through the existing KOGCC and 30 tpd of carbon from the flotation tails leach train treated through the proposed KOGCC.

The results of the assessment show that predicted Ground Level Concentrations (GLCs) for all compounds are below the ambient air quality criteria at all locations (onsite and offsite) within the modelled domain for all scenarios. The maximum predicted GLCs were predicted to occur onsite within the vicinity of the stacks.

When compared against the guidelines, the results indicate that predicted GLCs for all pollutants are negligible with the exception of predicted benzene GLCs for Scenarios 2 (for all stack heights) and 3 where impacts from the proposed KOGCC without the use of an RTO resulted in elevated GLCs. However, the predicted offsite GLCs of benzene from Scenario 2 (for all stack heights) and Scenario 3 were approximately 6% of the relevant short-term guideline and are not considered significant.

Northern Star is proposing to implement Scenario 1 as part of this Works Approval application.

The full Emissions Modelling Report is attached as Attachment 6A.

2.2 Noise

The Environmental Protection (Noise) Regulations 1997 (Noise Regulations), administered by DWER, stipulates assigned noise levels. KCGM has approval under Regulation 17 of the Noise Regulations to allow the emission of noise from the Fimiston operations to vary from the assigned noise levels. The Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016 which was published in the Government Gazette on March 22, 2016, stipulates approved noise levels for the Fimiston Gold Mine Operations.

[redacted]

An environmental noise assessment for the Processing Plant expansion was completed to ensure that predicted noise levels remained under those prescribed in the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.

Considering the variation in noise level for the current and proposed operations for the Processing Plant and Crushing Circuit, there is a general increase in the noise level by around 3 dB(A) for the processing operations.

Although there is an increase in noise levels for the processing operations, the noise levels of the Mill processing and Crushing without the inclusion of mining operations is significantly below the assigned noise levels at the Regulatory reference locations. As the processing operations are 10 dB less (or greater) than the mining noise levels, the Mill and Crushing for the proposed upgrades do not impact the overall noise levels at receivers, hence Compliance for the processing is readily achieved.

The full Noise Modelling Report is Attached as Attachment 6B

2.3 Dust

KCGM proactively manage its Fimiston Operations to ensure that the 24 hour average PM10, as a result of KCGM emissions, are less than 50 µg/m3 at the monitoring locations. This performance target was based on the PM10 Standard from the National Environmental Protection (Ambient Air Quality) Measure Variation 2003.

Dust control on the crushing circuit consists of water sprays on the ROM bin, dust extraction units on the crusher discharge and screen discharge chute. Dust extraction will be run by a bag house which is located next to the crushers, adjacent to the ROM pad. All transfer points will be equipped with rubber sealing and skirting to contain dust generated.

With these mitigation measures in place it is anticipated that any additional emissions from the upgraded Processing Plant will be negligible.

2.4 Waste

Waste emissions, such as construction/ demolition wastes will be handled in accordance with existing waste management plans and will be disposed of, or recycled the same as all other current mine site wastes. Majority of waste types generated during the project will be sent offsite for recycling. Some construction wastes and concrete will report to the onsite inert landfills. It is anticipated that the project may produce up to 7,000 tonnes of waste (mostly from decommissioned concrete footings/ plinths) that will report to onsite landfill facilities.

Operating Licence L6420/1988/14 authorises KCGM to have a Class I Inert Landfill onsite (category 63) with an approved capacity of 15,000 tonnes per year. In 2021 KCGM disposed of 339.3 tonnes of inert waste, therefore there is capacity for the existing facilities to accept waste and remain under Operating Licence limits.

Waste stream for materials to be generated during the project are shown in the table below.

