



Application for Licence Amendment

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

Licence Number	L8612/2011/1
Licence Holder	Pantoro South Pty Ltd
ACN	633 003 737
File Number	2011/010196-1
Premises	Norseman Gold Project Legal description – Being part mining tenements Miscellaneous Licence: L63/32 Mining lease: M63/11, M63/13, M63/14, M63/15, M63/29, M63/36, M63/42, M63/43, M63/48, M63/68, M63/112, M63/133, M63/140, M63/142, M63/155, M63/156, M63/173, M63/214, M63/257, M63/275, M63/325 and M63/659
Date of Report	19 April 2024
Proposed Decision	Revised licence granted

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

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1. Decision summary

Licence L8612/2011/1 is held by Pantoro South Pty Ltd (Licence Holder) for the Norseman Gold Project (the Premises), located adjacent to the town of Norseman.

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the operation of the Premises. As a result of this assessment, Revised Licence L8612/2011/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

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

2.2 Amendment summary

On 9 June 2023, the Licence Holder submitted an application to the department to amend Licence L8612/2011/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought:

- Increase the production/design capacity for category 5 from 700,000 to 1,500,000 tonnes per annum (tpa) – refer to Table 1;
- Incorporate the processing plant infrastructure and tailings storage facility (TSF) 4 stage 3 works constructed under W6472/2020/1 (refer to sections 2.2.1, 2.2.2 and 2.2.3);
- Allow the reprocessing of TSF Bluebird tailings (refer to section 2.2.4);
- Increase the production/design capacity of category 6 from 2,000,000 to 2,380,000 tpa (refer to Table 1) and include infrastructure constructed under W6472/2020/1 (refer to section 2.2.5);
- Category 52: Electric power generation, to be removed from the licence (refer to section 2.2.7);
- Increase the production/design capacity for category 64 from 500 to 5,000 tpa (refer to Table 1) and include the landfills constructed under W6472/2020/1 (refer to section 2.2.8);
- Inclusion of category 70 and the infrastructure constructed under W6472/2020/1 (refer to section 2.2.8);
- Include infrastructure from W6472/2020/1 still requiring construction (refer to section 2.2.9); and
- Extension of the premises boundary (refer to section 2.2.10).

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

Table 1: Proposed design capacity changes

Category	Current design capacity	Proposed design capacity	Description of proposed amendment
5	700,000 tonnes per annum	1,500,000 tonnes per annum	Licence Holder requested to add the current design/throughput capacity from W6472/2020/1 to the Licence L8612/2011/1
6	2,000,000 tonnes per annum	2,380,000 tonnes per annum	
52	10 MWe	NA	No changes. Category to be removed from the licence.
64	500 tonnes per annum	5,000 tonnes per annum	Licence Holder requested to add the current design/throughput capacity from W6472/2020/1 to the Licence L8612/2011/1
70	NA	50,000 tonnes per annum	

2.2.1 Category 5 infrastructure

The following infrastructure relating to category 5 has been constructed under W6472/2020/1:

- TSF4 – Stage 3 lift to a RL 309 m
- TSF4 seepage management infrastructure, which includes:
 - (a) Tailing and return water pipelines;
 - (b) Cut off trench for Stage 3 excavated to a nominal depth of 2.0 m;
 - (c) One recovery bore (SRB1); and
 - (d) One additional monitoring bore (PB2)
- The process plant which includes:
 - (a) Replacement of primary jaw crusher (primary crusher conveyor retained);
 - (b) Refurbished ROM bin, apron feeder, dribble chute, stacker conveyor, vibrating feeder chute, stockpile discharge conveyor, crusher control room;
 - (c) Secondary and tertiary crushing circuit and associated infrastructure;
 - (d) New ball mill circuit and associated infrastructure including the adsorption, leach and gold recovery circuits;
 - (e) Dust suppression sprays for: ROM bin, primary crusher, primary crushed ore stockpile, classifying screen, cone crusher, fine ore surge bin reclaim circuit; and
 - (f) Water sprays in stockpile infrastructure.
- Process plant - noise mitigation infrastructure:
 - (a) Noise attenuation equipment to be installed on plant; and
 - (b) Noise barrier walls.
- Process plant ponds:
 - (a) Raw water tanks and Process water dam; and
 - (b) Process plant events dam.

The department has included operational requirements for the above infrastructure under Condition 6 (Table 1) of Licence L8612/2011/1.

2.2.2 TSF4 – Stage 3

TSF4 had received no tailings since 2016 (DWER,2021). After the construction of Stage 3, tailing deposition restarted on 15 October 2022 (Pantoro South 2023b).

The TSF4 Stage 3 construction finalised on 04 November 2022 under works approval W6472/2020/1. The construction is compliant with the requirements of having an elevated perimeter drainage system and allowing the discharge of seepage to sumps. The seepage management infrastructure constructed includes:

- (a) A cut off trench excavated to a depth of 2.0 m, and backfilled with compacted clayey material, to manage seepage; and
- (b) One recovery bore installed. Four downstream recovery bores were meant to be constructed, but currently only one bore has been installed. Recovery bore PB03B (now called SRB1) was installed and equipped in quarter 2, 2022, to approximately 30 m depth. The Licence Holder stated that they attempted to install more recovery bores, but they were not successful (Pantoro South 2022a).

TSF4 has seepage, where monitoring bores MB02, MB03, MB10 and PB2 which are located nearest the TSF4 embankment, have detected changes in groundwater quality. The Licence Holder suggested that the contaminated water is limited to the immediate downgradient area. A summary of groundwater readings is provided below (Pantoro South 2023a):

- Higher values of cyanide are found in bores MB03, MB10 and PB2.
- WAD cyanide (WAD-CN) concentration results were below the licence limit of 0.8 mg/L, with bore MB08 recording the highest concentration of 0.382 mg/L in March 2020.
- Water acidity has increased in bores MB02, MB03 and MB04, MB08 and MB10.
- Salinity has increased in bores MB03 and MB10.
- Aluminium concentrations have increased in bores MB02, MB03 and MB04, which is attributed to the rising water acidity.
- Higher concentration of manganese has been recorded in bores MB03, MB05, MB07, MB10, MB13 and PB2.

A summary of standing water level (SWL) at TSF4 (Valley) was provided by the Licence Holder (Pantoro South 2023c) and is shown below in Figure 1.

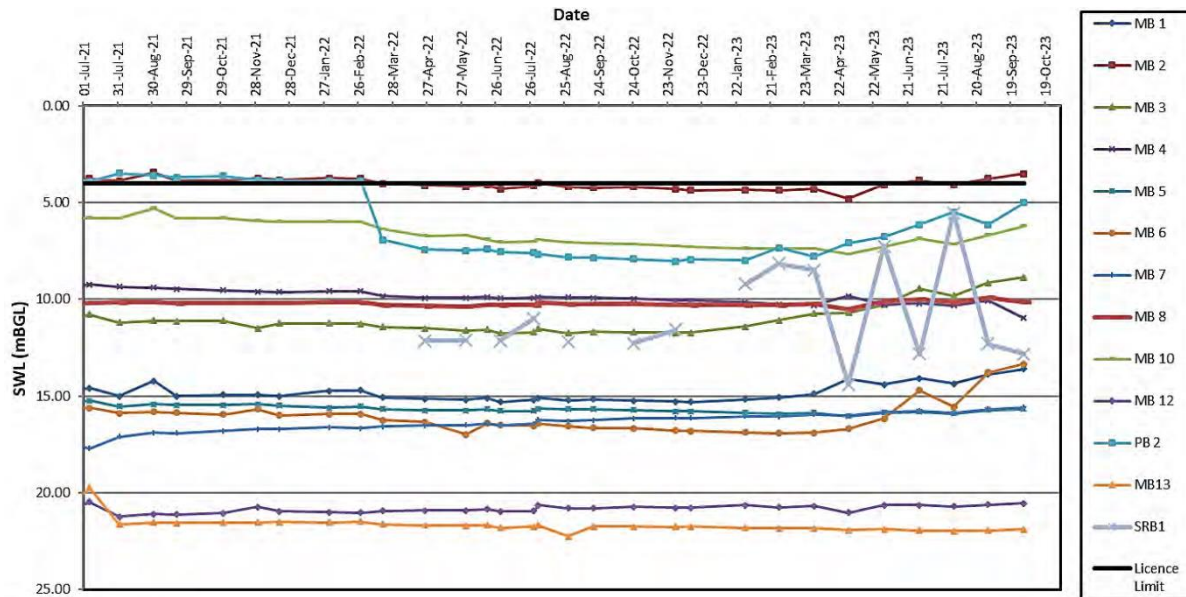


Figure 1: SWL (mBGL) at TSF4 (Valley) Compliance Bores

Leachate containing cyanide and elevated metals and metalloids affecting native vegetation is a concern regarding the operation of TSF4. A summary of the current native vegetation monitoring program is provided below:

To maintain vegetation health at the TSFs there is an existing SWL limit on Licence L8612/2011/1 of 4 m below ground level (mBGL).

The 2021-22 Annual Environmental Report (Pantoro South 2022b) assessed the trees condition, where tree health is rated from 1 “healthy” to 6 “dead” and 0 if a tree was “absent/removed”. The average health for the trees near to TSF4 have an average of 1.82, which is close to slightly stressed (e.g. showing signs of stress with dead limbs, loss of gloss or colour on leaves).

The native vegetation monitoring detected several trees death, which was attributed to the high-groundwater level. According to Native Vegetation Solutions (environmental consulting business), Bore MB10 was over the groundwater level limit between 2015-2016 which is considered to be the cause of several trees’ death, refer to Figure 2 below. Nevertheless, there has been no new tree death registered during the 2021-22 monitoring period.

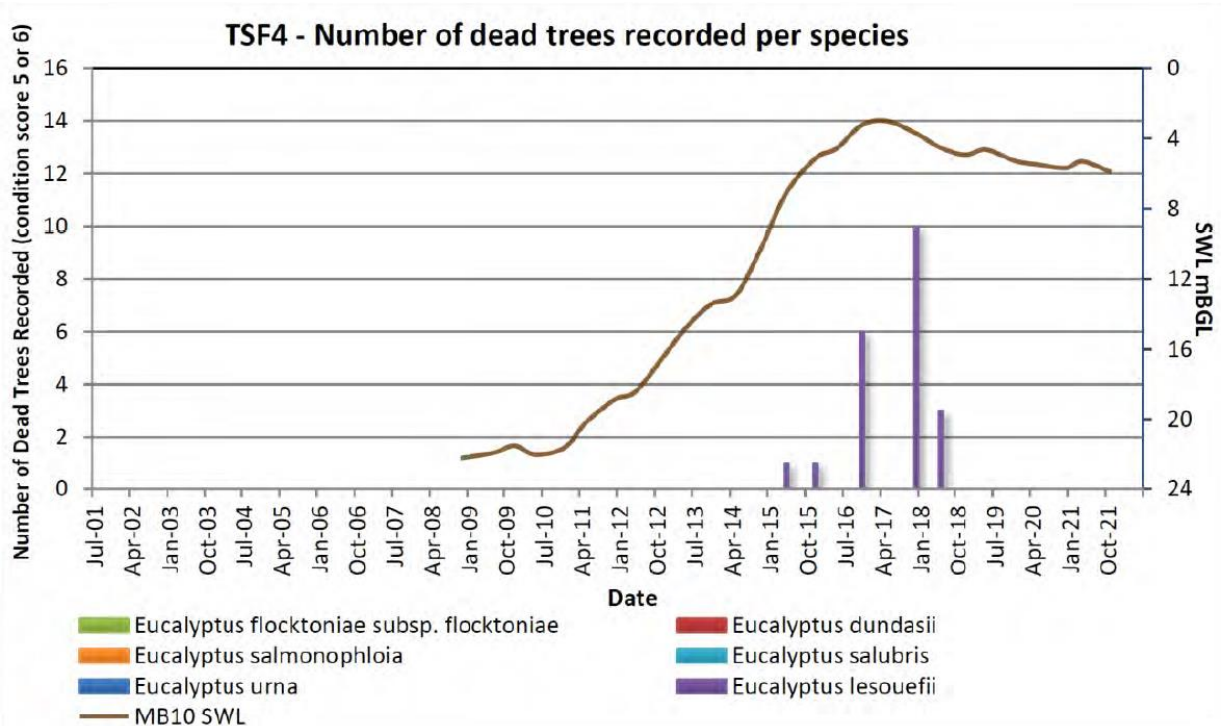


Figure 2: TSF4 Number of death trees recorded per species (Pantoro South 2022b)

The main cause of tree deaths between 2001 – 2022 is attributed to saline groundwater, corresponding with the groundwater level raising at bore MB10 (Figure 3). A hydrogeological field investigation indicated that the seepage recovery bore SRB1 had helped to maintain the groundwater level below the limit of 4 mBGL. Nevertheless, the average tree condition is declining overtime for all species except for *E. flocktoniae* subsp. *flocktoniae* and *E. oleosa* subsp. *oleosa* which are plateauing for Venture whilst at TSF4 only *E. salubris* is slightly increasing its condition.

Recovery bore SRB1 has been effective in keeping the SWL for Bores MB2 and PB2 under the limit since its installation, reducing the risk for the surrounding vegetation roots to reach polluted groundwater.

