Government of Western Australia
Department of Water and Environmental Regulation

Decision Report

Application for Works Approval

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

Works Approval Number	W2910/2025/1
Applicant	Mt Morgans WA Mining Pty Ltd
ACN	612 053 291
Application number	APP-0026822
Premises	Mt Morgans Gold Project Part of mining tenements: M39/236, M39/272, M39/282, M39/395 and M39/1107 LAVERTON WA 6440 as depicted in Schedule 1 and the coordinates in Schedule 2 of the works approval.
Date of report	10 September 2025
Decision	Works approval granted

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1. Decision summary

This decision report documents the assessment of potential risks to the environment and public health from emissions and discharges during the and operation of the premises. As a result of this assessment, works approval W2910/2025/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this decision report, the Department of Water and Environmental Regulation (the department; DWER) has considered and given due regard to its regulatory framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.2 Application summary and overview of premises

On 18 December 2025, the applicant submitted an application for a works approval to the department under section 54 of the *Environmental Protection Act 1986* (EP Act).

The application is to undertake construction works relating to the increase of embankment height of the tailings storage facility (TSF) cell 1 and cell 2 from 414 meters reduced level (mRL) to 418 mRL at the premises. The increase of embankment height will provide the applicant with an additional 6.8 million tonnes (Mt) of storage capacity for tailings. The premises is approximately 25 km northeast of Laverton.

The premises relates to the category and assessed production capacity under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) which are defined in works approval W2910/2025/1. The infrastructure and equipment relating to the premises category and any associated activities which the department has considered in line with *Guideline: Risk Assessments* (DWER 2020a) are outlined in works approval W2910/2025/1.

2.3 Tailings storage facility

2.3.1 TSF Background

The TSF is a hill side paddock that comprises of two cells (cells 1 and 2) and share a common embankment wall. The hill side paddock TSF was constructed under works approval W6008/2016/1 which was granted in February 2017. Construction of cell 1 starter embankment began from the base ground level of 399 mRL to the starter embankment height of 408 mRL. Cell 2 was constructed on the northeast side of cell 1. Initial construction of TSF cell 1 was completed in January 2018 and TSF cell 2 was completed in April 2019. The TSF embankment lifts have been constructed in stages using an upstream technique utilising suitable tailings from the beach and selected waste rock to form an erosion protection layer on the downstream face.

W6008/2016/1 is an active works approval which authorises the construction of the maximum embankment height of the TSF to 414 mRL. At the time of this decision report the TSF embankment height is currently 411.5 and 412 mRL for cell 1 and cell 2 respectively. This decision report and works approval W2910/2025/1 is for the construction and time-limited operation (TLO) of stage 4 of the TSF, which is to allow construction of the embankment height from 414 mRL to 418 mRL.

The applicant holds licence L9010/2016/1 (under the EP Act) which authorises the operation of the TSF with a maximum embankment height of up to 411.5 and 412 mRL for TSF cell 1 and cell 2 respectively.

2.3.2 Proposed embankment raise

The applicant has proposed to increase the height of the embankment of the TSF from 414 mRL to 418 mRL. To achieve this the applicant is proposing to continue to raise the embankment height via upstream lifts to 418 mRL for each cell (Figure 1) (CMW 2024). Each embankment lift is aimed to not exceed 300 mm of compacted lift thickness and achieve a density ratio greater than 95% standard maximum dry density (AS 1289.5.1.1), moisture content is targeted to be within 2% of the optimal moisture content (CMW 2024). Low-permeable materials will be used during the embankment lifts and will be sourced from selected clayey mine waste or dried tailings materials from within the cells utilised when clayey waste is not available. The downstream batter of each lift will be capped with mine waste for erosion protection (CMW 2024).

At the final embankment crest level of 418 mRL, TSF cells 1 and 2 will provide additional storage volume of 7.3 cubic megameters (Mm^3) when based on a tailing in situ density of 1.4 t/m^3 (dry), beach slope of 1% and a minimum embankment freeboard of 0.5 m (CMW 2024).

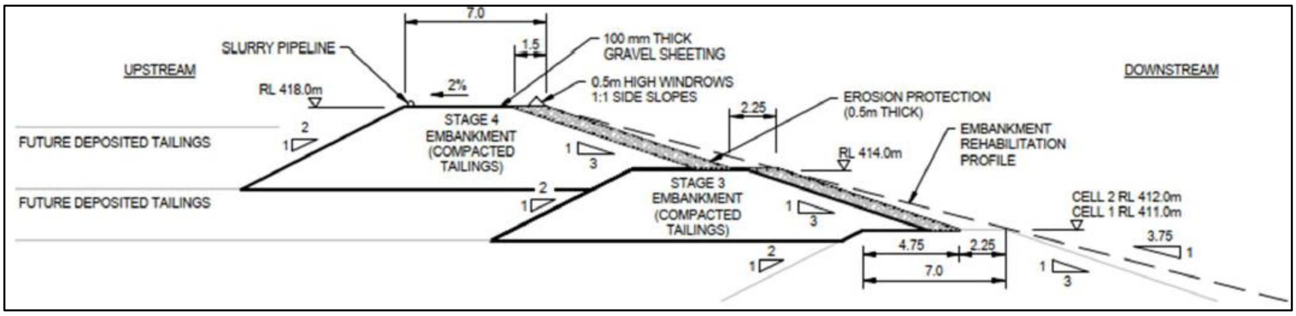

Figure 1: Cross section of TSFs Cells 1 and 2 perimeter embankment.