Waste Type	Amount Disposed Onsite	Endpoint
BUILDING/CONSTRUCTION MATERIAL	500 tonnes	If the waste stream is not steel or timber, it is to be disposed of into the Landfill.
CONCRETE	6,000 tonnes	Onsite inert landfill
CONTAMINATED HYDROCARBON WASTE	NA	Collected onsite in designated receptacles. Removed from site by certified contractor.
CONTAMINATED SOIL/WATER	NA	Peat moss (used to clean up spilt hydrocarbons on hard surface such as the fuel farm) is taken to the bioremediation farm. Small quantities (<20kg) can be disposed of in designated skips
CONVEYOR BELT & LINERS	NA	Rolled up and stored onsite. Recycled offsite or reused onsite

[redacted]

GREASE	NA	Controlled waste. Waste grease is placed in 205L drums which are wrapped in black plastic, strapped down then delivered to stores for transport offsite to Wren Oil. Grease pods are returned to the supplier where they are re-filled and returned to site.
POLY PIPE	NA	Stored onsite before being collected for offsite recycling
RUBBER	500 tonnes	The following types of rubber are sent offsite for recycling: ▪ SAG trommel screen panels ▪ SAG discharge grates, discharge and lifters of pulp lifters ▪ Ball mills, lifters and shell plates ▪ All other rubber including pipe lining from the mill is taken to landfill.
SCRAP METAL (GENERAL)	NA	Scrap metal is collected in scrap steel bins or at the scrap steel lay down area adjacent to the mill and sent offsite for recycling.
STEEL FROM THE PROCESSING PLANT	NA	Mill balls, SAG lifters (shell), feed end lifters, shell plates, Trojan horse liners and Jaw and Pebble crusher liners are sent offsite via stores for recycling.

3.0 Other considerations

3.1 Tailings Storage

Tailings will to be disposed of to the approved Fimiston I, Kaltails and Fimiston II TSFs. Existing TSFs have capacity to accept tailings from the expanded Processing Plant for approximately 24 months, after this time additional cells will be required. Approval under Part IV of the Environmental Protection Act was granted in September 2020 to allow construction of the Fimiston IIE TSF these cells will give an additional 24 months tailings capacity.

Approval for additional TSF capacity for KCGM's Fimiston Gold Mine Operations will be sought under Part IV of the EP Act. This approval is required primarily because the footprint of the TSF extension and associated infrastructure will be situated outside of the currently approved Authorized Extents for clearing, as specified in Attachment 7 to Ministerial Statement 782.

Tailings properties will not be significantly affected by the proposed throughput change or modernisation of processing facilities, as the process will be essentially identical to current, albeit at an increased volume per hour.

The TSF cells are designed by KCGM TSF Engineer of Record- Golder. The design of the TSF and the deposition strategy takes into account the known characteristics of the tailings, and change in throughput to 23.5 million tonnes per annum. TSF water management, including seepage recovery, will be continue to be managed the same way as in the current licence, namely through the Seepage and Groundwater Management Plans.

3.2 Groundwater Extraction

The water requirements for the increased plant throughput will initially be met through a nominal increase in the production rates of the existing licenced borefields

The design of the process plant expansion will also incorporate a new tailings thickener to increase water recovery. The new thickener will increase water efficiencies onsite by reducing the amount of water sent to tailings.

[redacted]

Identification and Management of risks associated the Fimiston Processing Plant Upgrade