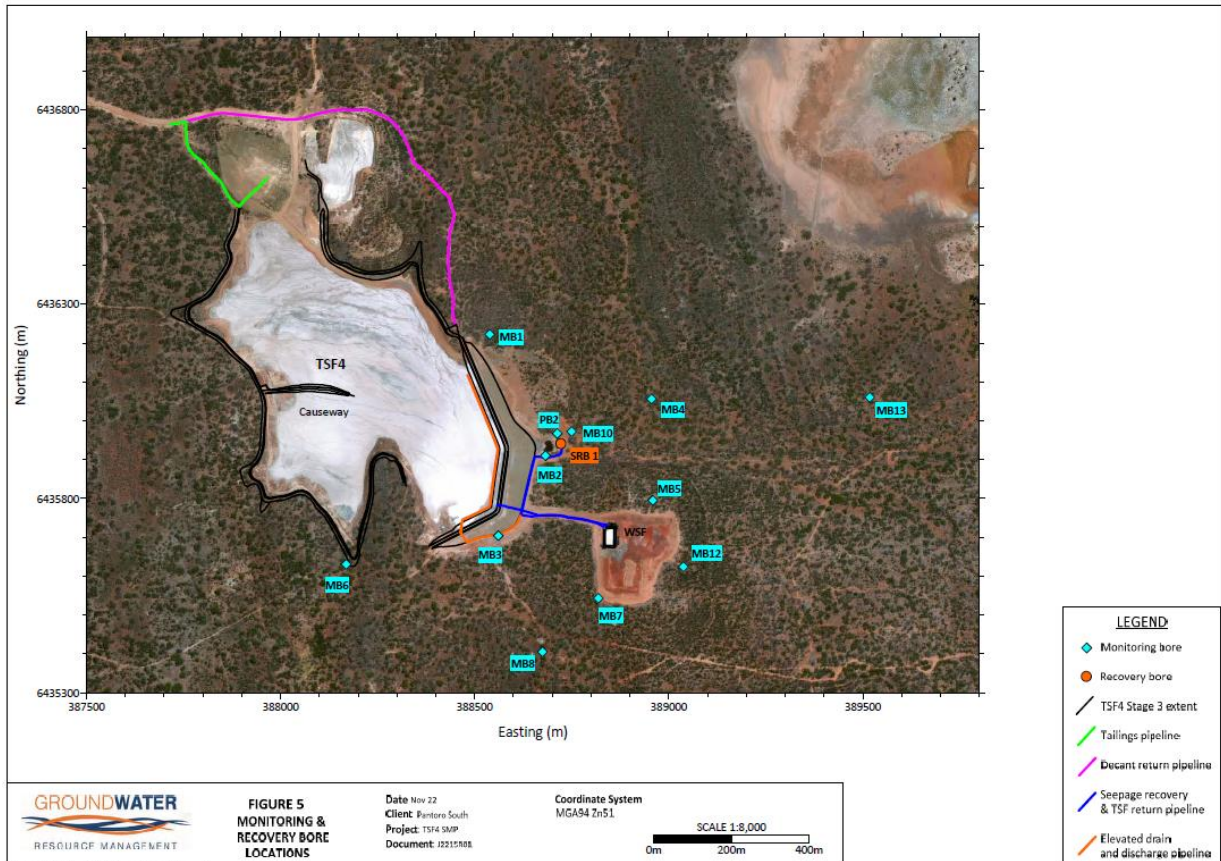


Figure 3: TSF4 – monitoring and recovering bores (Pantoro South 2023)

2.2.3 Seepage Management Plan

Condition 5 of W6472/2020/1 required the following:

The works approval holder must submit a Seepage Management Report after recovery measures relating to seepage infrastructure set out in Condition 1 have been operational and successful to meet current standing water level limits for all existing monitoring bores designated to TSF4. The Seepage Management Report must include the following:

- (a) a map clearly showing the location and label of installed seepage recovery bores;
- (b) bore logs for installed recovery bores;
- (c) findings of further investigations and extent of already occurring seepage before and after commencement of seepage recovery measures;
- (d) actual efficiency of seepage recovery;
- (e) seepage volume recovered; and
- (f) ambient groundwater monitoring as per condition 12, and brief interpretation of data, including reference to relevant guidelines and historical groundwater monitoring data.

The Seepage Management Plan was referred internally and the department’s Principal Hydrogeologist provided the following advice:

- Based on the information provided, it is considered that the seepage recovery plan was developed in a suitable manner using technically sound methodologies.
- The proposed combined use of seepage recovery bores and an interception drain should be adequate for controlling the elevation of the water table near the southern half of TSF4.

The following recommendations were made:

- That additional ground-based geophysical investigations are undertaken on the eastern side of TSF4 to ensure that potential groundwater fracture zones along the proposed northern part of the facility are identified.
- That additional monitoring bores are drilled and constructed on suitable geophysical targets so that baseline groundwater quality data can be obtained in the northern part of the proposed TSF footprint.

The department proposed to condition that additional ground-based geophysical investigations are undertaken on the eastern side of TSF4 to ensure that potential groundwater fracture zones along the proposed northern part of the facility are identified and that one or more monitoring bores are to be installed near the northern half of TSF4, even if it is unlikely that these bores would directly detect seepage from this facility.

The Licence Holder provided comments on the proposed draft conditions on 2 February 2024. As a result of new information provided by the applicant, the proposed conditions have been removed from the licence. Please refer to Appendix 1, item 1, for a summary of the applicant's comments and the department's response

Revised standing water level (SWL) limits for TSF

The saline groundwater can cause death of vegetation when the water table is high enough to reach land surface. Once the salt water is on that level, water and dissolved salt can reach the root zone of the vegetation by capillarity (Li *et al.*, 2013). Then, evaporation occurs at shallow depth which precipitate the salts which accumulate in the soil profile, which can negatively affect the plants.

The relationship between the depth of a saline water table and the development of harmful soil salinisation is complex, and depends on (Li *et al.*, 2013):

- The texture of soil materials and the degree of layering in regolith between the water table and the land surface;
- The density and characteristics of the vegetation cover in the area; and on
- Local climatic conditions.

Based on the mentioned factors, and using the Table 1 of Li *et al.* (2013), the department considers that the critical water table depth where soil salinisation would commence near TSF4 would be about 5 metres.

During this amendment, the department has updated the SWL limit in Table 11 of L8612/2011/1 from 4 mBGL to 5 mBGL and included a trigger level of 7 mBGL.

Other seepage management measures

Other measures that could be implemented to reduce the rate of seepage from TSF4 include:

- Reducing the water content of the tailings before discharge to the TSF by the use of a thickener; or by
- Increasing the efficiency of water recovery within the TSF by the installation of an appropriate drainage system (such as the installation of vertical wick drains).

The current pan factor found in the "Appendix E Static Water Balance" (Pantoro South 2023a) is 0.83. This factor does not correspond to the location of the premises, where hypersaline water is used.

The department recommend that under these conditions, the pan factor applied to estimate the

rate of evaporation from a decant pond should be about 0.4, and the pan factor to be applied to beach areas of a hypersaline TSF should be about 0.2 (Newson and Fahey, 2003). Newson and Fahey (2003) also suggested that pan factors are less than 0.2 in areas on a TSF where extensive salt crusts have formed.

2.2.4 Bluebird TSF reprocessing of tailings

The Licence Holder has applied to reprocess historical Bluebird TSF tailings. These tailings will be reprocessed through the processing plant and deposited into TSF4. Bluebird tailings will be reprocessed at a rate of approximately 18,811 tonnes per month over a period of 24 months (Pantoro South 2023c).

For the reprocessing of the Bluebird tailings, standard reagents/chemicals will be used e.g., sodium cyanide, quicklime, hydrochloric acid, sodium hydroxide, flocculant, leach aid, activated carbon (Pantoro South 2023b).

The Bluebird TSF will be mined in 2 m increments via conventional excavator and truck load and haul practices to deliver to the processing plant. The transport route utilises existing private mine roads comprising of Regent Road, Crusher Road and ramp to the fine ore bin/hopper at the process plant, which is a distance of approximately 750 m (Pantoro South 2023c).

The reprocessed Bluebird tailings will be deposited in TSF4, where it will be combined with other tailings. According to *Pantoro South 2023b*, this process and disposal of tailings “does not pose any additional threats to the downstream environment”.

The deposition of the reprocessed tailings will mix with the tailings from Scotia and OK, in TSF4. The Licence Holder claims that the Bluebird TSF tailings has a similar composition / characteristic to the tailings of Scotia and OK, which are classified as non acid forming (NAF). The “potential seepages from the Bluebird TSF tailings are likely to vary between moderately alkaline and alkaline and brackish with very low to low concentrations of dissolved metals and metalloids, whilst potential seepage from Scotia and OK is expected to be moderately alkaline, brackish and contain generally low concentrations of dissolved metals and metalloids” (Pantoro South 2023c).

A summary of Bluebird TSF tailing analysis (Pendragon report, Pantoro South 2023b and Pantoro South 2024) is provided below:

- (a) The Bluebird TSF most likely contains tailings from the processing of gold mineralisation hosted predominantly within gabbro intrusions, including the mega-crystic plagioclase bearing (Bluebird type) and standard medium to coarse-grained gabbro.
- (b) *Acid Formation Potential*: The Licence Holder tested the tailings to measure the potential of acid formation. Based on the procedure of calculation of Net Acid Production Potential (NAPP), the tailings tested negative.

Leachate assessments indicate that potential seepages from the tailings are likely to vary between moderately alkaline and alkaline and brackish with very low to low concentrations of dissolved metals and metalloids. Consequently, re-processing the Bluebird TSF and disposing of the resultant tailings on existing TSF4 does not pose any additional threats to the downstream environment (refer to Appendix 1 for additional clarification on leachate assessments carried out by the Licence Holder).

- (c) *Metalliferous Drainage*: Bluebird tailings are expected to have elevated concentrations of the major elements that may leach from the tailings.
- (d) Bluebird Tailings Extraction, 48-hr Solution ICP Analysis of Leachable Metals and Metalloids: Dissolved metals and metalloids (Al, As, B, Cd, Co, Cu, Fe, Hg, Mn, Mo, Ni, Pb and ZN) concentrations are slightly elevated with As, Cd, Hg and Pb at or marginally above their guideline thresholds.

- (e) *Bluebird Tailings Extraction, DI water Leachable Metals and Metalloids*: Assessment Level: relatively low concentrations of Al, As, B, Cr, Fe, Mn and Sb may leach from the tailings well below their relevant Non-Potable Groundwater Use thresholds (DoH, 2014; DWER, 2021). Ba, Cd, Co, Cu, Hg, Mo, Ni, Pb, Se, U, V and Zn were absent in the DI leachates at a pH of 7.1.

The department consulted its Principal Hydrogeologist about the tailing analysis and the reprocessing of the Bluebird tails. The advice received is as follows:

(a) *Additional groundwater monitoring*

The geochemical testing undertaken suggests that leachate from the materials that will be discharged to TSF4 will have relatively elevated compositions of calcium, magnesium and sulfate ions by comparison with the ionic composition of groundwater near the facility.

Consequently, increases in the ionic ratios Ca/Na, Mg/Na and SO₄/Cl in groundwater would be useful indicators that seepage from the TSF is taking place. Additionally, it is likely that increases in these ionic ratios would take place before contamination of groundwater by metals would be evident. That is, increases in these ratios could be useful early-warning indicators of more significant groundwater contamination.

Based on the above recommendations, the department has:

- Added molybdenum to Table 10 for the monitoring of ambient groundwater quality. The Licence Holder is required to measure groundwater for molybdenum before the deposition of reprocessed Bluebird tailings commences, as the seepage from the reprocessed tailings are likely to contain this element and a baseline of the element is necessary.
- Included the requirement to report the ionic ratios Ca/Na, Mg/Na and SO₄/Cl in the groundwater monitoring program through the Annual Environmental Report.

The Licence Holder has advised that they will submit the Mining Proposal to include the tailings reprocessing to the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) (Pantoro South 2023b). Approval by DEMIRS should also be sought prior to the reprocessing of Bluebird tailings.

2.2.5 Category 6 infrastructure

The following infrastructure relating to Category 6 has been constructed under W6472/2020/1:

- Dewatering ponds and tanks:
 - (a) to Bullen Underground and water storage facility from OK underground;
 - (b) from Scotia pit to Lake Dundas;
 - (c) to Scotia water storage facility from Green Lantern; and
 - (d) To raw water storage tanks and process water pond from the mainfields area, including the existing Ajax shaft.
- Dewatering pipelines:
 - (a) Scotia Pit to Lake Dundas;
 - (b) To Bullen Underground and Water Storage Facility from OK Underground; and
 - (c) Dewater pipeline at final discharge point to Lake Dundas.

The department has included operational requirements for the above infrastructure under Condition 6 of L8612/2011/1.

2.2.6 Aquatic Biota assessment

Condition 6 of W6472/2020/1 required the following:

Prior to the commencement of any time limited operations, the works approval holder must submit a revised Lake Dundas Aquatic Biota assessment report with following additional information:

- (a) *revision and confirmation that all identified resting stages have been classified correctly;*
- (b) *identification of Branchinella species if resting stage has been found;*
- (c) *further information on identified egg bank viability and proposed site-specific salinity ranges;*
- (d) *identification of Parartemia species [Parartemia sp] and determination of acceptable salinity range for each life stage; and*
- (e) *a map showing the confirmed vegetation monitoring locations.*

The assessment of Aquatic biota, written by Wetland Research & Management (WRM) and Biota Environmental Sciences, confirmed to have found specimens of *Parartemia sp.* and *Chara sp.* in resting stage. *Branchinella sp* was not found. Moreover, they confirmed the presence of single-celled flagellates and ciliates (genera Dileptus, Frontonia and Paramecium), and Cyprididae ostracods (Pantoro South, 2022).

The specific salinity range for *Parartemia sp.* egg bank viability could not be determined, as the closest relative brine shrimp species *P. serventyi*, has a lower salinity tolerance than the naturally occurring in Lake Dundas. Nevertheless, a “site-specific salinity trigger value of 301 g/L, and a site-specific threshold value of 357 g/L” was proposed. It was recommended to “prompt further investigations if the salinity increase above the proposed trigger during or post-operation of Scotia discharge outlet” (Pantoro South, 2022a).

Regarding the identification of *Parartemia sp.* acceptable salinity range for each life stage, it was proposed to use *P. serventyi* range as a guideline as it was not possible to determine the exact species. The tolerance range proposed is 15 – 262 g/L, “but likely require a flood pulse of rainwater with a salinity level at the lower end of this range, or fresh (i.e., < 3 g/L), to trigger emergence, breeding and restocking of the egg bank” (Pantoro South, 2022a).

The department referred the Aquatic Biota assessment to the Department of Biodiversity, Conservation and Attractions (DBCA). The following advice was provided:

- DBCA acknowledged that the Licence Holder liaised with the two Australian experts on *Parartemia sp.* who have identified the species as *Parartemia serventyi* and considers their expertise appropriate.
- *Branchinella* species are unlikely to occur in Lake Dundas due to salinity levels, however, may occur in adjacent freshwater claypans if they exist.
- The discharge is likely to accumulate within the deepest northern section of the lake (Figure 4) which is where the only *Parartemia serventyi* species was found. It is unclear what the salinity of the discharge water is, but it is assumed likely to be high. Per 100g/L of salinity, a discharge of 380,000 tonnes of water per annum would equate to about 38,000 tonnes of salt/annum accumulating on the surface of sediment with low permeability. This may create an additional depth of salt crust which may cover areas of *P. serventyi* egg bank, and result in higher salinities earlier in the hydrological cycle than would otherwise be the case. With juvenile *P. serventyi* requiring lower salinity to develop, this may affect the *P. serventyi* populations, especially when there is only a partial fill event.