2.3.3 Proposed commissioning

The applicant has proposed a commissioning period to achieve specific objectives:

- **Pre-commissioning**: Comprising static checks on unpowered equipment to confirm that the infrastructure has been built according to specification;
- **Energisation**: The new equipment will be energised to ensure all systems are working; and
- **Tails commissioning**: Comprising test operation of equipment with tailings.

During the tailings commissioning period the applicant has proposed that tailings deposition will be discharged by embankment spigots covering an embankment length of approximately 800 m.

The tailings commissioning period aims to fill the low points in the cell beach floor and establish a consistent beach towards the decant tower to assist in positioning the pond around the decant tower. Spigots may be cycled daily in each quarter to achieve the goal but for the first couple of layers in the cell spigots may need to run for longer to fill in certain low points (GML 2024a). The applicant has estimated that approximately 900,000 tonnes of tailings will be deposited over the proposed three-month commissioning period.

Industry Regulation Guide to Licensing (DWER 2019) mentions that commissioning testing is undertaken to validate actual environmental performance relative to predicted performance as assessed by the department under the works approval. Environmental commissioning may also include testing the integrity of containment such as pipelines, liners, barrier systems or testing the performance of emission controls such as baghouses, filters, testing waste digestion or treatment processes (DWER 2019).

The department does not consider the filling in of low points in the cell beach floor after construction of a TSF embankment lift to be a commissioning activity that requires conditioning of a separate commissioning phase within the works approval as there are no environmental performance criteria to be determined prior to normal operation of the TSF. Any commissioning activities can be carried out during time limited operations phase. The department notes that 900,000 tonnes over three months (GML 2024a) equates to a greater maximum production/design capacity of the works approval of 3,500,000 tonnes per annual period suggesting operations are close to normal.

In addition, the department has not incorporated a commissioning phase for the testing of pipelines and equipment as it is understood that there is no significant change to pipelines or equipment used in the operation.

2.4 Hydrology and Hydrogeology

The premises lies within the Lake Carey catchment and the lake forms the most dominant hydrological drainage feature near the site. All watercourses and drainage lines in the vicinity of the project are ephemeral. Flooding may occur during the summer months between January and March when high intensity rainfalls take place. Prior to tailings deposition, groundwater flowed in a south-easterly direction towards the playa lake, which is a groundwater sink in the area (CMW 2024).

Two hydro stratigraphic units were identified in the area namely:

- Fractured bedrock aquifer associated with the meta-basalt units; and
- Aquitard clay units associated with the saprolite, saprock and saturated playa deposits.

The fractured bedrock aquifer is associated with discontinuities within the Meta-Basalt units, which underlies the saprolite and clay deposits. Borehole logs indicate that the Meta-Basalt is "weathered to very weathered" indicating that the fractures might be filled with clay with a suspected low hydraulic conductivity (CMW 2024).

Historical geotechnical investigations carried out as part of the TSF design indicated that the saturated playa deposits have a very low hydraulic conductivity of about 2.6 x 10-8 m/s (0.002 m/d). The assessment indicated that the saprolite comprises of clay, hence the hydraulic conductivity of the saprolite is also likely to be low at about 0.01 m/d (CMW 2024).

2.5 Groundwater

2.5.1 Groundwater levels

Groundwater monitoring requirements under licence L9010/2016/1 involves measuring the standing water level (SWL) of eight monitoring bores (surrounding the TSF) monthly and sampling the monitoring bores for a variety of parameters every quarter. Monitoring bore locations are presented in Figure 2. The department considers, based on the available information, that the current state of the monitoring program is suitable for assessing groundwater quality changes caused by seepage from this facility.

Historical groundwater levels within the vicinity of the TSF was shallow prior to the construction of the TSF and ranged from 0.68 meters below ground level (mbgl) (TSF MB2) to 9.31 mbgl (TSF MB1) in December 2017 prior to tailings deposition. Figure 3 and Figure 4 provides the historic and current groundwater levels recorded in monitoring bores surrounding the TSF over time. As depicted in Figure 3 and Figure 4 groundwater levels have increased since the operation of the TSF which has caused groundwater mounding and reported surface expression surrounding the TSF namely on the eastern and southern side of the TSF (GLM 2024b).

Groundwater levels are generally recorded at the shallowest at monitoring bores - TSF MB2 and TSF MB3 which are situated within the Playa. The applicant has mentioned that since January 2024 groundwater levels in all monitoring bores have shown an upward trend (GML 2024b). This can be attributed to two significant rainfall events of approximately 100 mm each that occurred in February and March 2024 (GML 2024b). The department notes that during the 2024-2025 monitoring period (after the groundwater level limits were implemented on the licence in July 2024) SWL recorded in monitoring bore TSF MB3 was exceeded in September 2020 when the licence was held by Dacian Gold.

Monitoring bore TSF MB7 was installed on 1 October 2024 (GML 2024c) at the recommendation of the 2021 groundwater management plan (GMP) (GRM 2021). The objective of installing this bore was to replace monitoring bore TSF MB5 which is situated within the Playa and is heavily impacted by seasonal weather factors and therefore is considered unlikely to assess the effectiveness of the seepage interception system. Groundwater levels for monitoring bore TSF MB7 for January and February 2025 was 1.186 and 1.196 mbgl respectively.