Key Environmental Factor	Risk Pathway	Likelihood	Consequence	Risk	Actions to be implemented/Treatment	Likelihood	Consequence	Risk	Procedure incorporating risk treatment
Dust Emissions	Potential for dust emissions during construction to negatively impact the surrounding vegetation.	C	2	M (8)	Dust can be generated by various mining activities such as vehicle movement, blasting, and clearing. Northern Star implement the following dust control measures across its sites to mitigate the impact to surrounding vegetation: • The use of water carts on site to minimise the dust generated by vehicle movement. • Clearing and other activities which have the potential to create high volumes of dust are conducted during suitable conditions. • Conveyors and stockpiles at the Processing Plant will be fitted with dust mitigating infrastructure such as spray bars, enclosures, and vacuum chutes. • Plan activities in high-risk areas (e.g. digging/loading) during day shift when fugitive dust can be seen and managed where practicable • Use of additional dust control measures (i.e. a dust binding agent) where necessary Visual dust inspections are conducted daily.	D	2	L (5)	FIMISTON AIR QUALITY MANAGEMENT PLAN
	Potential for dust emissions during operation to negatively nearby residents	C	2	M (8)	KCGM proactively manage its Fimiston Operations to ensure that the 24 hour average PM10 as a result of KCGM emissions are less than 50 µg/m3 at the monitoring locations. This performance target was based on the PM10 Standard from the National Environmental Protection (Ambient Air Quality) Measure Variation 2003. Continuous PM10 dust monitoring is undertaken at seven monitoring locations stations within the town, using Thermo Beta Attenuation Monitor (BAM) samplers, fitted with PM10 inlets. To ensure the PM10 dust monitoring network is adequately maintained, greater than 90% availability of the continuous PM10 data from each dust monitoring location is required on an annual basis. PM10 is validated on a weekly basis.	D	2	L (5)	FIMISTON AIR QUALITY MANAGEMENT PLAN
Noise Emissions	Noise impacting on nearby residents during construction	C	2	M (8)	The nearest permanent private residence is the town of Kalgoorlie, which is located approximately 3km to the west of the Processing Plant. The Kalgoorlie townsite is located 3km from the Processing Plant. A 15m high earth sound bound has been constructed between the Fimiston mining area and township. KCGM utilizes five "real-time" noise monitoring sites within the Kalgoorlie townsite. Compliance environmental noise monitoring is completed each quarter by specialist noise consultants using a manned sound level meter. The processing plant is located to the east of the ROM Pad, at a lower elevation, acting as a noise mitigation for all processing equipment except the crusher. An environmental noise assessment for the Processing Plant expansion was completed to ensure that predicted noise levels remained under those prescribed in the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016. As the processing operations are 10 dB less (or greater) than the mining noise levels, the Mill and Crushing for the proposed upgrades do not impact the overall noise levels at receivers.	D	2	L (5)	2016 Fimiston Noise Approval KCGM-ENV-033-PLA NOISE AND VIBRATION MANAGEMENT PLAN
	Potential for noise emissions to negatively impact the work force during construction.	C	2	M (8)	Construction noise will be managed consistently with standard site procedures, i.e. where fixed, mounted or hand held power tools are being operated, mandatory hearing protection will be required. As construction will be in close proximity to the operating mill (which is a mandatory PPE sign posted area), this will apply to construction personnel also. The current occupational noise levels in the vicinity of the primary mill requires personnel to wear hearing protection devices to reduce auditory exposure.	D	2	L (5)	FIMISTON AIR QUALITY MANAGEMENT PLAN

[redacted]