Figure 3. Modelled flowpath from the Scotia discharge point to Lake Dundas (GRM 2020)

Figure 4: Modelled flowpath from Scotia discharge point to Lake Dundas (Pantoro South 2020, WRM figure 3)

- There is a paucity of data on salinity during an entire hydrological cycle, but the presence of *P. serventyi* suggests that salinity is very low early in the fill event. The highest recorded salinity is not a useful measurement as it likely occurred after *P. serventyi* completed its lifecycle. The salinities measured during the biological surveys in 2020 and 2021 (288 and 301 g/L) were higher than the known tolerance for *P. serventyi* and no *Parartemia sp.* were collected except for eggs in the sediment. It is likely that each inundation event will have a slightly different concentration profile. The proposed site-specific salinity trigger value of 301 g/L and site-specific threshold value of 357 g/L may be suitable for later in a hydrological cycle, but salinities need to be much lower earlier in the hydrological cycle. Perhaps these trigger values combined with no discharge in the first few months of a major fill event could be applied.

Monitoring salt crust depth in the discharge zone is recommended, as suggested by WRM. A trigger value is unknown, however, if there is a significant increase over time then the effects should be examined.

- Egg hatching occurs very early in a salt lake fill (potentially within days) during a fresh to very low salinity stage, before the bulk of the salt has dissolved. Monitoring of salinity and *Parartemia sp.* populations should be carried out in the discharge area during fill events.
- The proposed salinity trigger/threshold are above the known salinity tolerances of *Parartemia serventyi*, but salinity changes from first inundation to drying, and these values have been measured near the end of a cycle when *P. serventyi* adults have deposited eggs and presumably died. Monitoring of salinity and *P. serventyi* should be undertaken throughout a hydrological cycle (monthly initially, then less frequent) to

ensure early salinity remains low (<20 g/L on first fill).

- The water acidity is recommended to stay between pH 5.0 – 8.0.
- The consultant notes that hatching of resting stages and development of juveniles occurs at very low salinities i.e. when salt lakes first fill, and *Parartemia sp.* become tolerant of greater salinities as they mature. It is agreed that discharging highly saline water onto the lakebed when the lake first fills after significant rains should be avoided. Discharge onto the lake when the lake is dry is preferable but noting concerns about salt crust affecting egg hatching as mentioned above.

Lake salinity – mass balance calculations

On 15 February 2024, PNRS provided additional technical information from SLR consultants (formerly Wetland Research & Management WRM) (Technical Memorandum, SLR, 15 February 2024) on mass balance calculations for the site. This work was done to determine if the dewatering discharge would affect calculated salt concentrations within Lake Dundas following a major fill event. Calculations were made for expected concentration of salt in the lake under a “major fill event”, load of salt dissolved within the lake water body when inundated based on concentration and lake volume, load of salt in discharge and volume of discharge added to the lake by PNRS. The additional work indicates that dewatering discharge to Lake Dundas will result in minimal change in lake salinity after a ‘major fill event’.

A summary of this additional work is provided below:

- It is generally agreed that breeding for *P. serventyi* only occurs after a fill event, when the lake is close to freshwater, with a salinity < 20 g/L.
- DWER raised concern that a deeper salt crust will develop across the lake as a result of PRNS discharge, which will affect lake salinity when filled. This is based on the assumption that the PRNS discharge will accumulate within the deepest northern section of Lake Dundas, where cysts of *Parartemia sp.* were found. This assumption is challenged, because discharge by PRNS is into the middle of a small, western sub-basin of Lake Dundas, which connects to the main lake via a narrow channel, but there has been no observable surface flow/connectivity into the main body of the lake. Discharge is into the middle of this western basin, where it dissipates, and does not express as surface flow into the main body of the lake. On one occasion, following a significant rainfall event, there was surface flow from this basin into the main body of the lake, but this was rainfall run-off as opposed to discharged water.
- Discharge will therefore not accumulate in the northern basin where *Parartemia sp.* have been recorded, nor will there be development of a deeper salt crust across the northern basin, because the additional salt load is retained in the western sub-basin. Although discharge will increase the salt load to the lake, it is unlikely that lake salinity will increase due to dissolution of a deeper salt crust, especially as the existing salt crust does not totally dissolve, and a salt crust is already well established across much of the lake.
- To assess the impact of PRNS continuing to discharge into Lake Dundas, calculations were made for expected concentration of salt in the lake under a “major fill event”, load of salt dissolved within the lake water body when inundated based on concentration and lake volume, load of salt in discharge and volume of discharge added to the lake by Pantoro, and mass balance calculations to determine if the discharge would affect calculated salt concentration.
- Some assumptions were made for these mass balance calculations. It is assumed that the salinity concentration will be the same throughout the lake. A continual discharge rate and salt load value used in calculations were obtained from reports provided by PRNS. It is assumed that these values are accurate estimates, and

calculations conducted by SLR are also accurate estimates. As a clear definition of a 'fill event' was not provided by DWER, a range of fill depths were used to estimate lake volume, and to analyse the impact of the salt load estimates being discharged into Lake Dundas. It is also assumed that only one fill event will take place during the 3-month period. Additional rainfall may further dilute the salt concentration in the lake.

- A conservative 50% of the surface area was used in calculations of lake volume to allow for the numerous small islands and dunes that are scattered throughout the lake and occupy lake 'volume' when the lake is filled. A "major filling event" was not defined by DWER, therefore a range of depths were used to calculate volume of water when filled. Average depths of 0.1m, 0.2m and 0.3m were used in mass balance calculations. These depths are conservative, and if the lake is deeper, greater average depths will increase lake volume and thereby reduce the effects of discharge on lake salinity. Salinity of surface water inflow and run off has not been included in any analysis. It is however expected that lake salinity at filling is equivalent to the salinity breeding tolerance of *Parartemia sp.*, given the brine shrimp occur in the lake and are known to breed.
- Under the 0.1 m average depth fill event, it was estimated the salinity after one month would only increase from 20 g/L to 21.4 g/L, which is a 6.9% increase. This is a relatively minor increase in salinity, especially relative to the ill-defined threshold for breeding for *Parartemia serventyi*, and reflects the size of Lake Dundas relative to the volume and salinity of the discharge. As the size of the fill event increases, to 0.2 m and 0.3 m average depth, the percent change in salinity decreases (3.4 and 2.3% respectively), reflecting the greater volume of freshwater diluting the discharge. Salt load changes the most at the lower rainfall event fill level (0.1m) but it is unknown if this is an adequate amount of water to trigger the conditions needed for *P. serventyi* cysts to hatch, even though the salinity used in the calculations equates to the known salinity needed for breeding.
- The estimates are conservatively high, using the current salinity of the Pantoro discharge. If a major fill event occurs, there will be infiltration of flood waters into the Pantoro pits and underground, and therefore the salinity of the dewatering discharge will be reduced (GRM, 2022). Assuming a 50% reduction in salinity of dewatering discharge for the first month, the percent increase in lake salinity will decline to 3.4%, 1.7% & 1.1% for the three fill scenarios.
- Based on the mass balance calculations presented above, and the minor changes in salinity estimated to occur, especially with reduced salinity of dewatering water after a significant rain event, it seems unlikely that the increase in salinity within the northern arm of Lake Dundas would adversely affect breeding by *Parartemia sp.* An adaptive management approach has therefore been recommended, with salinity and breeding success by *Parartemia sp.* monitored on a weekly basis following a major fill event, and dewatering discharge suspended if an unacceptable increase in salinity in the northern basin is detected in the first month after the event, when breeding may be occurring.

DBCA are supportive of the proposed adaptive management approach outlined above. Regarding the lack of detail on what constitutes a 'major fill event', DBCA suggest that for the purposes of managing and assessing related risks a 'major' fill is when >1/3 of the lakebed area has been inundated.

DBCA also advised that *Parartemia sp.* likely reach maturity rapidly in episodic salt lakes Geddes (1976) found *P. zietziana* could reach maturity in 3 weeks. This suggests that the period of lower salinity need only be a month. While adult *Parartemia sp.* can withstand high salinities adaptation to extremes is usually associated with gradual increases in a stressor, so a large and rapid increase in salinity may affect survivability.

The NGP mine has a 3-year life and has been dewatering the mine underground and pits and discharging into Lake Dundas for approximately 12 months. This therefore limits the overall timeframe for dewatering discharges into the lake.

Based on the above, the department has:

- Updated Condition 17 to limit pH (between 5.0 – 8.0) for W2 to be in line with historical mean pH levels within Lake Dundas between 2013 and 2023. Lake Cowan will also have these limits for mine dewater discharges;
- Included Lake Dundas for the monitoring of point source emissions to surface water (Condition 20);
- Included Lake Dundas for the monitoring of ambient surface water quality (Table 12);
- Included Lake Dundas for the monitoring of ambient sediment quality (Table 13);
- Included Lake Dundas dune and woodland for vegetation health monitoring (Table 14); and
- Included Condition 26 for preparation and implementation of an Adaptive Discharge Management Plan for Lake Dundas. The plan shall include, but not limited to:
 - Monitoring details for dewatering discharge at pipe end to confirm discharge rate and electrical conductivity concentrations, before and during a fill event, to confirm volume and change in salinity of water due to rainfall runoff/inputs;
 - Monitoring of electrical conductivity of the lake immediately after filling, and weekly thereafter to monitor changes in salinity with evapoconcentration;
 - Sampling in the northern basin of the lake, where cysts have been recorded, for presence of hatched *P. serventyi*, to relate hatching to timing of a fill event and salinity;
 - Measuring water depth after a major fill event, and record changes in depth as the lake recedes and evapoconcentrates;
 - triggers for suspending dewatering discharges to Lake Dundas where unacceptable increases in salinity in the Northern Basin is detected in the first month after a fill event; and
 - Include other lake monitoring requirements as captured in separate licence conditions outlined above.

Annual reporting requirements have been updated to ensure that a summary of related monitoring results is reported to the department periodically.

2.2.7 Category 52: Electric power generation

The Licence Holder originally requested to remove category 52 as the Power Plant is managed and operated by Pacific Energy.

The department will retain this category on the licence until such a time as Pacific Energy has been granted a licence for the Power Plant and this site can be excluded from the prescribed premises boundary of licence L8612/2011/1.

2.2.8 Transferred infrastructure from W6472/2020/1

Additional to the infrastructure constructed under category 5 and 6, the following infrastructure has also been constructed under W6472/2020/1:

Category 64: Landfills

- (a) Butterfly (disposal of asbestos waste)

- (b) OK (type 2 (tyres) waste)
- (c) Scotia (type 2 (tyres) waste)
- (d) Bullen (type 2 (tyres) waste)

Category 70: Screening etc. of material

- (a) Crushing and screening plant - Mobile Plant

The department assessed two reports provided by the Licence Holder on 02 December 2023 and on 08 August 2023. The department confirms that the constructed infrastructure complies with the construction requirements of W6472/2020/1 and has therefore been transferred to the licence.

W6472/2020/1 authorises the construction of Category 85: Sewage facility. This infrastructure has not been constructed and will not be transferred onto the licence.

2.2.9 Transferred construction requirements

The Licence Holder requested to transfer infrastructure not yet constructed under W6472/2020/1 associated with landfill trenches; dewatering infrastructure and discharge pipelines; and TSF4 stages 4 and 5.

The department has conditioned the construction of this infrastructure under Condition 12. The Licence Holder will be required to submit an Environmental Compliance Report to the department within 30 days of the completion of construction of each item of infrastructure as per Condition 34.

2.2.10 Extension of premises boundary

The Licence Holder has requested to add mining tenements L63/32, M63/36, M63/42, M63/43 M63/112, M63/214, M63/275, M63/325 and M63/659 to the Licence. These tenements were included within the premises boundary of W6472/2020/1.

The department has extended the prescribed premises boundary under this licence amendment.

2.2.11 Other amendments

During this amendment the department has also removed the following conditions:

Previous condition 1.3.13 which required the Licence Holder to submit to the department a report assessing the integrity of processing liquor and stormwater containment that must be provided before operations at the plant commence.

The Licence Holder had to demonstrate compliance with the existing licence condition 1.3.13 and ensure that the new infrastructure (ponds) is compliant with operations requirements of maintaining freeboard and the containment of specific materials, during the time limited operations.

The old processing plant was decommissioned before Condition 1.3.13 could be actioned and now with the refurbished plant the Licence Holder has to show compliance.

The Licence Holder confirmed that in the refurbished Process plant (Pantoro South 2023a):

- Tanks are bunded to capture any spillage with sump pumps recirculating spilt slurry within the leaching circuit.
- The elution column is bunded which is lined with acid resistant paint within the gold recovery circuit.
- Pipe work from heat exchangers and elution tanks are insulated and clad to prevent accidental burns from contact with hot pipework within the gold recovery circuit.

- All reagents are stored in tanks in a bunded area. Note the reagent storage location was amended slightly from the original design to improve traffic management within the area.
- Cyanide bund has extensive water-stop in bund construction to prevent egress of spills.
- Hydrochloric acid bund is painted with acid resistant paint.
- Unloading area includes a kerbed concrete apron and directs any spillage into the bund sump.
- Process control system incorporated to monitor flow and pressure of reagents.
- New raw water pond and process water dam were installed with a high density polyethylene (HDPE) lining, telemetry system control for water level and recovery pump, to reduce the risk of seepage and overflow. These tanks will hold process water coming from the tailings facilities includes tailing thickener overflow and decant water. This water will be used in wet screening and mill feed.

The Process Water Dam contains return water from the plant, tailings thickener overflow, raw water from the raw water tanks and/or borefield, rainwater, OK mine water and decant/return water from TSF4 (Pantoro South 2023b). The Process Water Dam is HDPE lined and has fitted a sensor to control water levels (Pantoro South 2022a).

Environmental Dam and Events Dam are HDPE lined. The Events Dam is setup to overflow to the evaporation dam from freeboard level. Water that is processed through the nearby upgraded triceptor system will report to the evaporation dam only, thereby allowing for greater capacity in the process plant events dam. The Events Dam allows for adequate road and plant site stormwater runoff, specifically through a water transfer rock lined channel named 'Transfer Point 1'.