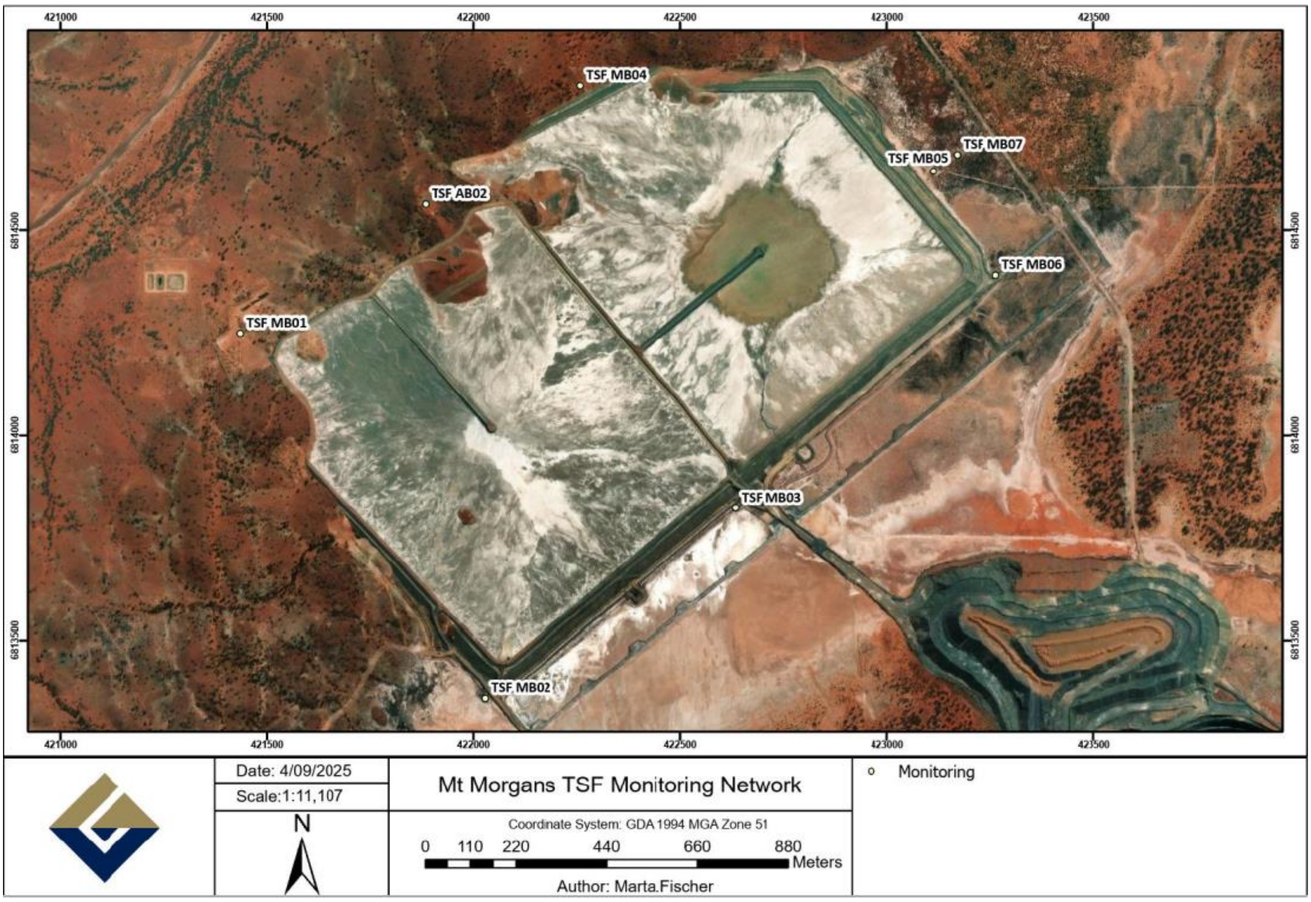

Figure 2: Monitoring bore locations (Sourced from GML 2024c)