Key Environmental Factor	Risk Pathway	Likelihood	Consequence	Risk	Actions to be implemented/Treatment	Likelihood	Consequence	Risk	Procedure incorporating risk treatment
					During the construction phase, workers will be required to undergo training in noise and hearing protection and will be sampled randomly for personal noise exposure recordings. Further action and controls will be implemented by NSR should the results of sampling warrant them. The Contractor will be required to submit a Health, Safety and Environmental Management Plan addressing noise risks that is aligned to and in compliance with NSR's site standards, policies and procedures.				KCGM-ENV-033-PLA NOISE AND VIBRATION MANAGEMENT PLAN
Processing Emissions	Potential for point source emissions to air to breach licence limits.	C	2	M (8)	Northern Star has completed emissions modelling based on four different scenarios regarding the Processing Plant expansion. The results of the assessment show that predicted Ground Level Concentrations (GLCs) for all compounds are below the ambient air quality criteria at all locations (onsite and offsite) within the modelled domain for all scenarios. It is anticipated that pollutants from the emission points listed in L6420/1988/14 will continue to remain well under the allocated licence limits as indicated by the modelling. Emissions will continue to be monitored and reported annually as per Operating Licence conditions.	D	2	L (5)	FIMISTON AIR QUALITY MANAGEMENT PLAN FIMISTON PROCESSING PLANT AIR QUALITY ASSESSMENT
	Potential for point source emissions to negatively impact the work force.	C	2	M (8)	Emissions modelling predicted concentrations of all relevant pollutants at a number of elevated locations located close to the stack of the proposed KOGCC where KCGM workers would expect to work. All of the predicted concentrations were well below the workplace exposure standards, with the maximum predicted concentration on top of any of the tanks predicted to be no greater than 0.5% of the relevant standard.	D	2	L (5)	FIMISTON AIR QUALITY MANAGEMENT PLAN FIMISTON PROCESSING PLANT AIR QUALITY ASSESSMENT
Waste Emissions	Potential for waste generated to breach licence limits.	C	2	M (8)	Waste emissions, such as spoil from earthworks, packing material and scrap steel will be handled in accordance with existing waste management plans, and will be disposed of, or recycled the same as all other current mine site wastes. All non-recyclable inert and putrescible wastes will be disposed of to the site landfill trenches in accordance with the Operating Licence or sent off site to be disposed of at a licenced facility. All recyclable items (cardboard, paper, steel, poly pipe, etc.) will be sent off site for reuse or donated to local communities/stakeholders.	D	2	L (5)	KCGM-ENV-023-PLA WASTE MANAGEMENT PLAN
Water Resources	Insufficient water management resulting in localised flooding or areas of water starvation.	B	3	H (17)	The Fimiston plant is designed to contain all stormwater that has the potential to become contaminated with the plant site run-off. This water is captured in catch-pits and can either be reused or left to evaporate. Solids are regularly removed from the catch-pits to ensure that catch-pit capacity is not compromised. Surface water samples are collected from compacted and hardstand areas at KCGM after periods of significant runoff and are analysed for a range of components, including metals and hydrocarbons. Water management structures will be constructed in accordance with their approved design specifications, and monitoring conducted to identify and correct any poor surface water quality. Reinstating surface water flow is a closure objective.	D	2	L (5)	KCGM-ENV-012-PLA WATER MANAGEMENT PLAN
	Insufficient water management resulting in interaction of surface water with landforms and	C	3	H (13)	The Fimiston plant is designed to contain all stormwater that has the potential to become contaminated with the plant site run-off. This water is captured in catch-pits and can either be reused or left to evaporate. Solids are regularly removed from the catch-pits to ensure that catch-pit capacity is not compromised. Reinstating surface water flow is a closure objective.	D	3	M (9)	KCGM-ENV-012-PLA WATER MANAGEMENT PLAN

[redacted]

Key Environmental Factor	Risk Pathway	Likelihood	Consequence	Risk	Actions to be implemented/Treatment	Likelihood	Consequence	Risk	Procedure incorporating risk treatment
	contributing to increased erosion/stability issues and poor surface water quality.								
	Contamination of soil or groundwater due to hydrocarbon spills/leaks.	B	3	H (17)	The design and construction of storage facilities is to Australian standards and maintenance is conducted as required. Education and training is provided to personnel working on site regarding the correct storage and management of hydrocarbons and chemicals, as well as procedures for clean-up and remediation in the event of a spill. All hydrocarbons are to be adequately bunded to ensure any spills or leaks are contained. Spill kits are located in hydrocarbon storage areas. In the event of a spill, contaminated soil is collected and removed to the bioremediation area for treatment. Education and training is provided to staff regarding the correct use of the bioremediation area. All spills are reported to the environment department and recorded.	D	3	M (9)	KCGM-ENV-023-PLA WASTE MANAGEMENT PLAN ENVIRONMENTAL PROCEDURE HYDROCARBON STORAGE AND HANDLING
Biodiversity/ Flora/ Fauna/ Ecosystem	Clearing outside the approved disturbance envelope resulting in breach of tenement conditions.	C	2	M (8)	Clearing approval will be gained from relevant government departments prior to commencement of clearing activities. Clearing Activity Permits will be gained by personnel from the Environment Department outlining the area to be cleared, ensuring it is within approved envelope. A copy of the permit and a map of proposed clearing will be given to responsible project manager. Clearing of vegetation will be contained to within the Processing Plant area.	D	2	L (5)	KCGM-ENV-036-GUI VEGETATION CLEARING AND REHABILTATION MATERIAL STRIPPING
	Potential for saline leaks, spills or spray to adversely impact the surrounding environment.	C	2	M (8)	All saline pipelines are in bunded areas, v-drains or buried, which provide adequate containment in the event of a pipeline failure. Leaks are identified using leak detection systems and KCGM are alerted to any leaks in the system by the Distributed Control System (DCS), which is continuously monitored by the Control Room Operators and Site Services. During pumping, saline pipelines are inspected twice daily and any leaks are reported and fixed. Personnel are educated in spill clean-up procedures. Dribble bars are installed on water trucks to avoid overspray impacting on roadside vegetation.	D	2	L (5)	KCGM-ENV-012-PLA WATER MANAGEMENT PLAN