The controls listed above should be sufficient to reduce the risk of contaminated water seepage and spillage of tailings water from the Process Plant.

Previous condition 2.4.1

The Licence Holder has requested to reprocess the Bluebird TSF tailings under this amendment (refer to section 2.2.4). This activity has been risk assessed under section 3 and will be allowed hence the removal of this condition.

Previous improvement condition 4.1.2

The Licence Holder submitted an email to prove compliance of 03 September 2019. The Licence Holder confirmed to have drilled bore PB2, installed as a monitoring bore and since then has been undertaking quarterly water monitoring (Pantoro South 2019).

This bore has not been converted to a seepage recovery bore, but a new seepage recovery bore was constructed SRB1 and currently is functional. Additionally, the Licence Holder tried to drill three bores for seepage recovery, but was not successful (Pantoro South 2022a, p. 376).

The Licence Holder confirmed that they are returning the seepage to TSF4 and the water has been re-used in processes.

3. Risk assessment

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

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this Amendment Report are detailed in Table 2 below. Table 2 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

Table 2: Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
Construction			
Category 64 – Class II putrescible landfill site			
Noise	Construction of landfill and landfill extensions	Air/windborne pathway	Noise management plan will be developed for the construction period. (DWER, 2021)
Dust			Regular watering of unsealed surfaces. Topsoil stripping and spreading activities restricted during high winds if dust cannot be adequately suppressed. Vehicles kept on designated roads. Vehicle speed limits to reduce dust generation. Regular inspections to evaluate effectiveness of dust mitigation, corrective actions if required. (DWER, 2021)
Operation			
Category 64 – Class II putrescible landfill site			
Noise	Operation landfills	Air/windborne pathway	Distance to dwellings further than 1.35 km. (DWER 2021)
Dust			Deposited waste will be covered with 100 mm type inert waste or soil on weekly basis. Covered in batches separated from each other by at least 100 mm of soil and final soil cover of minimum 500 mm of soil.
Odour			
Windblown waste			
Contaminated fire water		Discharge to land	Fenced to prevent windblown

Emission	Sources	Potential pathways	Proposed controls
			waste and fauna access. (DWER, 2021)
Leachate and contaminated stormwater		Direct infiltration	Covered in batches separated from each other by at least 100 mm of soil and final soil cover of minimum 500 mm of soil. Cover with 100 mm type 1 inert waste or soil on weekly basis. Stormwater diverted away from landfill. Waste volumes will be monitored. (DWER, 2021)
Contaminated runoff		Overland runoff from landfill following rainfall events	Stormwater diverted away from landfill. (DWER, 2021)
Asbestos	Butterfly landfill (designated asbestos disposal area)	Air/windborne pathway	Asbestiform demolition waste wrapped or contained appropriately. Asbestos and asbestos containing material is unloaded and placed within designated cell of landfills. GPS location of each load will be recorded for all asbestos loads. Plastic wrapped and covered with minimum of 150 mm of fill. (DWER 2021)
Category 5 - Processing or beneficiation of metallic or non-metallic ore			
Leachate containing cyanide and elevated metals and metalloids	Additional tailings depositions into TSF4 Addition of re-processed Bluebird tailings	Seepage of leachate	Groundwater levels and quality monitored in accordance with current licence. (DWER, 2021) Stage 2 cut-off trench has been extended with Stage 3 raise cut-off trench on northern and southern ends of the main embankment Perimeter drainage system. (Pantoro South 2022a) A new seepage recovery bore (SRB1) installed in March 2022. The pump is powered with genset to ensure continuous functioning. (Pantoro South 2023c)
Tailings and process water	Additional tailings depositions into	Direct discharge to land - leaks/pipe	Tailings and return water pipelines bunded and fitted with flow

Emission	Sources	Potential pathways	Proposed controls
with elevated metals and metalloids	TSF4 Addition of re-processed tailings	bursts	sensors to detect loss of content. Daily inspection of pipelines for damage. (DWER, 2021)
Tailings and return water containing elevated metals and metalloids	TSF4 pipelines (tailings and return)	Direct discharge to land – pipeline leak/rupture	Tailings and return water pipelines bunded and fitted with flow sensors to detect loss of content. Daily inspection of pipelines for damage. (DWER 2021)
Contaminated runoff, process water, stormwater	Operations of processing plant, water storage and process water	Direct discharge to land - leaks/pipe bursts	<p>Processing activities conducted on bunded hardstand.</p> <p>Existing storm water run-off drain and sump structure retains run off which then reports to lined environmental dam/process plant dam; overflow reports to existing triceptor tank system which will be upgraded with environmental filter.</p> <p>Surface water reporting to existing drain and sump water recovery system located next to workshop and to new environmental dam (DWER, 2021).</p> <p>All chemical reagents are stored within tanks in appropriately bunded facilities whereby 110% of the largest vessel is contained and 25% of the total volume is contained according to Australian Standards AS1940 and AS1692 (Pantoro South 2023b).</p> <p>The process plant area has been re-shaped to ensure that surface water reports to the existing drain and sump water recovery system located next to the workshop and to the process plant events dam.</p>
	Operations of processing plant, water storage and process water	Overflow from water storage dams	<p>Dams (raw-, process-, environment/process dam) HDPE lined, freeboard, water level controlled by telemetry system, recovery pumps.</p> <p>Environment/process dam sized for maximum event and includes overflow to wash-down bay water recovery system and HDPE lined dam where excess water can be reclaimed by pump for re-use.</p>

Emission	Sources	Potential pathways	Proposed controls
			(DWER, 2021)
Dust	<p>Operations of processing plant, water storage and process water</p> <p>Crushing and screening</p> <p>Excavator and truck load and haul activities.</p>	Air/windborne pathway	<p>Dust suppression sprays and dust extraction fans/filters particularly for: ROM bin, primary crusher, primary crushed ore stockpile, classifying screen, cone crusher, fine ore surge bin reclaim circuit.</p> <p>Water cart sprays for dust suppression used for stockpiles.</p> <p>A Dust Management Plan (Pantoro South Pty Ltd, 2021a) was provided, key aspects summarised below:</p> <ul style="list-style-type: none"> • Regular watering of unsealed surfaces to prevent dust; • Dust suppression measures implemented as required during operations; • Water applied at ROM pad during ore crushing; • Dust sprays fitted on crushing and screening circuit; • Water cart for dust suppression where required; and • No crushing and screening activities during strong winds.
	Reprocessing Bluebird tailings		<p>Regular watering of unsealed surfaces to prevent dust release.</p> <p>During high winds, excavation and truck load and haul activities restricted if dust cannot be adequately controlled.</p> <p>Vehicles and mining equipment kept to the designated roads.</p> <p>Vehicle speed limits apply to reduce dust generation from vehicle movements.</p> <p>Adherence to the NGP Dust Management Plan. Additional dust suppression measures implemented as necessary during operations.</p> <p>(Pantoro South Pty Ltd, 2023b)</p>
Noise	Operations of processing plant, water storage and	Air/windborne pathway	<p>Regular maintenance of vehicles and equipment.</p> <p>Where possible mufflers, other</p>

Emission	Sources	Potential pathways	Proposed controls
	<p>process water</p> <p>Crushing and screening</p>		<p>noise attenuating equipment installed and maintained on plant, vehicles and equipment.</p> <p>Noise mitigation via noise bunds and walls to ensure compliance with the <i>Environmental Protection (Noise) Regulations 1997</i> according to acoustic assessment provided (Herring Storer 2020).</p> <p>Noise management plan developed.</p> <p>(DWER 2021)</p>
Sediment laden stormwater and potentially contaminated stormwater	Crushing and screening	Overland runoff	<p>Existing storm water run-off drain and sump structure retains run off which then reports to lined environmental dam/process plant dam; overflow reports to existing triceptor tank system which will be upgraded with environmental filter.</p> <p>Surface water reporting to existing drain and sump water recovery system located next to workshop and to new high-density polyethylene (HDPE) lined dam environmental dam.</p> <p>(DWER 2021)</p>
Reagents	Storage of quicklime, sodium cyanide, activated carbon, hydrochloric acid, sodium hydroxide (caustic), leach aid, flocculant	Direct discharge to land – storage leak/rupture	<p>Quicklime silo with dust collector and extractor.</p> <p>Cyanide, caustic and hydrochloric acid solution stored individually in bunded areas with dedicated sump pumps.</p> <p>(DWER 2021)</p>
Spillage of hydrocarbons	Operation Processing plant, vehicle movement	Direct discharge to land	<p>Heavy and light vehicle maintenance undertaken in designated workshop areas located on concrete pads which drain to a clean water recovery system. Where maintenance activities occur outside of these areas, hydrocarbon spillages and leakages are to be captured and appropriately managed through the use of drip trays and hydrocarbon absorbent materials.</p> <p>Spill kits located at all hydrocarbon and chemical storages and carried on surface mobile equipment to ensure immediate clean-up of any spills of contaminants such as oil</p>

Emission	Sources	Potential pathways	Proposed controls
			<p>or fuel.</p> <p>Oily rags, vehicle filters and other hydrocarbon waste (e.g. waste oil) collected and stored in bins, tanks or on bunded pallets for periodic collection and disposal offsite by a licenced contractor.</p> <p>Soil contaminated by hydrocarbons either treated in-situ or moved to a bioremediation area for treatment.</p> <p>(Pantoro South 2023b)</p>
Category 6: Mine Dewatering			
<p>Hypersaline and contaminated dewater</p>	<p><u>Pipelines:</u></p> <ul style="list-style-type: none"> -from Scotia Pit to Lake Dundas -from OK Underground to Bullen Underground -from OK Underground to a Water Storage -Overflow from pits <p><u>Ponds and tanks include:</u></p> <ul style="list-style-type: none"> -to Bullen Underground and water storage facility from OK underground -from Scotia pit to Lake Dundas 	<p>Direct discharge to land – pipeline leak/rupture</p>	<p>Pipeline placed within v drain on land to capture potential spills.</p> <p>Contaminated or saline water flow pipelines are bunded or buried and fitted with leak detection devices capable of shutting the pumping system down.</p> <p>Pipeline pressure monitoring interlocked with the pump, resulting in shut down of pumping if flow drops below certain level.</p> <p>Discharge to Lake Dundas fitted with dispersion manifold to minimise erosion.</p> <p>Discharge pond kept away from lake edges to minimise impacts to riparian vegetation.</p> <p>Minimum 5 m freeboard for pit to pit transfers.</p> <p>HDPE lined dams.</p> <p>Minimum 0.3 m freeboard for water storage dams.</p> <p>Pipelines installed with HDPE.</p> <p>Daily visual inspections for integrity.</p> <p>(DWER 2021)</p>
	<p>Source: Mine dewater from Scotia Pit</p> <p>Activities: dewater discharge into Lake Dundas</p>	<p>Direct discharge into Lake</p>	<p>Water and sediment quality monitoring, and littoral vegetation monitoring as per the Annual environmental assessment for discharge related changes to Lake Dundas ecological value (September – November).</p> <p><u>Littoral vegetation monitoring:</u></p>

Emission	Sources	Potential pathways	Proposed controls
			<p>2 sites on shoreline of small basin (LSC02, LSC08).</p> <p>8 additional locations within and outside of small basin.</p> <p>Height, percentage foliage cover (PFC) recorded for each species present in quadrat.</p> <p>Total vegetation cover, cover of shrubs and trees (>2m tall) and shrubs (< 2 m).</p> <p>Photographs from lake edge towards foredune for comparison with past and future surveys.</p> <p><u>Water and sediment quality monitoring:</u></p> <p>Eight sites (including 2 control sites, Figure 19).</p> <p>Water in situ measurements including pH, EC, temperature.</p> <p>Water parameters (NATA) including: nutrients, dissolved metals, ions, TDS.</p> <p>Sediment parameters (NATA) including: nutrients, dissolved metals, ions, TDS, moisture content, pH, EC.</p> <p>Adaptive discharge management plan for discharges to Lake Dundas – refer to Section 2.2.6.</p>
Category 70 – Screening etc. of material			
Dust	<p>Screening, crushing, unloading, loading and storage of material</p> <p>Vehicle movements</p>	Air / windborne pathway	<p>Crushing and screening operations (including stockpiles) undertaken on bunded areas within waste rock dumps.</p> <p>Dust suppression activities undertaken as part of mining operations.</p> <p>Stockpiles within the bunded area where crushing and screening activities take place.</p> <p>Stockpiles dust suppression via water carts when required.</p> <p>(DWER 2021)</p>
Noise			<p>Works conducted for aggregate crushing and screening on day shift only.</p> <p>Crushing and screening activities</p>

Emission	Sources	Potential pathways	Proposed controls
			<p>occur within a bunded area of the waste rock dump (WRD) and only occur twice per annum for a period of two to three weeks per activity.</p> <p>The Butterfly WRD/TSF acts as a buffer to residences from any potential noise from crushing and screening activities carried out at Bullen WRD during daylight hours.</p> <p>Regular maintenance of vehicles and plant equipment.</p> <p>Where possible, mufflers and other noise attenuating equipment installed and maintained on plant, vehicles and equipment. (Pantoro 2023b)</p>
Sediment laden stormwater		Overland runoff	Crushing and screening operations undertaken on the working level of each WRD and will be bunded. (DWER 2021)

3.1.2 Receptors

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

Table 3 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises (*Guideline: Environmental siting* (DWER 2020)).