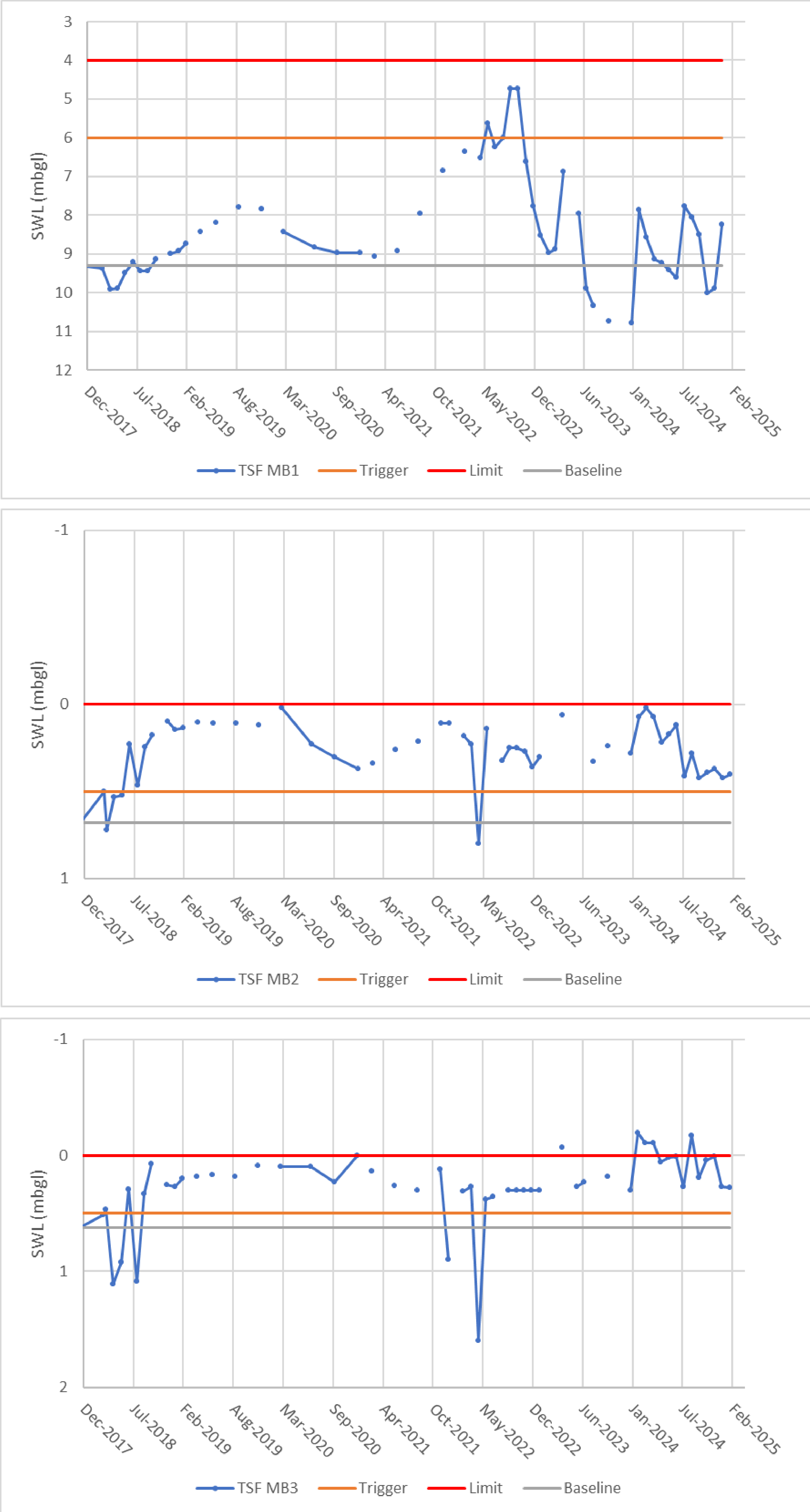

Figure 3: Historical groundwater levels with baseline trigger and action limit levels for TSF Cell 1. Trigger and action values sourced from L9010/2016/1