Qualitative measures used for the determination of an event likelihood rating

Likelihood		Description
A	Almost Certain	Common or Frequent occurrence (e.g. once per day)
B	Likely	Is known to occur or "it's happened" (e.g. >once per month, but <once per day)
C	Possible	Could occur or "I've heard of it happening" (e.g. >once per year, but <once per month)
D	Unlikely	Not Likely to occur (e.g. <once per year)
E	Rare	Rare / practically impossible (e.g. very unlikely to ever occur)

[redacted]

Qualitative measures used for the determination of an event consequence

Environmental Factor	Very Low (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Biodiversity/ Flora/ Fauna/ Ecosystem	None or insignificant impact to ecosystem component (physical, chemical or biological) with no effect on ecosystem function.	Moderate to minor impact to ecosystem component (physical, chemical or biological) resulting in a minor, recoverable impact.	Minor and short-term impact to ecosystem expected, resulting in a moderate, recoverable impact.	Long-term impact to ecosystem expected, resulting in a major, recoverable impact.	Irreversible impact to ecosystem expected.
Water Resources	Low impact to isolated area without affecting any use of the water.	Contained low impact with negligible effect on the use of the water.	Uncontained impact that will materially affect the use of water, but to be rectified in the short-term.	Extensive hazardous impact requiring long-term rectification.	Uncontained hazardous impact with residual effect.
Landforms	Negligible impact to isolated areas.	Contained low impact, not impacting on any environmental value.	Uncontained impact, able to be rectified in short-term without causing pollution or contamination.	Extensive hazardous impact requiring long-term rectification.	Uncontained hazardous impact with residual effect.
Air Quality	No detectable impact.	Contained low impact not impacting on any environmental value.	Uncontained impact that will materially affect an environmental value, but able to be rectified in the short-term.	Extensive hazardous impact on an environmental value requiring long-term rectification.	Uncontained hazardous impact with residual effect.
Mine Closure	Site is safe, stable and non-polluting, and post-mining land use is not adversely affected.	The site is safe, all major landforms are stable, and any stability or pollution issues are contained and require no residual management. Post-mining land use is not adversely affected.	The site is safe, and any stability or pollution issues require minor, ongoing maintenance by end land-user.	The site cannot be considered safe, stable or non-polluting without long-term management or intervention. Agreed end land-use cannot proceed without ongoing management.	The site is unsafe, unstable, and/or causing pollution or contamination that will cause an ongoing residual affect. The post-mining land use cannot be achieved.

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Risk Ranking Matrix

		CONSEQUENCES				
LIKELIHOOD		Very Low **1**	Minor **2**	Moderate **3**	Major **4**	Catastrophic **5**
A	Almost Certain	**H** (11)	**H** (16)	**E** (20)	**E** (23)	**E** (25)
B	Likely	**M** (7)	**H** (12)	**H** (17)	**E** (21)	**E** (24)
C	Possible	**L** (4)	**M** (8)	**H** (13)	**E** (18)	**E** (22)
D	Unlikely	**L** (2)	**L** (5)	**M** (9)	**H** (14)	**E** (19)
E	Rare	**L** (1)	**L** (3)	**M** (6)	**M** (10)	**H** (15)

Matrix Legend:

E: Extreme risk — Immediate action required, further reduction needed. If not possible, Country Manager or COO approval required

H: High risk — Senior management attention needed

M: Moderate risk — Management responsibility must be specified

L: Low risk — Manage by routine procedure

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