Table 3: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	Distance from prescribed activity
Industrial Lot	Approx. 1.96 km southwest of the processing plant
BP Roadhouse	Approx. 1.85 km northwest of the processing plant
Norseman Tourist Park	Approx. 1.74 km northwest of the processing plant
Town of Norseman	Approx. 1.5 km west of the Processing Plant
Norseman Visitor Centre	Approx. 1.35 km west of the processing plant
Residential receptors	<p>Close to WRD where mobile crushing screening plant will operate:</p> <p>Residence 1: located 1.11 km west from Bullen WRD, 2.32 km from OK WRD.</p> <p>Residence 2: located 1.12 km from Bullen WRD, 2.15 km from OK WRD.</p>

	<p>Residence 3: located 1.15 km from Bullen WRD, 2.21 km from OK WRD</p> <p>Close to processing plant:</p> <p>Residence 1 – located 0.32 km southeast of the processing plant.</p> <p>Residence 2 – located 0.73 km southwest of the processing plant.</p> <p>Residence 3 – located 1.03 km southwest of the processing plant.</p> <p>Residence 4 – located 1.10 km southwest of the processing plant.</p> <p>Residence 5 – located 1.96 km southwest of the processing plant.</p> <p>Residence 6 – located 1.80 km southwest of the processing plant.</p>
<p>Environmental receptors</p>	<p>Distance from prescribed activity</p>
<p>Native vegetation</p>	<p>South-east of TSF4</p> <p>Lake Dundas vegetation:</p> <p><i>Acacia kerryana</i> (P2)</p> <p>Norseman pea (<i>Daviesia macrocarpa</i>) (T)</p> <p><i>Eremophila parvifolia</i> subsp. <i>parvifolia</i> (P4)</p> <p>Purple eremophila (<i>Eremophila purpurascens</i>) (P3)</p> <p>Woodland vegetation Source: <i>Flora & Vegetation Assessment Norseman Gold Project, 2020</i> (Pantoro South 2020)</p> <p>Littoral vegetation near to Lake Dundas, State listed priority flora:</p> <p><i>Angianthus newbeyi</i> (P2)</p> <p><i>Cyathostemon</i> sp.(P3)</p> <p><i>Frankenia glomerata</i> (P4)</p> <p><i>Angianthus</i> sp. (which may represent the Priority 2 <i>A. newbeyi</i>)</p> <p>Eucalyptus species around TSF4 (Pantoro South 2022b): <i>Eucalyptus dundasii</i>, <i>Eucalyptus flocktoniae</i> subsp. <i>flocktoniae</i>, <i>Eucalyptus lesouefii</i>, <i>Eucalyptus oleosa</i> subsp. <i>oleosa</i>, <i>Eucalyptus salmonophloia</i>, <i>Eucalyptus salubris</i>, and <i>Eucalyptus urna</i></p>
<p>Native fauna</p>	<p>Fifteen conservation significant fauna potentially occur in the NGP area.</p> <p><u>Three Threatened species:</u></p> <ul style="list-style-type: none"> • Curlew Sandpiper (<i>Calidris ferruginea</i>) – Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) - Critically Endangered and Migratory • Chuditch (<i>Dasyurus geoffroii</i>) – EPBC Act -Vulnerable • Malleefowl (<i>Leipoa ocellata</i>) – EPBC Act -Vulnerable <p><u>One Specially Protected species:</u></p> <ul style="list-style-type: none"> • Peregrine Falcon (<i>Falco peregrinus</i>) – BC Act (Other Specially Protected).

	<p><u>Five Priority species:</u></p> <ul style="list-style-type: none"> • Lake Cronin Snake (<i>Paroplocephalus atriceps</i>) (P3) • Hooded Plover (<i>Thinornis cucullata</i>) (P4) • Inland Western Rosella (<i>Platycercus icterotis xanthagenys</i>) (P4) • Central Long-eared Bat (<i>Nyctophilus major tor</i>) (P3) • Western Brush Wallaby (<i>Notamacropus irma</i>) (P4) <p>• millipede <i>Atelomastix</i> sp.'B03' is a short range endemic (SRE) species, identified in desktop studies and recorded in the field survey.</p> <p>This species is expected to be widespread throughout multiple habitats in the region and not restricted solely to Project areas.</p> <p>As stated in the application: <i>The remaining three confirmed, three likely and 12 possible SRE species (four mygalomorph spiders, four land snails, two pseudoscorpions, two isopods, and one millipede) were not recorded.</i></p> <p><i>An additional five conservation significant invertebrates (widespread, non-SRE species) were identified in the desktop assessment, but none were recorded during the field survey.</i></p>
<p>Lake Dundas aquatic biota</p>	<p>Two aquatic biota resting stage taxa were recorded from the Lake Dundas sampling sites in July 2020 (Pantoro South 2020), antheridia of <i>Chara</i> charophyte algae and cysts of <i>Parartemia</i> brine shrimp (<i>P. serventyi</i>, Pantoro 2022a).</p> <p>Both taxa were recorded within the small basin and in the greater Lake Dundas north basin. Abundance was low in the small basin compared to north basin sites. These species are currently not listed on the Department of Biodiversity Conservation and Attractions (DBCA) Threatened and Priority Fauna Rankings.</p> <p>Seven diatom species were recorded from Lake Dundas sediment samples collected in July 2020. All seven diatom species recorded in this survey have been collected elsewhere in the Goldfields region.</p>
<p>Surface waterbodies</p>	<p>Lake Cowan and Lake Dundas (Scotia dewatering discharge point-new) within the Premises boundary to west and north of Scotia pit</p>
<p>Aboriginal Heritage Places</p>	<p>The licence holder confirmed that the transferred items from the Works Approval to the licence will not have any effect on Aboriginal registered sites (Pantoro South 2020)</p> <p>Returned Servicemen Memorial, Place ID 20482</p> <p>Norseman gravesite, Place ID: 2922</p> <p>Norseman burial 1, Place ID: 2799</p> <p>Norseman burial 2, Place ID: 2800</p> <p>Norseman burial 3, Place ID: 2801</p> <p>Norseman burial 4, Place ID: 2802</p> <p>Norseman burial 5, Place ID: 2193</p> <p>Norseman burial 6, Place ID: 2139</p> <p>Norseman burial 7, Place ID: 2140</p>

	<p>Norseman burial 8, Place ID: 2141</p> <p>Norseman burial 9, Place ID: 2142</p> <p>Norseman burial 10, Place ID: 2143</p> <p>Norseman burial 11, Place ID: 2144</p> <p>Ngadju No.1 Dam Water Trees, Place ID 38810</p> <p>Ngadju Hiden Road Water Trees No 2, Place ID 38811</p> <p>Munguni, Place ID 2920</p> <p>Jimberlana Well Camp, Place ID 1343</p> <p>Eclipse Well Camp, Place ID 1344</p> <p>Horse Rocks, Place ID 2923</p>
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3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 0. Where linkages are incomplete they have not been considered further in the risk assessment.

Where the Licence Holder has proposed mitigation measures/controls (as detailed in Section 0), these have been considered when determining the final risk rating. Where the Delegated Officer considers the Licence Holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the Licence Holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 4.

The Revised Licence L8612/2011/1 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises.

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

Table 4. Risk assessment of potential emissions and discharges from the Premises during operation

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
Construction								
Construction works of landfills, dewatering infrastructure, TSF4 stage 4 and stage 5	Dust	Air/windborne pathway causing impacts to health and amenity	Town of Norseman is ~ 3km to the NW of TSF4 2.4 km north of OK underground mine	Refer to Section 3.1	C = Slight L = Possible Low Risk	Y	NA	NA
	Noise		Town of Norseman, other human receptors (min 1.35 km distance) from proposed landfills and landfill extension		C = Slight L = Possible Low Risk	Y	NA	NA
	Contaminated stormwater	Overland runoff from construction site	Native vegetation Superficial water	Refer to Section 3.1	C = Slight L = Possible Low Risk	Y	Condition 3 – stormwater management	NA
Operation								
Category 5								
Additional tailings depositions into TSF4	Leachate containing cyanide and elevated metals and metalloids	Seepage of leachate from TSF4 causing contamination of surrounding soil and groundwater Groundwater mounding resulting in impacts on native vegetation	Groundwater Vegetation (incl Eucalyptus trees) Ngadju No.1 Dam Water Trees (water source, Aboriginal Heritage site) south-east of TSF4 Surrounding soil	Refer to Section 3.1	C = Moderate L = Possible Medium Risk	N	Condition 6 – Operational requirement for seepage recovery bore Condition 22 - Table 11 – groundwater monitoring Condition 29 - Table 16 – reporting monitoring results of current and	Refer to section 2.2.4. Molybdenum has been added to the list of parameters for the monitoring of ambient groundwater quality. The Licence Holder will be required to measure molybdenum concentrations prior to the deposition of re-processed Bluebird tailings into TSF4.

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
							historical ion ratios	Historical and onward results of ionic ratios reporting added to the licence Refer also to section 2.2.4.
	Tailings and process water with elevated metals and metalloids	Direct discharge to land - leaks/pipe bursts causing contamination / degradation of surrounding soil and groundwater with impacts on vegetation growth and survival	Groundwater Surrounding soil and vegetation	Refer to Section 3.1	C = Minor L = Possible Medium Risk	N	Condition 6 – Freeboard requirement Condition 7 – Inspection of tailing pipelines and embankment freeboard requirement	NA
Deposition of reprocessed Bluebird tailings into the TSF4	Acidic, saline, metalliferous tailings Decant water including hazardous processing chemicals such as cyanide	Excess seepage of contaminated water from TSF4 This could lead to groundwater contamination and mounding, resulting in vegetation stress or death and adverse impacts to fauna	Minimum groundwater level around TSF4 is 3.5 mBGL Surrounding vegetation and fauna	Refer to Section 3.1	C = Moderate L = Possible Medium Risk	N	Condition 22, 23 - Monitoring of ambient ground water, triggers and limits	Trigger values and limits for groundwater level changed in Condition 22 to ensure native vegetation root does not reach contaminated groundwater. Additionally molybdenum was added to the groundwater monitoring program. New monitoring bore to be installed in the northern half of TSF4 to improve the monitoring bores spatial distribution in order to develop a more holistic

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
								understanding of the nature of the groundwater flow regime near the TSF.
Operations of processing plant, water storage and process water	Contaminated process water, reagents	Direct discharge to land - leaks/pipe bursts, contaminated surface water runoff from processing plant causing contamination of surrounding soil and groundwater	Groundwater Soil Vegetation	Refer to Section 3.1	C = Moderate L = Possible Medium Risk	Y	<p>Condition 2 – Recovery of environmentally hazardous materials</p> <p>Condition 3 – Stormwater run-off management</p> <p>Condition 4 – Pipelines containing saline water, acidic or alkaline liquors or tailings and tailings return water to have secondary containment</p> <p>Condition 6 – Operational requirements</p> <p>Condition 7 – Inspection to pipelines and embankment freeboard</p>	NA
	Contaminated process water	Overflow from water storage dams causing contamination of surrounding soil and groundwater	Groundwater Soil Vegetation		C = Moderate L = Possible Medium Risk	Y	<p>Condition 6 – Operational requirement including freeboard and overflow management</p> <p>Condition 7 – Inspection to pipelines and embankment</p>	NA

Licence: L8612/2011/1

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
							freeboard	
	Dust				C = Slight L = Possible Low Risk	Y	The general provisions of the EP Act apply	NA
	Noise	Air/windborne pathway causing impacts to health and amenity	Town of Norseman 1.5 km west of processing plant	Refer to Section 3.1	C = Slight L = Possible Low Risk	Y	Condition 6 – Operational requirement – Noise management infrastructure	The acoustic assessment within the application indicates that noise from the processing plant operations can be managed to comply with the assigned noise levels, as specified in the <i>Environmental Protection (Noise) Regulations 1997</i> at the three nearest residences if acoustic barrier walls are positioned on the residential side of plant/infrastructure and also used to attenuate the run of mine operations (DWER 2021).
Source: Mine dewater Activities: Onsite dust suppression	Hypersaline and contaminated dewater	Overspray or runoff from ongoing use of mine dewater for dust suppression (e.g. action of spraying saline water) impacting on native	Native vegetation Soil	No controls proposed	C = Slight L = Possible Low Risk	Y	Condition 5 – Control the use of saline dewatering for dust suppression	NA

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
		vegetation and soil i.e. soils becomes dispersive, reduced vegetation health or death						
Category 6: Mine Dewatering								
Source: Mine dewater from Scotia pit Activities: dewater discharge into Lake Dundas underground	Hypersaline and contaminated dewater	Direct discharge into Lake impacting ecosystem	Lake Dundas Native vegetation Fauna Aquatic biota Lake Dundas, disrupting reproductive cycle biota	Refer to Section 3.1	C = Moderate L = Possible Medium Risk	N	<p>Condition 6 – Operational requirements</p> <p>Condition 17 – Authorised discharge to Lake Dundas and pH range control before discharging</p> <p>Condition 20 – Table 9 - Inclusion of Lake Dundas for monitoring of point source emissions to surface water</p> <p>Condition 23 – Table 12 – Inclusion of Lake Dundas for monitoring of ambient surface water quality</p> <p>Condition 22 – Table 13 – Inclusion of Lake Dundas for monitoring of ambient sediment quality including salt crust thickness</p> <p>Condition 24 –</p>	<p>Condition 17 updated by adding Lake Dundas</p> <p>Refer also to section 2.2.6.</p> <p>Condition 26 has been included to prepare adaptive Discharge Management Plan for Lake Dundas to monitor Parartemia sp. and allow its life cycle to be completed</p> <p>Refer to section 2.2.6.</p>

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
							Inclusion of Lake Dundas dune and woodland vegetation to monitor vegetation health Condition 26 – to prepare adaptive Discharge Management Plan for Lake Dundas	
Source: Mine dewater Activities: Pipeline or storage tank/ponds leak/rupture causing discharge to surrounding environment.		Direct discharge impacting/ causing reduced health or death of native vegetation, local fauna and impacts to surrounding ecosystems.	Native vegetation Soil Fauna		C = Moderate L = Possible Medium Risk	Y	Condition 4 – Pipelines containing saline water, acidic or alkaline liquors or tailings and tailings return water to have secondary containment Condition 6 – Operational requirements including HDPE lined, recovery pumps Condition 12 – Construction requirements – dewatering pipelines and ponds	NA
Category 64 – Class II putrescible landfill site								
Operation landfill	Noise	Air/windborne pathway causing impacts to health	Town of Norseman, other human receptors (min 1.35 km distance from Butterfly,	Refer to Section 3.1	C = Slight L = Possible	Y	NA	NA

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
		and amenity	Ok, Scotia and Bullen landfills)		Low Risk			NA
	Dust				C = Slight L = Possible Low Risk	Y	Conditions 8 – 9 relating to the regulation of waste processing, cover requirements and, and condition for disposal of Special waste type 1 (asbestos)	
	Odour				C = Slight L = Possible Low Risk	Y	Condition 9 – to manage landfill to ensure cover is maintained	
	Contaminated runoff/ leachate from non-conforming waste types	Overland runoff from landfill following rainfall events	Soil, Groundwater		C = Moderate L = Possible Medium Risk	Y	Condition 3 – to prevent stormwater run-off becoming contaminated	
	Windblown waste	Air/windborne pathway causing impacts to health and amenity	Aboriginal heritage sites		C = Slight L = Possible Low Risk	Y	Condition 9 – cover on landfills Condition 11 - windblow waste control	
	Leachate and contaminated stormwater	Direct infiltration impacting surrounding soil, groundwater and native vegetation	Soil, vegetation, fauna, ground water		C = Slight L = Possible Low Risk	Y	NA	
	Contaminated fire water	Discharge to land causing contamination	Vegetation		C = Slight L = Possible	Y	Condition 3 – to prevent stormwater run-off becoming	

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
					Low Risk		contaminated	
Category 70 – Screening etc. of material								
Source: Mobile crushing/screening plant (operated on Harlequin, Bullen, OK and Scotia waste rock dumps) Screening, crushing, unloading, loading and storage of material Vehicle movements	Dust	Air / windborne pathway causing impacts to health and amenity	Town of Norseman 1.11 km in a northeast from Bullen WRD 1.25 km north from OK WRD	Refer to Section 3.1	C = Slight L = Possible Low Risk	Y	NA	NA
	Noise				C = Moderate L = Possible Medium Risk	Y	Condition 6 – Operational requirements including the location for the mobile crushing/screening plant	
	Contaminated and/or sediment laden stormwater	Overland runoff potentially causing ecosystem disturbance	Threatened Flora		C = Slight L = Possible Low Risk	Y	Condition 3 – to prevent stormwater run-off becoming contaminated	

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk assessments* (DWER 2020).