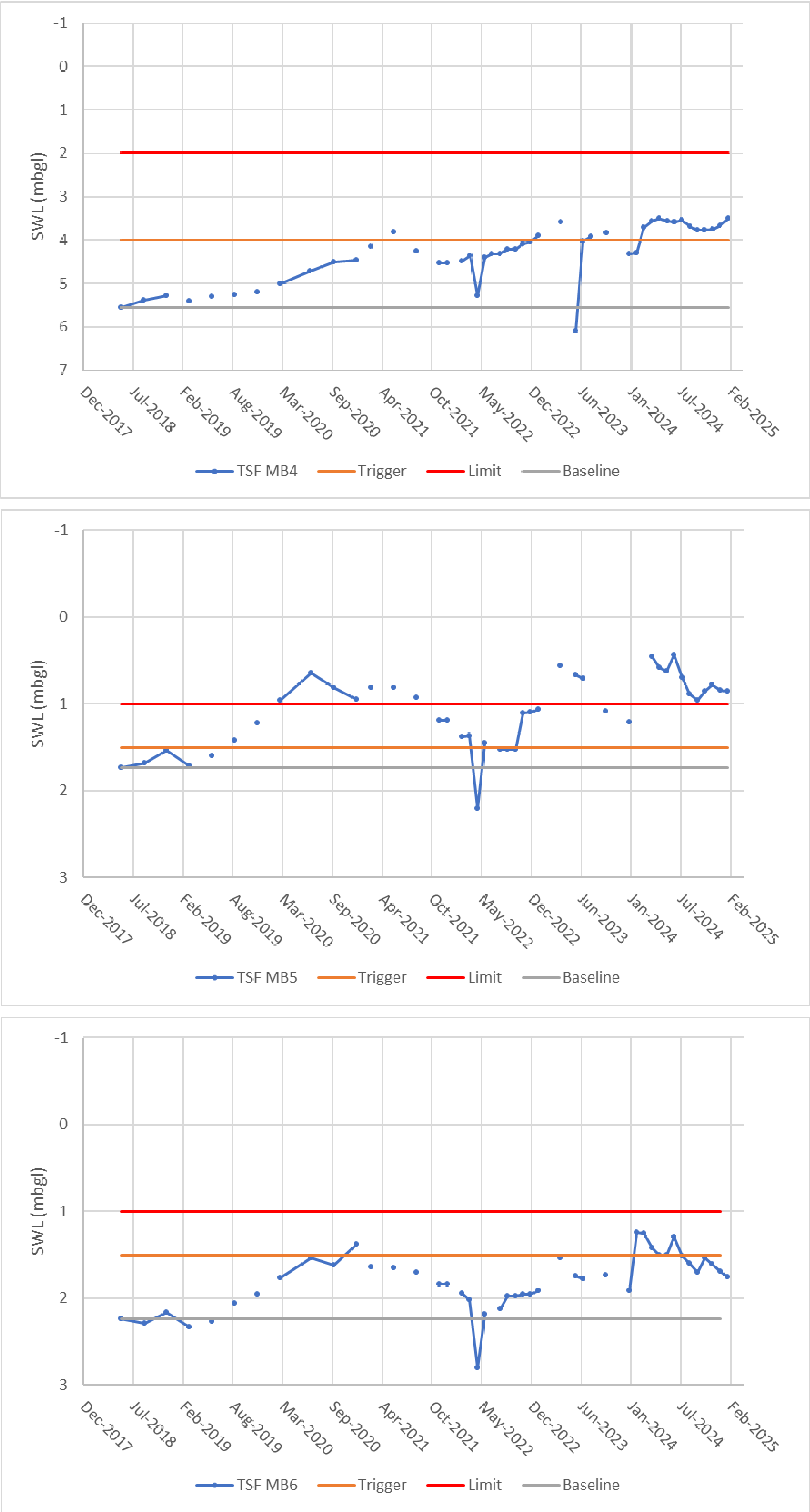

Figure 4: Historical groundwater levels with baseline trigger and action limit levels for TSF Cell 2. Trigger and limit values sourced from L9010/2016/1

2.5.2 Water recovery infrastructure

Decant

The applicant has proposed that surface water will be removed from each cell of the TSF by a decant pump deployed within a central decant structure. The return decant water will be pumped directly from the central decant structure to the process plant for re-use (CMW 2024). The water recovery system is designed for a minimum recovery of not less than 100% of the slurry water, including additional capacity for storm events.

Seepage recovery infrastructure

Seepage around the TSF is currently managed through a variety of installed infrastructure which include;

- Seepage collection sumps (SP01-SP07);
- Seepage interception trenches; and
- Seepage recovery bores (TSF AB01, TSF AB03-TSF AB10).

The infrastructure location is presented in Figure 5.

Conditioned in licence L9010/2016/1 seepage recovered from the TSF is required to be either returned to the TSF or re-used in the processing plant. The TSF was designed to incorporate an underdrainage system within both cells 1 and 2. The underdrainage system involved a 1.5 mbgl (or until refusal on weather rock) cutoff lined trenches under the upstream toe to restrict potential seepage under the perimeter embankment. The trench led to seepage collection sumps (SP01-SP07) surrounding the TSF (Figure 6). The sumps consist of a 1.5 x 1.5 x 1.5 m lined concrete box (Dacian 2019) or a 1.8 m x 1.8 m diameter concrete well with a 0.15 m precast concrete slab (CMW 2024).

The applicant has mentioned that there is an expectation for water levels at monitoring bores TSF MB4, TSF MB5 and TSF MB6 to increase once tailings deposition recommences in Cell 2. To mitigate the increase in groundwater levels and to prevent groundwater exceeding the conditioned SWL limit within the monitoring bores, seven additional seepage recovery bores (TSF AB04 – TSF AB10) and a monitoring bore (TSF MB7) was installed in September and October 2024. Two recovery bores (TSF AB04 – TSF AB05) were installed at the southwestern portion of the TSF and five recovery bores (TSF AB06 – TSF AB10) were installed at the northeastern portion of the TSF.

Monitoring bore (TSF MB7) was installed to replace monitoring bore TSF MB5, GRM (2024) noted that "the monitoring bore *(TSF MB5)* is unlikely to assess the effectiveness of the seepage interception system along the vegetated area at the north-eastern side of Cell 2 because of the proximity of the seepage sources and related seepage interception infrastructure" (GRM 2021). Based on the recommendations of the report, monitoring bore TSF MB7 was included in the Licence L9010/2016/1.

The constructed seepage recovery bores have been constructed to a depth between 20 to 24 mbgl and each bore will be equipped with a submersible pump with a pumping capacity of 1.5 kL/hr with actual abstraction rates approximately 0.5 kL/hr. It is understood by the department that the newly constructed seepage recovery bores (TSF AB04 – TSF AB10) have not been equipped with a submersible pump and headworks. The department has conditioned the applicant to submit an environmental compliance report for the submersible pump and headworks within 30 days of being constructed.