Note 2: Proposed Licence Holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

4. Consultation

Table 5 provides a summary of the consultation undertaken by the department.

Table 5: Consultation

Consultation method	Comments received	Department response
<p>Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal on 18/08/2023</p> <p>Noting DMIRS is now known as DEMIRS</p>	<p>DMIRS provided the following comments on 18/09/2023:</p> <p>TSF4:</p> <ul style="list-style-type: none"> • The proposed staged lifting of TSF4 is in line with the approved Mining Proposal (Reg ID 92542). • The Northeast Saddle Dam raise height (309 mRL) does not appear to be included within the table outlining the proposed items to be included in the proposed licence amendment (Table 3 of the supporting documents). • Figure 4 of appendix 1 of the supporting documents appears to show an additional tailings slurry discharge pipeline than what is displayed in the approved Mining Proposal (Reg ID 92542). • The details of the operation of TSF4 appears to be in line with the TSF design report appended to the approved Mining Proposal (Reg ID 92542). The operation of this TSF is required to be operated in accordance with this report, as per section 9 of the mining proposal and required by Tenement Condition 41 of M63/133-l. <p>Given the above, DEMIRS recommends the proposed heights of the Northeast Saddle Dam be included with the licence amendment.</p> <p>Bluebird Tailings Reprocessing:</p> <ul style="list-style-type: none"> • There does not appear to be any approved mining proposals that relate to the reprocessing / repurposing of the tailings within the Bluebird TSF. • The site wide Mine Closure Plan (MCP) (Reg ID 92491) approved in 2021, identifies Bluebird TSF as a “mineral resource to be retained for future processing” <p>In the following circumstances a revised Mining Proposal should be submitted to DMIRS for assessment and approval:</p>	<p>Noted, the Licence Holder has stated that they will submit the Mining Proposal to include the reprocessing of the TSF Bluebird tailings.</p>

Consultation method	Comments received	Department response
	<ul style="list-style-type: none"> • When any disturbance is proposed outside the approved disturbance envelope; • The characteristics of any 'Key Mine Activities' detailed in the Mining Proposal need to be altered; • A new activity, or change to an activity type, beyond that listed in the 'Activity Details' section of the Mining Proposal is proposed; or • An increase in area is required for any key mine activity or total activity area on any tenement. <p>Given this, DMIRS advises that should the reprocessing of tailings from the Bluebird TSF be proposed, a revised mining proposal, as per the DMIRS Statutory Guidelines for Mining Proposals (Version 5.0, updated June 2023) will need to be submitted for assessment and approval.</p>	
<p>DBCA was advised from the proposal on 26/10/2023</p>	<p>Comments received on 28/11/2023, refer to section 2.2.6</p>	<p>Refer to section 2.2.6</p>
<p>Licence Holder was provided with draft amendment on 2/01/2024</p>	<p>Comments received on 2/02/2024 (further information also provided on 15/02/2024)</p>	<p>Refer to Appendix 1</p>
<p>Licence Holder was provided with second draft amendment on 21/03/24</p>	<p>Comments received on 9/04/2024</p>	<p>Minor comments and requested information received. Refer to Appendix 1 for additional responses (included where relevant).</p>

5. Conclusion

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

5.1 Summary of amendments

Table 6 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Licence as part of the amendment process.

Table 6: Summary of licence amendments

Condition no.	Proposed amendments
Cover page	Mining tenements added Increase in capacity for categories 5, 6 and 64 Inclusion of category 70
Content and Introduction	Removed as per new licence format
Condition numbering and tables	Amended with new formatting
Licence history	Updated to remove reference to works approvals and registrations; and include this amendment
Interpretation	Included as per new licence format
1.1.1 – 1.15	Condition removed as per new licence format
Definitions	Definitions moved to Table 18 as per new licence format
5	Added condition (d)
6, Table 1	Added operational requirements for the following infrastructure: <ul style="list-style-type: none"> • TSF4 Stages 3, 4, 5; • Seepage recovery bores; • Process plant and associated infrastructure; • Dams including Process plant events dam; Environmental dam; Process water pond; and Raw water dam; • Dewatering activities; • Mobile crushing and screening plant. OK Pond 1 and 2 changed to OK Water Storage Facility (WSF) Lake Bower name changed to Transfer Point 1 Location of infrastructure and figures updated Bullen oily water separator pond removed Transfer point 1 – operational requirement updated
Previous Condition 1.3.4	Removed as is now included within Condition 5, Table 1
8, Table 3	Inclusion of constructed landfills Inclusion of special waste type 1 (asbestos) disposal requirements
9, Table 4	Cover requirement for asbestos added
Previous Condition 1.3.13	Removed as the Licence Holder confirmed compliance with the integrity of the processing liquor and contaminated stormwater containment facilities. Refer to section 2.2.11
12, Table 5	Construction requirements added for transferred infrastructure from W6472/2020/1

Condition no.	Proposed amendments
13	Inclusion of requirement to submit an Environmental Compliance Report following construction of infrastructure
16 Table 7	W1 – new sources transferred from Works Approval New emission W2 point added, discharge to Lake Dundas
17, Table 8	New emission point limits added
Previous Condition 2.4.1	Condition ensuring that no tailings are processed or beneficiated removed
20, Table 9	New monitoring point in Lake Dundas added
21, Table 10	Special waste type 1 added to waste inputs
22, Table 11	Monitoring bores for TSF4 (SRB1 and PB2) added Molybdenum groundwater monitoring added
23	Condition updated from six (6) to seven (7)
Tables 12 and 13	Ecological monitoring points for Lake Dundas added
24, Table 14	Vegetation health monitoring for Lake Dundas added
26	Condition to prepare and implement Adaptive Discharge Management Plan for Lake Dundas
Section 4 - Improvement conditions	Improvement program removed
5.1.1 – 5.1.4	Conditions removed as per new licence format
28 and 29	Inclusion of conditions in line with new licence format
30, Table 16	Updated in line with changes to licence conditions (as above)
32	Monitoring mine dewater discharged to Lake Dundas added
33 - 35	Inclusion of conditions in line with new licence format
Definitions – Table 28	Definitions updated in line with licence conditions
Figure 1	Updated premises map changed
Figure 2	Venture TSF and related monitoring points
Figure 3	Phoenix TSF and Butterfly TSF locations map added
Figure 4	Locations of the monitoring points for TSF 123 updated
Figure 5	TSF4 and related pipeline flow map (note: Seepage Recovery Bore - SRB1)
Figure 6	TSF4 embarkment raise stages

Condition no.	Proposed amendments
Figure 7	Layout processing plant added
Figure 8	Process Water Pond, Water Storage Facility (WSF) (Process plant events dam), Environmental Dam, and the Power Station (emission points A1-A10)
Figure 9	Processing Plant Water Pipeline Flow map added
Figure 10	Harlequin Landfill area map updated
Figure 11	TSF123 Return Water pond map added
Figure 12	Landfills, landfill extensions and proposed bioremediation pads locations map added, landfills map consolidate to one map
Figure 13	Locations of containment and dewatering infrastructure OK Mine map changed for new map
Figure 14	OK Mining Area and infrastructure map added
Figure 15	North Royal and Slippers dewatering infrastructure map added
Figure 16	Scotia – Dewatering Layout map added
Figure 17	Mobile crushing-screening plant areas map added
Figure 18	Lake Cowan Existing Monitoring map updated, consolidated to one map
Figure 19	Lake Dundas Ecological monitoring Points map added
Figure 20	Locations of ambient groundwater quality monitoring points and monitoring points for TSF4
Figure 21 and 22	Tree monitoring area maps added

References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
3. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
4. DWER 2021, *Decision Report W6472/2020/1*, Perth, Western Australia
5. DWER 2023a, *Contaminated sites advice* (REF: A2203474).
6. Li, X., Chang, S.C. and Salifu, K.F., 2013, *Soil texture and layering effects on water and salt dynamics in the presence of a water table: a review*. *Environmental Reviews*, 21, 1-10. The paper is available from the following website: www.researchgate.net.
7. Newson, T.A. and Fahey, M., 2003, *Measurement of evaporation from saline tailings storages*. *Engineering Geology*, 70, 217-233.
8. Pantoro South 2019, *Norseman Gold Project-L8612/2011/1- TSF 4 Monitoring Bore update* (REF: DWERDT837643).
9. Pantoro South 2020, *Norseman Gold Project Works Approval supporting documents* (REF: A1955884).
10. Pantoro South 2021a, *Norseman Gold Project Dust Management Plan* (REF: DWERDT434204).
11. Pantoro South 2021b, *Annual Environmental Report 1 October 2020 – 30 September 2021*, Perth, Western Australia (REF: A2120511).
12. Pantoro South 2022a, *Works Approval Environmental Compliance Report*, Perth, Western Australia (REF: DWERDT695491).
13. Pantoro South 2022b, *Annual Environmental Report L8612/2011/1 1 October 2021 – 30 September 2022*, Perth, Western Australia (REF: A2197078).
14. Pantoro South 2023a, *Licence Amendment application documents*, Perth, Western Australia (REF: DWERDT790940).
15. Pantoro South 2023b, *Second request for further information regarding Pantoro South Pty Ltd, Norseman Gold Project, Licence Amendment Application L8612/2011/1* (REF: DWERDT851336).
16. Pantoro South 2023c, *Third request for further information regarding Pantoro South Pty Ltd, Norseman Gold Project, Licence Amendment Application L8612/2011/1* (REF: A2225067).
17. Pantoro South 2024, *NGP PNRS Comments draft Lic* (REF: A2252502)

Appendix 1: Summary of Licence Holder's comments on draft Amended Licence and Amendment Report

Given the substantial number of comments provided on the draft amendment package, DWER has itemised them and consolidated a summary in the Table below.

Item No.	Amendment Report Section / Condition	Summary of Licence Holder's comment	Department's response
1-9, 13, 21, 26-32, 34-52, 54-60, 62-63, 65-67, 72-75, 77-89	N/A	Comments on sections of the Amendment Report and/or sections of the draft licence to acknowledge (note) information and/or clarify information presented for accuracy purposes.	Noted, proposed changes and/or updated information adopted where applicable. DWER notes that several items raised as 'inaccurate' or 'incorrect' was information taken from the applicant's application and supporting documents.
10, 64, 89 and 90	Amendment Report: Section 2.2.3: Seepage Management Plan (page 5-6) – proposed additional monitoring bores in the northern part of the proposed TSF footprint (item 10). Draft conditions 14 and 15 (item 64 and 89).	<p><u>Section of Amendment Report:</u></p> <p><i>The Seepage Management Plan was referred internally, and the department's Principal Hydrogeologist provided the following advice:</i></p> <ul style="list-style-type: none"> • <i>Based on the information provided, it is considered that the seepage recovery plan was developed in a suitable manner using technically sound methodologies.</i> • <i>The proposed combined use of seepage recovery bores and an interception drain should be adequate for controlling the elevation of the water table near the southern half of TSF4.</i> <p><i>The following recommendations were made:</i></p> <ul style="list-style-type: none"> • <i>That additional ground-based geophysical investigations are undertaken on the eastern side of TSF4 to ensure that potential ground water fracture zones along the proposed northern part of the facility are identified.</i> • <i>That additional monitoring bores are drilled and constructed on suitable geophysical targets so that baseline groundwater quality data can be obtained in the northern part of the proposed TSF footprint".</i> <p><u>Pantoro South Pty Limited (PNRS) comments:</u></p> <p>The above-mentioned recommendations refer to the northeastern uphill/upstream</p>	DWER has considered the additional information about the local geological and hydrogeological conditions at the site, and has withdrawn the proposed requirements for additional geophysical and drilling investigations to be undertaken near the north-eastern part of the TSF. Draft conditions 14 and 15 (dated 2/01/2024) have been removed from the licence.

Item No.	Amendment Report Section / Condition	Summary of Licence Holder's comment	Department's response
		<p>portion of the TSF which is a valley fill facility. The area recommended for the additional geophysical investigation and subsequent additional monitoring bores is a hill, therefore, would offer limited benefit in undertaking additional work over this area (note: PNRS provided a photo with the response to show the north eastern uphill profile of the area recommended for further investigation).</p> <p>Inspections of the uphill area has not observed any seepage and/or vegetation stress which is unlikely as deposited tailings drain to a central decant in the central/southern portion of the dam.</p> <p>PNRS provided a figure of an electromagnetic (EM) survey that illustrates the impermeable conditions that can be expected towards the higher-lying bedrock at the northern end of TSF4 including the hill and indicated that it is unlikely that monitoring bores in this area (if installed), would directly intercept seepage from the TSF4 facility.</p>	
11 and 70	<p>Amendment Report: Section 2.2.3: Seepage Management Plan (page 6) – Revised SWL limit (item 11).</p> <p>Draft condition 25 (item 70).</p>	<p><u>PNRS comments:</u></p> <p>PNRS noted the rationale provided in the Amendment Report in relation to SWL triggers and limits and with regards to the proposed changes to the SWL limit in condition 25 (Table 12) of Licence L8612/2011/1 from 4 mBGL to 5 mBGL and the associated trigger level of 7 mBGL.</p>	Noted.
12	<p>Amendment Report: Section 2.2.3: Seepage Management Plan (page 6) – Other seepage management measures.</p>	<p><u>Section of Amendment Report:</u></p> <p><i>“Other measures that could be implemented to reduce the rate of seepage from TSF4 include:</i></p> <ul style="list-style-type: none"> • <i>Reducing the water content of the tailings before discharge to the TSF by the use of a thickener; or by</i> • <i>Increasing the efficiency of water recovery within the TSF by the installation of an appropriate drainage system (such as the installation of vertical wick drains).</i> <p><i>The current pan factor found in the “Appendix E Static Water Balance” (Pantoro South 2023a) is 0.83. This factor does not correspond to the location of the premises, where hypersaline water is used.</i></p> <p><i>The department recommend that under these conditions, the pan factor applied to</i></p>	Noted.

Item No.	Amendment Report Section / Condition	Summary of Licence Holder's comment	Department's response
		<p><i>estimate the rate of evaporation from a decant pond should be about 0.4, and the pan factor to be applied to beach areas of a hypersaline TSF should be about 0.2 (Newson and Fahey, 2003). Newson and Fahey (2003) also suggested that pan factors are less than 0.2 in areas on a TSF where extensive salt crusts have formed'.</i></p> <p><u>PNRS comment:</u></p> <p>Noted. The efficiency of the current water management system is reviewed on an ongoing basis and measures such as wick drains would be considered, if required. The TSF water balance is also reviewed regularly, and a lower evaporation pan factor will be considered as required.</p>	
14	Amendment Report: Section 2.2.4: Bluebird TSF reprocessing of tailings (page 6-7).	<p><u>Section of Amendment Report:</u></p> <p><i>"The deposition of the reprocessed tailings will mix with the tailings from Scotia and OK, in TSF4. The Licence Holder claims that the Bluebird TSF tailings has a similar composition / characteristic to the tailings of Scotia and OK, which are classified as non acid forming (NAF). The "potential seepages from the Bluebird TSF tailings are likely to vary between moderately alkaline and alkaline and brackish with very low to low concentrations of dissolved metals and metalloids, whilst potential seepage from Scotia and OK is expected to be moderately alkaline, brackish and contain generally low concentrations of dissolved metals and metalloids" (Pantoro South 2023c).</i></p> <p><i>A summary of Bluebird TSF tailing analysis (Pentadragon report, Pantoro South 2023b) is provided below:</i></p> <p>(a) <i>The Bluebird TSF most likely contains tailings from the processing of gold mineralisation hosted predominantly within gabbro intrusions, including the megacrystic plagioclase bearing (Bluebird type) and standard medium to coarse-grained gabbro.</i></p> <p>(b) <i>Acid Formation Potential: The Licence Holder tested the tailings to measure the potential of acid formation. Based on the procedure of calculation of Net Acid Production Potential (NAPP), the tailings tested negative.</i></p> <p><i>The conclusion is that that leachates from these materials is expected to be moderately alkaline, brackish and contain generally low concentrations of dissolved metals and metalloids. Arsenic is the element of highest environmental risk potential in tailings but varies across the ore bodies and will be contained within the TSF. Therefore, the reprocessing tails produced are expected to be NAF.</i></p> <p>(c) <i>Metalliferous Drainage: Bluebird tailings are expected to have elevated</i></p>	Noted. The description of the tailing classification has been changed accordingly.

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		<p><i>concentrations of the major elements that may leach from the tailings.</i></p> <p>(d) <i>Bluebird Tailings Extraction, 48-hr Solution ICP Analysis of Leachable Metals and Metalloids: Dissolved metals and metalloids (Al, As, B, Cd, Co, Cu, Fe, Hg, Mn, Mo, Ni, Pb and ZN) concentrations are slightly elevated with As, Cd, Hg and Pb at or marginally above their guideline thresholds.</i></p> <p>(e) <i>Bluebird Tailings Extraction, DI water Leachable Metals and Metalloids: Assessment Level: relatively low concentrations of Al, As, B, Cr, Fe, Mn and Sb may leach from the tailings well below their relevant Non-Potable Groundwater Use thresholds (DoH, 2014; DWER, 2021). Ba, Cd,Co, Cu, Hg, Mo, Ni, Pb, Se, U, V and Zn were absent in the DI leachates at a pH of 7.1".</i></p> <p><u>PNRS Comment:</u></p> <p>In terms of (b) Acid Formation Potential: The Licence Holder tested the tailings to measure the potential of acid formation. Based on the procedure of calculation of Net Acid Production Potential (NAPP), the tailings tested negative.</p> <p>The summary in red text and aspects with regard to the assessment are incorrect. The correct classification is Tailings from the Bluebird TSF classifies as non-acid forming with acid consuming capacity [NAF(ACM)]. This classification was not based on the highlighted section above.</p> <p>Please note: 48-hr solutions (this is far more rigorous than what would be representative of the processes in a tailings complex) contained large concentrations of the major elements, dissolved metals and metalloids (Al, As, B, Cd, Co, Cu, Fe, Hg, Mn, Mo, Ni, Pb and ZN) concentrations were slightly elevated with As, Cd, Hg and Pb at or marginally above their guideline thresholds. Relatively low concentrations of Al, As, B, Cr, Fe, Mn and Sb were present in in laboratory leachates using deionized water and well below their relevant non-potable groundwater use thresholds whilst Ba, Cd, Co, Cu, Hg, Mo, Ni, Pb, Se, U, V and Zn were absent.</p> <p>In conclusion, leachate assessments indicate that potential seepages from the tailings are likely to vary between moderately alkaline and alkaline and brackish with very low to low concentrations of dissolved metals and metalloids. Consequently, re-processing the Bluebird TSF and disposing of the resultant tailings on existing TSF4 does not pose any additional threats to the downstream environment.</p>	

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		<p>A comparison of dissolved metals and metalloids in groundwater and the tailings</p> <table border="1" data-bbox="613 300 1529 440"> <thead> <tr> <th></th> <th>pH</th> <th>Al</th> <th>As</th> <th>Cu</th> <th>Fe</th> <th>Mn</th> <th>Cd</th> <th>Co</th> <th>Pb</th> <th>Ni</th> </tr> </thead> <tbody> <tr> <td>Average (2019-2023) Groundwater at TSF4</td> <td>5.2</td> <td>69.5</td> <td>0.012</td> <td>0.127</td> <td>2.3</td> <td>9.0</td> <td>0.009</td> <td>0.876</td> <td>0.021</td> <td>3.11</td> </tr> <tr> <td>Tailings Leachate (DI)</td> <td>7.1</td> <td>0.3</td> <td>0.020</td> <td><0.010</td> <td>0.7</td> <td>0.0</td> <td><0.005</td> <td><0.010</td> <td><0.010</td> <td><0.01</td> </tr> <tr> <td>Tailings Leachate (48-hr)</td> <td>-</td> <td>0.2</td> <td>0.100</td> <td>8.40</td> <td>7.9</td> <td>1.1</td> <td>0.050</td> <td>0.550</td> <td>0.100</td> <td>3.40</td> </tr> </tbody> </table> <p>Note: Sb, Se and Hg are absent in groundwater. Sb present in DI Leachate: 0.01mg/L; Se and Hg remains absent. Sb and Se were not analysed for in the 48-hr Solution; Hg is present at 0.09 mg/L.</p> <p>leachate reveal that:</p> <ul style="list-style-type: none"> Groundwater at TSF4 with an average pH of 5.2 contains elevated concentrations of heavy metals and metalloids often in excess of the DI leachate and the 48-hr Solution. Cognisance must be taken that the interpretation of the 48-hr Solution laboratory test (which involves rigorous agitation with acid for a period of 48 hours) results must be undertaken within the context of test methodology and the controlling physical and chemical mechanisms in the natural/built environment (e.g. pH of the tailings and effluent, liquid to soil ratio, and mode of water contact, etc.); hence, these test provide an indication of the potential leachate concentrations rather than the actual concentration. 		pH	Al	As	Cu	Fe	Mn	Cd	Co	Pb	Ni	Average (2019-2023) Groundwater at TSF4	5.2	69.5	0.012	0.127	2.3	9.0	0.009	0.876	0.021	3.11	Tailings Leachate (DI)	7.1	0.3	0.020	<0.010	0.7	0.0	<0.005	<0.010	<0.010	<0.01	Tailings Leachate (48-hr)	-	0.2	0.100	8.40	7.9	1.1	0.050	0.550	0.100	3.40	
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15, 16, 18 and 65	<p>Amendment Report: Section 2.2.4: Bluebird TSF reprocessing of tailings (page 8) – Geochemical characteristics of tailings materials and sampling (item 15, 16 and 18).</p> <p>Draft condition 16 (item 65)</p>	<p>Section of Amendment Report:</p> <p><i>(a) Geochemical characteristics of tailings materials and sampling</i> (DWER Principal Hydrogeologist advice); relates to insufficient sampling and analysis to adequately characterise tailings materials and recommendations to adopt an adequate sampling program to characterise tailings.</p> <p>PNRS Comments:</p> <p>Please note that reference to 'geochemical testing from drill cores' from 'ten sub-samples' was not included in the Pendragon report and is not relevant to the Bluebird TSF. A search of the Pendragon report for drill core has reference only to the drill cores (core trays) stored on the Bluebird TSF which are proposed to be removed to the core shed.</p> <p>Representative samples of tailings from the Bluebird TSF were obtained using mechanical augers to a depth of 1.5m. The sample locations were spread as evenly as possible across the TSF; the grid reference represent 15m squares with samples nominally 30m apart [note: a grid figure was provided to DWER for additional</p>	<p>DWER acknowledges the provision of additional information on how tailings were sampled for chemical analysis at the TSF. The issue of the statistical significance of samples that are collected from TSF's and other mine waste landforms can be highly problematic for the department, and can lead to the implementation of poor management measures when not done well. In this case, DWER considers that PNRS has taken sufficient care to ensure that tailings samples that have been collected are statistically relevant.</p> <p>The related section in the Amendment Report has been removed. Draft conditions 16 (dated 2/01/2024) has also been removed from the licence.</p>																																												

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		<p>information and context].</p> <p>In accordance with the <i>NSW EPA Sampling Design Part 1 – Application, Contaminated Land Guidelines of 2022</i>, the minimum number of samples based on a site area of 4ha (the footprint of the Bluebird TSF) is 50 which equates to a grid size of 28m. The diameter of the hotspot that can be detected with 95% confidence is 33.4m. We note that the sampling design for the Bluebird TSF complies with this guidance.</p> <p>In addition to the above, cognisance must be taken of the relative homogeneity of the ore bodies and the processes of mining and beneficiation which further homogenise the ore and subsequent tailings; hence only a few samples may suffice to characterise the tailings materials.</p>	
17, 19, 20, 71 and 76	<p>Amendment Report: Section 2.2.4: Bluebird TSF reprocessing of tailings (page 8-9) – Additional groundwater monitoring (item 17, 18, 19 and 20)</p> <p>Draft condition 25 – addition of molybdenum to the groundwater monitoring program (item 71)</p> <p>Draft condition 25 – addition of reporting on ionic ratios in the Annual Environmental Report (item 76)</p>	<p><u>Section of Amendment Report (item 17):</u></p> <p><i>(b) Additional groundwater monitoring (DWER Principal Hydrogeologist advice); The geochemical testing undertaken suggests that leachate from the materials that will be discharged to TSF4 will have relatively elevated concentrations of calcium, magnesium and sulfate ions by comparison with the ionic composition of groundwater near the facility.</i></p> <p><u>PNRS Comment:</u></p> <p>This statement is incorrect. The ionic concentrations in groundwater exceed the ionic concentrations of potential leachates from the tailings once deposited [note: a table providing a summary of ionic concentrations was provided to DWER for additional information and context].</p> <p><u>Section of Amendment Report (item 19 and 71):</u></p> <p><i>“Added molybdenum to Table 12 for the monitoring of ambient groundwater quality. The Licence Holder is required to measure ground water or molybdenum before the deposition of reprocessed Bluebird tailings commences, as the seepage from the reprocessed tailings are likely to contain this element and a baseline of the element is necessary”.</i></p> <p><u>PNRS Comment:</u></p> <p>Molybdenum was absent in the DI Leachate but present in the 48-hr Solution between 0.10 mg/L and 0.20 mg/L which is marginally above the limit in drinking water (0.05mg/L) and <0.01 mg/L in livestock water.</p>	<p>DWER considers that it is likely that pore water in tailings that are deposited to the TSF will have a different major-ion chemical composition to that of natural saline groundwater near the facility (whether or not these materials have been reprocessed). This is supported by the ionic-ratios that have been provided in tabulated form by PNRS. Therefore, any progressive changes in these ratios that are shown in monitoring bores could be a sensitive indicator that seepage is being detected in these bores. DWER has clarified its previous comments on this issue with regards to elevated concentrations of individual ions and has instead referred to elevated levels of ionic composition (ratios).</p> <p>DWER acknowledges that groundwater near the TSF is hypersaline and is unlikely to have any beneficial uses. However, this should not be seen as a reason by proponents to not adequately assess changes in concentrations of metals and other contaminants in groundwater that can be caused locally by seepage from TSFs in areas with hypersaline groundwater. Emissions from TSFs need to be adequately characterised and monitored even in such environments.</p>