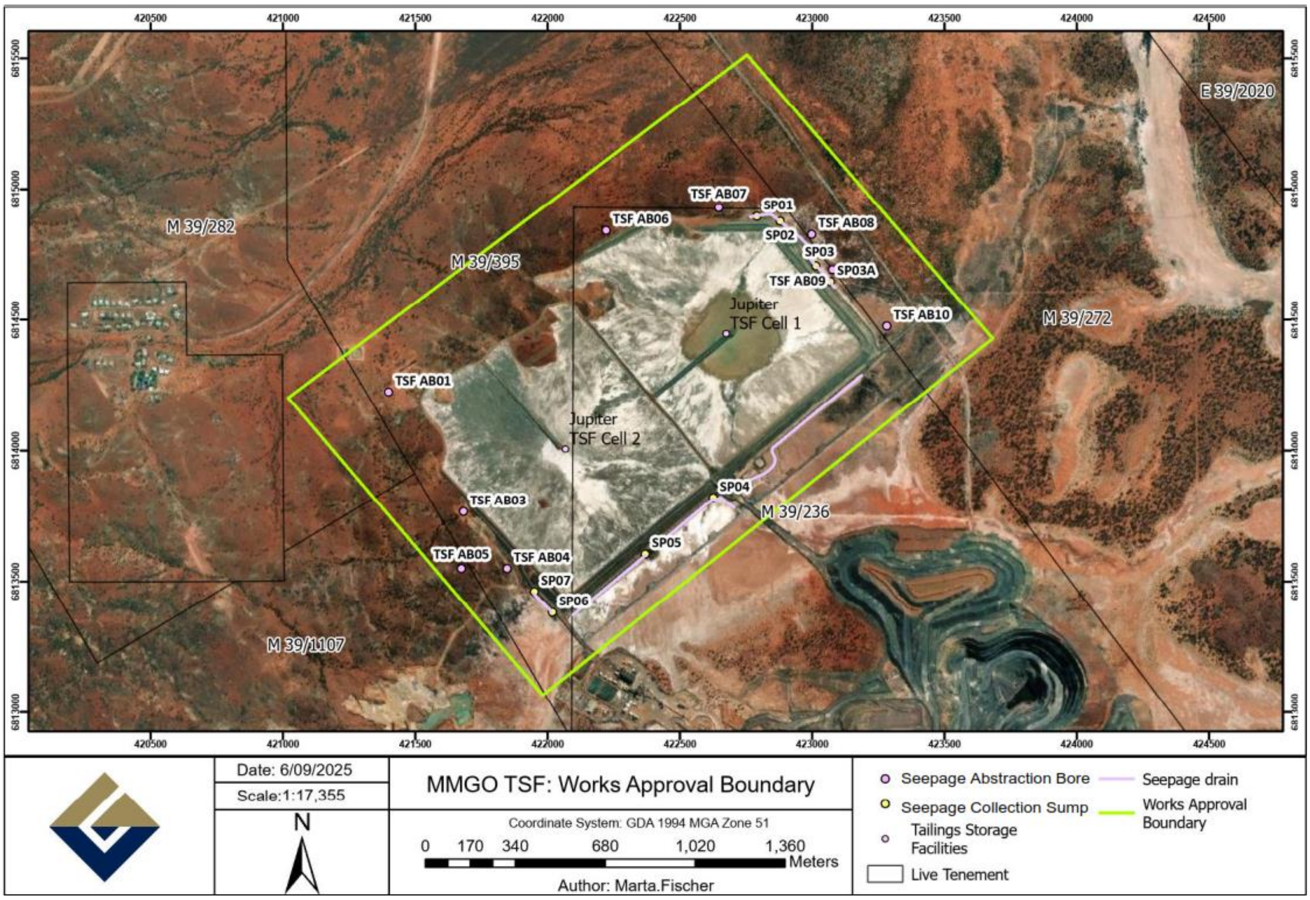

Figure 5: Premises boundary and current installed seepage recovery infrastructure (Sourced from GML 2024b)

Figure 6: Interception trench and sump (SP4) (Sourced from GRM 2024)

2.5.3 Seepage/Groundwater surface expression

Surface water expression along the southern and eastern embankments of the TSF have been observed during the operation of the TSF. Surface expression has most likely occurred due to seepage resulting in groundwater mounding underneath the TSF which has then created lateral flows away from the TSF resulting in groundwater expression (GRM 2021). To address the surface expression occurring Groundwater Resource Management Pty Ltd (GRM) updated the existing Groundwater Management Plan (GMP). The latest GMP was submitted to the department in April 2024, a summary of the GMP is presented in section 2.5.6.

The applicant is understood to collect surface water samples when groundwater emerges at the surface. Table 1 presents the average water quality data from these groundwater expressions and other sampling locations. The results suggest that seepage from the TSF may have mixed with the groundwater, as indicated by elevated concentrations of Weak Acid Dissociable (WAD) cyanide in the surface expressions compared to background groundwater quality data.

The rate of groundwater discharge along the TSF embankments is considered small by the applicant. The rate varies between about 110 ML/year for Scenario 1 (functioning underdrainage) and 250 ML/year for scenario 2 (non-functioning underdrain). The volumes of water draining to Lake Carey during flood conditions has not been calculated but could be several orders of magnitude higher than the groundwater discharge rates (GML 2024b). GRM (2024) concluded that potential impact from groundwater expressions on the surface on the playa lake is very small due to dilution affects.

The Department of Energy Mines Industry Regulation[1] (DEMIRS) attended the site on 16 December 2024 and during the inspection there were no evidence of ongoing seepage and DEMIRS noted that the facility was being adequately managed at time of inspection.

Table 1: Average concentration of metals in groundwater expressions at surface (mg/L) (Sourced from GML 2024b).

Chemical of Concern	Supernatant	Background Groundwater	Groundwater Expression at surface	Groundwater Expression/Background Groundwater Ratio
Cadmium	0.0014	0.002	0.011	5.5
Chrome	<0.005	0.011	0.243	22
Cobalt	0.455	0.009	0.993	110
Copper	13	0.011	0.259	23
Lead	<0.005	<0.005	0.0065	>1.3
Nickel	1.255	0.015	0.053	3.5
Selenium	0.0825	0.079	0.137	1.7
Zinc	0.5625	0.029	0.0869	3.0
WAD Cyanide	24	0	0.244	Not determined

2.5.4 Seepage modelling

Initial seepage modelling predicted that lateral seepage through the constructed embankment boundary was not anticipated while the anticipated lateral seepage rates at the existing perimeter embankment of the TSF is likely to be less than 1 m^3 per day and vertical seepage rates was less than 5 m^3 per day (ATC 2016).

The SEEP/W software used by ATC (2018) to estimate seepage loss from the TSF, concluded that:

[1] Now referred to as Department of Mines, Petroleum and Exploration (DMPE) as of 1 July 2025.

- Significant lateral seepage through the constructed embankment is not anticipated, particularly with the incorporation of an upstream geomembrane;
- Lateral seepage rates beneath the perimeter embankment of the TSF are likely to be very low (less than 4 m^3 per day), provided the facility is satisfactorily constructed; and
- Vertical seepage rates from the operating cell are likely to be very low (less than 3 m^3 per day) and would be predominantly controlled by the presence of the residual clay materials.