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		<p>PNRS note that groundwater across the region is hyper-saline with no beneficial use i.e. it cannot be used for drinking water and/or livestock watering without extensive treatment.</p> <p><u>Section of Amendment Report (item 20 and 76):</u></p> <p>"Included the requirement to report the ionic ratios Ca/Na, Mg/Na and SO4/Cl in the groundwater monitoring program through the Annual Environmental Report".</p> <p><u>PNRS Comment:</u></p> <p>These are merely calculations of ions included in current laboratory analyses. However, PNRS are uncertain as to what the Department would like to achieve with these ratios in light of the tabulated data below. Groundwater contains ions in concentrations several orders of magnitude larger than the potential leachates. The dominant ions in groundwater are Cl>Na>SO4>Mg>Ca whilst the potential leachates will have a different signature Cl>SO4>Na>Ca>Mg. Section of Amendment Report:</p> <table border="1" data-bbox="622 746 1536 1098"> <thead> <tr> <th></th> <th>pH</th> <th>EC</th> <th>TDS</th> <th>Cl</th> <th>SO4</th> <th>Ca</th> <th>Mg</th> <th>K</th> </tr> </thead> <tbody> <tr> <td>Groundwater</td> <td>5.2</td> <td>84,831</td> <td>66,377</td> <td>33,508</td> <td>4,545</td> <td>1,011</td> <td>2,228</td> <td>697</td> </tr> <tr> <td>Tailings Leachate (48-hr)</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>800</td> <td>167</td> <td>79</td> </tr> <tr> <td>Tailings Leachate (DI)</td> <td>7.1</td> <td>1,440</td> <td>-</td> <td>310</td> <td>272</td> <td>90</td> <td>16</td> <td>13</td> </tr> <tr> <th>Ion Ratios</th> <th>Groundwater</th> <th>Leachate (48-hr)</th> <th>Leachate (DI)</th> <td colspan="5"></td> </tr> <tr> <td>Ca/Na</td> <td>0.06</td> <td>0.38</td> <td>0.63</td> <td colspan="5"></td> </tr> <tr> <td>Mg/Na</td> <td>0.12</td> <td>0.08</td> <td>0.11</td> <td colspan="5"></td> </tr> <tr> <td>SO4/Cl</td> <td>0.14</td> <td>-</td> <td>1.92</td> <td colspan="5"></td> </tr> </tbody> </table>		pH	EC	TDS	Cl	SO4	Ca	Mg	K	Groundwater	5.2	84,831	66,377	33,508	4,545	1,011	2,228	697	Tailings Leachate (48-hr)	-	-	-	-	-	800	167	79	Tailings Leachate (DI)	7.1	1,440	-	310	272	90	16	13	Ion Ratios	Groundwater	Leachate (48-hr)	Leachate (DI)						Ca/Na	0.06	0.38	0.63						Mg/Na	0.12	0.08	0.11						SO4/Cl	0.14	-	1.92						<p>Given the high salinity of natural groundwater and of process water at the site, PNRS should be cautious about using leaching tests with deionised water as a tool to determine the likely concentrations of metals in any seepage water from the TSF.</p> <p>Consequently, monitoring of molybdenum will stay within the groundwater monitoring program specified in licence conditions.</p>
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22	Amendment Report: Section 2.2.6: Aquatic Biota Assessment (page 10)	<p><u>Section of Amendment Report:</u></p> <p><i>"A more conservative approach as the salinity tolerance for P. serventyi of 262 g/L was also recommended, with a "prompt further investigations if the salinity increase above the proposed trigger during or post-operation of Scotia discharge outlet" (Pantoro South, 2022a)".</i></p> <p><u>PNRS Comment:</u></p> <p>Noted, however, the site-specific salinity trigger value of 301 g/L, and site-specific</p>	Noted, amended accordingly.																																																																								

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		threshold value of 357 g/L, were proposed for surface water in Lake Dundas in 2021 (WRM 2021), with a recommendation that exceedance of the 301 g/L trigger during or post-operation of the Scotia discharge outlet should prompt further investigation, not 262 g/L. Please amend accordingly.	
23	Amendment Report: Section 2.2.6: Aquatic Biota Assessment (page 11)	<p>Section of Amendment Report:</p> <p><i>“The proposed salinity trigger/threshold are above the known salinity tolerances of Parartemia serventyi, but salinity changes from first inundation to drying, and these values have been measured near the end of a cycle when P. serventyi adults have deposited eggs and presumably died. Monitoring of salinity and P. serventyi should be undertaken throughout a hydrological cycle (monthly initially, then less frequent) to ensure early salinity remains low (<20 g/L on first fill)”.</i></p> <p>PNRS Comment:</p> <p>Noted. However, there is limited data on the salinity during the entire hydrological cycle and it is based on an assumption that <i>P. serventyi</i> require very fresh conditions to reproduce.</p>	<p>The department sought additional advice from DBCA on this item. A summary is outlined below:</p> <p>The WRM report for Pantoro notes that <i>P. serventyi</i> likely requires a period of low salinity to hatch. Campagna (2007) found hatching rates of <i>Parartemia veronicae</i> to be much higher when salinity was <60-80 mS.cm⁻¹ = approx. 35 - 50 g/L)) compared to higher salinities, with no hatching occurring at conductivities >100-150 mS.cm⁻¹. By contrast, Geddes (1981) found <i>Parartemia zietziana</i> hatching at salinities as high as 202 g/L but this species can inhabit permanent salt lakes and likely has a different physiology. Geddes (1976) notes egg hatching for <i>P. zietziana</i> occurred only after rainfall reduced salinity but still >100 g/L, albeit in a more permanent lake.</p> <p>Additional research into the salinity requirements for Parartemia hatching are required and this would be a good opportunity for Pantoro to contribute to such research.</p> <p>References:</p> <ul style="list-style-type: none"> • Campagna V. (2007). Limnology and biota of Lake Yindarlgooda – an inland salt lake in Western Australia under stress. Curtin University of Technology, Perth, W.A. • Geddes M.C. (1976). Seasonal fauna of some ephemeral saline waters in Western Victoria with particular reference to <i>Parartemia zeitziana</i> Sayce (Crustacea: Anostraca). Australian Journal of Marine and Freshwater Research 27, 1–22.

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			<ul style="list-style-type: none"> Geddes M.C. (1981). The brine shrimps <i>Artemia</i> and <i>Parartemia</i>. Comparative physiology and distribution in Australia. <i>Hydrobiologia</i> 81, 169–179 															
24, 33 and 68, 69	<p>Amendment Report: Section 2.2.6: Aquatic Biota Assessment (page 11-12) (item 24)</p> <p>Draft condition 20 – pH limits on discharges to Lake Dundas (item 68)</p>	<p>Section of Amendment Report:</p> <p><i>“The water acidity is recommended to stay between pH 6.7 to 7.5”.</i></p> <p>PNRS Comment:</p> <p>The pH range in the surface water in the main body of Lake Dundas currently and historically exceeds this range. Could DWER please provide the source of the pH range, relevance and how to apply the values as the current monitoring at the Lake Dundas discharge point (W2) also exceeds this range for all but one quarterly result as shown the Table below:</p> <table border="1" data-bbox="622 740 1173 948"> <thead> <tr> <th>Sample ID</th> <th>Date Sampled</th> <th>pH</th> </tr> </thead> <tbody> <tr> <td>Scotia Discharge</td> <td>21/03/2023</td> <td>5.79</td> </tr> <tr> <td>Scotia Discharge</td> <td>13/06/2023</td> <td>7.26</td> </tr> <tr> <td>Scotia Discharge</td> <td>19/09/2023</td> <td>6.06</td> </tr> <tr> <td>Scotia Discharge</td> <td>12/12/2023</td> <td>6.44</td> </tr> </tbody> </table>	Sample ID	Date Sampled	pH	Scotia Discharge	21/03/2023	5.79	Scotia Discharge	13/06/2023	7.26	Scotia Discharge	19/09/2023	6.06	Scotia Discharge	12/12/2023	6.44	<p>The department sought additional advice from DBCA on this item. A summary is outlined below:</p> <p>This points to the need for the proponent to undertake hydrological and water quality monitoring to provide an improved understanding of the hydrological regimes and water quality during natural fill events at Lake Dundas and during discharge periods when the lake is otherwise dry.</p> <p>Table 5 of the WRM report notes that the ‘L. Dundas north/main basin current known range (1999 – 2021) for pH is 6.92 to 7.3. The pH of lake Dundas sediment is also circum-neutral (Table 6 of the WRM report). This was the only data available to DBCA.</p> <p>The discharge point is in a different part of the lake, possibly with different sediment and water quality.</p> <p>DWER has removed the narrow range for the proposed pH limit for discharges to Lake Dundas. A broader range of 5-8 pH has instead been adopted or surface water discharges.</p>
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25 and 68	<p>Amendment Report: Section 2.2.6: Aquatic Biota Assessment (page 11-12) (item 25)</p> <p>Draft condition 20 – ‘Note 2’ to Table 9 – ‘Discharge must be seasonal, no</p>	<p>Section of Amendment Report:</p> <p>In response to the department’s update to condition 20 “Based on the above, the department has:</p> <p>•<i>Updated Condition 20 to limit pH (between 6.7 to 7.5) for W2 and to ensure that discharge to Lake Dundas is not undertaken after the first few months of a major fill event”.</i></p> <p>PNRS Comment:</p>	<p>Re pH, see above comments from DBCA and the department.</p> <p>Re lake ‘fill event’, DWER has considered the additional information provided by the Applicant and has updated Section 2.2.6 of the Amendment Report. The licence has also been updated to include conditions related to the recommend adaptive management approach for discharge to Lake Dundas. DBCA were consulted on the</p>															

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	<p>discharge after the first few months of a major fill event' (item 68)</p>	<p>PNRS request the following:</p> <ul style="list-style-type: none"> • Define in the definitions table what is referred to as a 'major fill event'? Is this a 1:100 year event? • Define how many months is meant by 'after the first few months'? Is this 2 or 3 months? <p>Under extreme rainfall conditions (Scotia and Green Lantern Dewatering Report (GRM,2022):</p> <ul style="list-style-type: none"> • Inundation of the lake with fresh water would dilute any additional mine water discharged • Partial flooding of the pits would improve the quality of mine water discharge. <p>In addition, the overall volumes of mine water discharged onto the lake are low. The trigger set by SLR was based on water quality in the basin at times when it was sampled, and intended to detect a systematic rise in salinity at that stage of the hydrocycle, and was not intended to be applied to when fresh and when reproducing. There is no data for salinity early in the hydrocycle, when <i>P. serventyi</i> are active and only assumed the water quality will be much fresher. Based on the above, SLR are currently conducting a mass balance calculation for the lake, combining the discharge water's salt loading with an estimate of salinity for the lake after a major fill event to determine if it is even possible for the discharge water to affect the whole of lake salinity.</p> <p>On 15 February, 2024 PNRS provided additional technical information from SLR consultants (Technical Memorandum, SLR, 15 February 2024) on mass balance calculations for the site. This work was done to determine if the dewatering discharge would affect calculated salt concentrations within Lake Dundas following a major fill event. Calculations were made for expected concentration of salt in the lake under a "major fill event", load of salt dissolved within the lake water body when inundated based on concentration and lake volume, load of salt in discharge and volume of discharge added to the lake by PNRS. The additional work indicates that dewatering discharge to Lake Dundas will result in minimal change in lake salinity after a 'major fill event', therefore, the proposed change to the condition 20 that discharge to Lake Dundas "is not undertaken after the first few months of a major fill event" is overly conservative.</p> <p>As an alternative, PNRS have recommended that an adaptive management approach is taken to assess discharges to the Lake.</p>	<p>proposed approach and were supportive in-principle. Comments from DBCA have been factored into Section 2.26 for completeness.</p>

Item No.	Amendment Report Section / Condition	Summary of Licence Holder's comment	Department's response
53	Draft condition 6 – Bioremediation treatment cells (Table 1)	<p>Section of Draft Licence:</p> <p><i>“Clay lined (or equivalent) with a permeability of 10⁻⁹ m/s or less All leachate runoff is directed to, and contained within, an impermeable leachate collection sump with capacity to contain a 1 in 100 year, 72 hour duration rainfall event The leachate collection sump is lined in accordance with Water Quality Protection Note 27, Liners for containing pollutants, using engineered soils, June 2010 August 2013 or Water Quality Protection Note 26, Liners for containing pollutants, using synthetic membranes, February 2009 August 2013”.</i></p> <p>PNRS Comment:</p> <p>This wording is more suited for a bioremediation pad constructed for an industrial site and is not a common setup for a mine site. Please amend this section this section to say ‘All contaminated soil materials will be contained within a clay lined bioremediation cell. The bioremediation pad will be constructed to contain a 1 in 100 year, 72 hour duration rainfall event’. PNRS provided feedback regarding typos and minor adjustment.</p>	<p>The applicant comments relate to an existing condition which is not within the scope of the amendment application. The condition has therefore been retained.</p> <p>Any separate amendment application and must be supported by appropriate information as to the rationale for deviating from existing licence requirements.</p>
61	Draft condition 12 – Design and construction requirements for landfills (Table 5)	<p>Section of Draft Licence:</p> <p><i>“Design and construction requirements – (1) Landfill trenches:</i></p> <p><i>(a)Cobbler</i></p> <p><i>(b)GEV</i></p> <p><i>(c)Harlequin”</i></p> <p>PNRS Comment:</p> <p>Please remove Cobbler. Cobbler was part of the Works Approval application but at this stage, PNRS propose that it is not included as part of this Licence Amendment. Please add Scotia waste rock dump (WRD) landfill.</p>	<p>The department has removed reference to the Cobbler landfill as requested.</p> <p>The Scotia WRD landfill has been added to the licence. The amendment application notes that the landfill is to be located within the Scotia waste rock dump to allow for disposal of inert type 1, inert type 2 (tyres) and putrescible waste.</p>
Second draft comment summary	Condition 6 Page 8, 9	<p>PNRS Comment:</p> <p>The freeboard of the Environmental Dam changed from 0.75 m in the first licence draft to 0.705 m in the second licence draft. DWER to change Environmental Dam freeboard from 705 mm to 750 mm, as per the first licence draft and the original Works Approval.</p>	<p>The department corrected the freeboard requirements.</p>

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Second draft comment summary	L8612/2011/1 Draft Licence Condition 19 Page 17	<p>PNRS Comment:</p> <p>An updated Lake Dundas ecological monitoring points figure with discharge point depicted is provided in Attachment 4. DWER to add 'mine water from Green Lantern pit and Scotia Pit to Scotia WSF to Lake Dundas' against emission point reference W2.</p>	The department included changes consistent with the licence amendment application.
Second draft comment summary	L8612/2011/1 Draft Licence Figures Page 57	<p>PNRS Comment:</p> <p>After Figure 21, suggest adding in 'Figure 16: Processing Plant Alternative Water Supply' which was provided within the Licence Amendment application. Could all figures from the Licence Amendment please be used where applicable as they have been updated with the most accurate information.</p>	The department did include the Figure as it is not referenced in licence conditions.