During tailings deposition it was identified that actual infiltration rates were higher and this was due to preferential flow pathways and higher than expected permeability zones through the clay layer. GRM (2024) estimates that the revised seepage rate is closer to approximately 40 m^3 per day. CMW (2024) seepage analysis on the TSF at maximum capacity indicates approximately 0.0194 and 0.0473 m^3/day per meter of embankment for Cells 1 and 2 resulting in approximately 15 and 71 m^3/day per meter through the perimeter embankments.

For the proposed increase in TSF embankment height seepage analysis was completed by CMW (2024) to estimate the position of the phreatic surface for the embankment design at the maximum embankment level of RL 418 m. Groundwater analyses were undertaken using the groundwater module of the 'Slide' software package. It is noted within the application that the modelling was conducted by 2D modelling as a simplified approach and does not consider 3D effects such as seepage flow through geological structures such as joints (CMW 2024).

Departments technical review

The department has undertaken a technical review of the supporting documentation and has made the following conclusions:

- Due to the large variations in groundwater salinity and density near the TSF, groundwater within the TSF vicinity is likely to be complex. The complexity of the underlying groundwater does not appear to be addressed in the original seepage modelling for the facility that was undertaken by ATC Williams Consultants which has potentially led to unreasonably low seepage rate estimates for the facility.
- A revised conceptual model for the area surrounding the TSF has been developed (Figure 7) based on research that has been undertaken on density-dependent groundwater flow systems that was carried out by Simmons *et al*. (1999) and Nield *et al*. (2008). The revised conceptual model indicates that the dominant component of groundwater flow near the TSF is likely to be in a vertical direction. The direction is likely to be driven by the large salinity and density difference between hypersaline fluid in the TSF porewater and the less saline shallow groundwater that immediately underlies the facility. It is also expected that there would also be a lateral component of groundwater flow that would be driven by a regional hydraulic gradient, however, this would probably be a less significant transport process for contaminants from the TSF than the vertical flow component. In situations where hypersaline water overlies less saline groundwater, a hydrologically unstable situation develops which can trigger the formation of "fingers/fingering" of denser brine water (Figure 7) that can rapidly sink into the underlying groundwater. These fingers in turn can displace the surrounding groundwater to form vertical convection cells below the water table. These vertical convection cells can occur immediately hydraulically upgradient and downgradient of the brine fingers (not shown in Figure 7).
- Due to the combined effects of groundwater mounding and the upwelling of groundwater due to vertical convection cells it is likely to have produced the large groundwater expression areas that have been observed near the TSF (Section 2.5.3). It is expected that the area where groundwater discharge would take place near the TSF would also increase when the additional lift is implemented on the facility. The maximum elevation of groundwater that would take place due to seepage from the TSF would probably be smaller than beneath a similar TSF that does not overlie a saline-hypersaline groundwater interface. This would likely limit the lateral extent

of the mound from the facility, potentially limiting the impacts on more distant receptors.

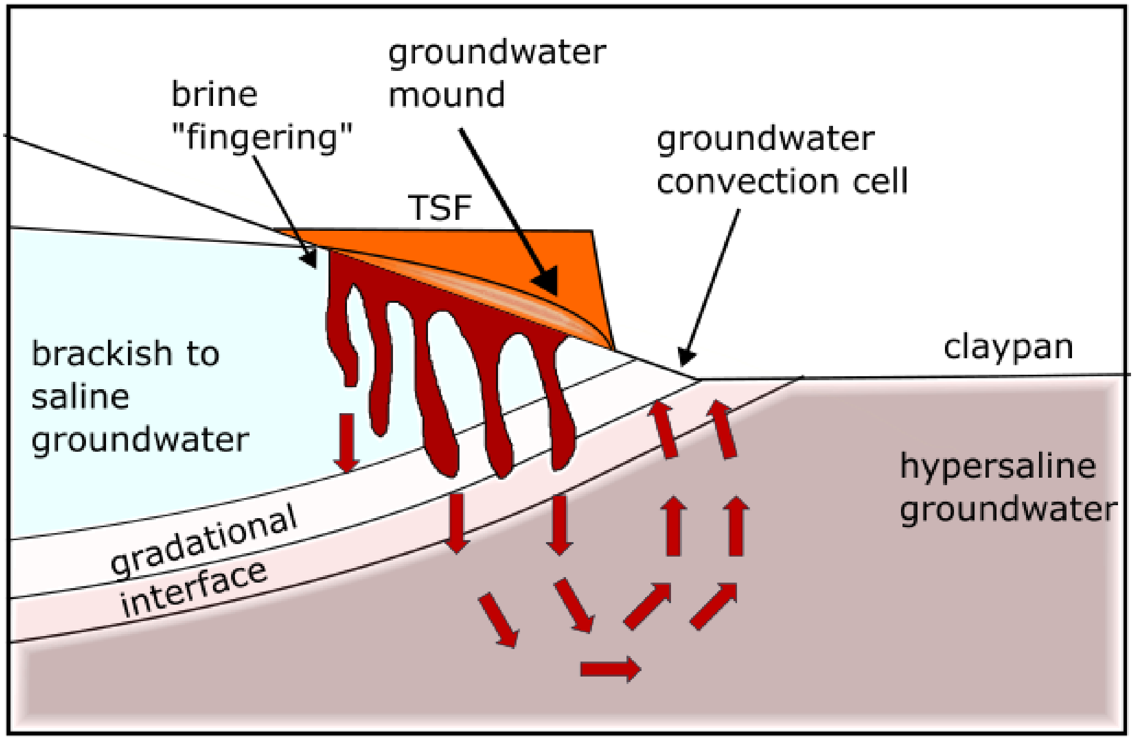

Figure 7: Conceptual model of the groundwater flow system near the TSF

2.5.5 Groundwater quality

Total dissolved solids

Groundwater surrounding the TSF is brackish to hypersaline water with total dissolved solids (TDS) concentrations ranging from 1,360 to 190,000 mg/L. The large variation is due to groundwater density effects where hypersaline playa water infiltrates the ground with a fresh groundwater lens situated on top of the hypersaline water (GML 2024). Figure 8 presents the historical TDS concentrations recorded within monitoring bores surrounding the TSF. Results indicate that most monitoring bores have shown an increase in TDS concentrations over the life of the TSF with the highest concentrations reported in monitoring bores TSF MB2 and TSF MB3 located at the southwest and southern side of the TSF respectively. It’s noted that these are located close to or within the playa and generally has the shallowest groundwater and is where groundwater expression occurs the most often when compared to other areas of the TSF.

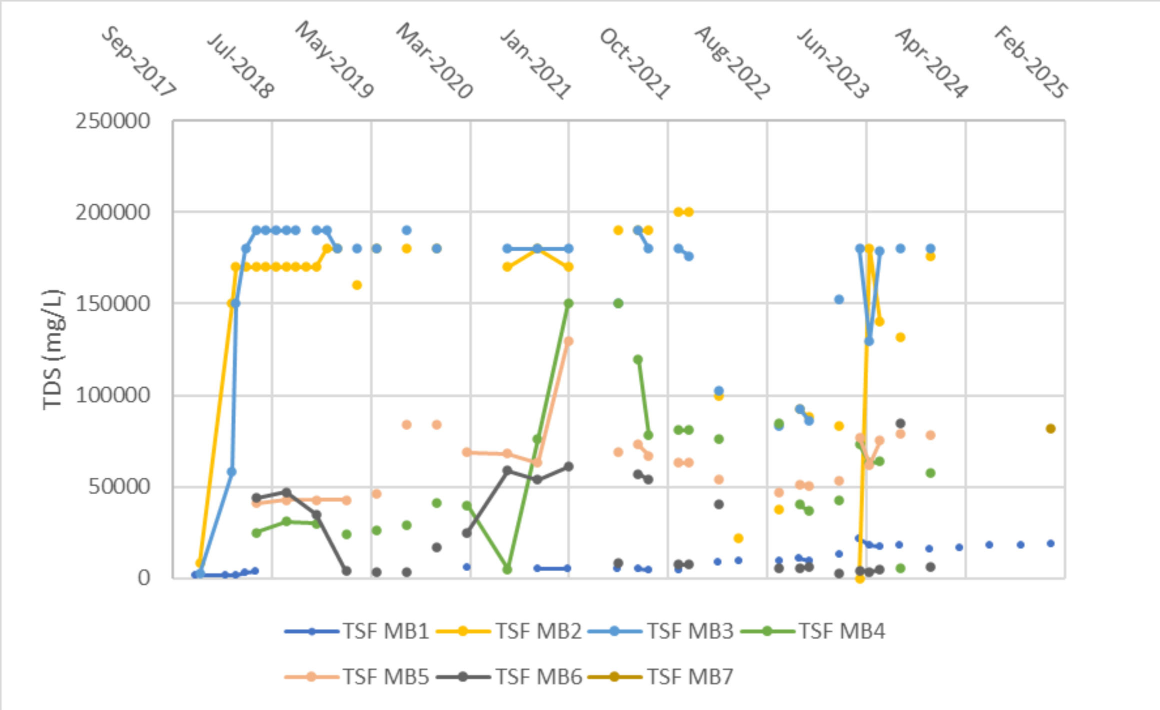

Figure 8: Historical TDS concentrations within monitoring bores surrounding the TSF

pH

pH concentrations recorded in the TSF monitoring bores prior to tailings discharge ranged between 6.3 to 8.4. Recent results indicate that pH concentrations have not significantly changed since tailings discharge began.

WAD cyanide

WAD cyanide is generally reported below the trigger level of 0.5 mg/L on licence L9010/2016/1 (Figure 9). WAD cyanide concentrations are generally reported at higher concentrations at monitoring bores TSF MB2, TSF MB4 and TSF MB6.

GRM (2024a) mentions that the WAD cyanide concentrations at monitoring bores TSF MB2, TSF MB4 and TSF MB6 were recorded as a result of the implementation of seepage interception infrastructure. The seepage interception infrastructure promoted the movement of seepage affected groundwater towards the sumps, which results in WAD cyanide being detected in the adjacent monitoring bores. Since this seepage affected groundwater is intercepted, it does not affect the groundwater conditions further away from the TSF.

In 2024 WAD cyanide results exceeded the limit of reporting (LOR) which was in monitoring bores TSF MB4 and TSF MB5 with concentrations of 0.057 mg/L and 0.018 mg/L respectively. All other results in the 2024 monitoring period was reported below the LOR suggesting that seepage from the TSF has been reduced.

An abnormal WAD cyanide result was recorded at monitoring bore TSF MB5 during September 2021 with a result of 0.66 mg/L. This is the only recorded instance of the exceedance of the trigger level of 0.5 mg/L for WAD cyanide. Concentrations in monitoring bore TSF MB5 have been reported lower since and have recently been reported below LOR from July 2024 to January 2025.

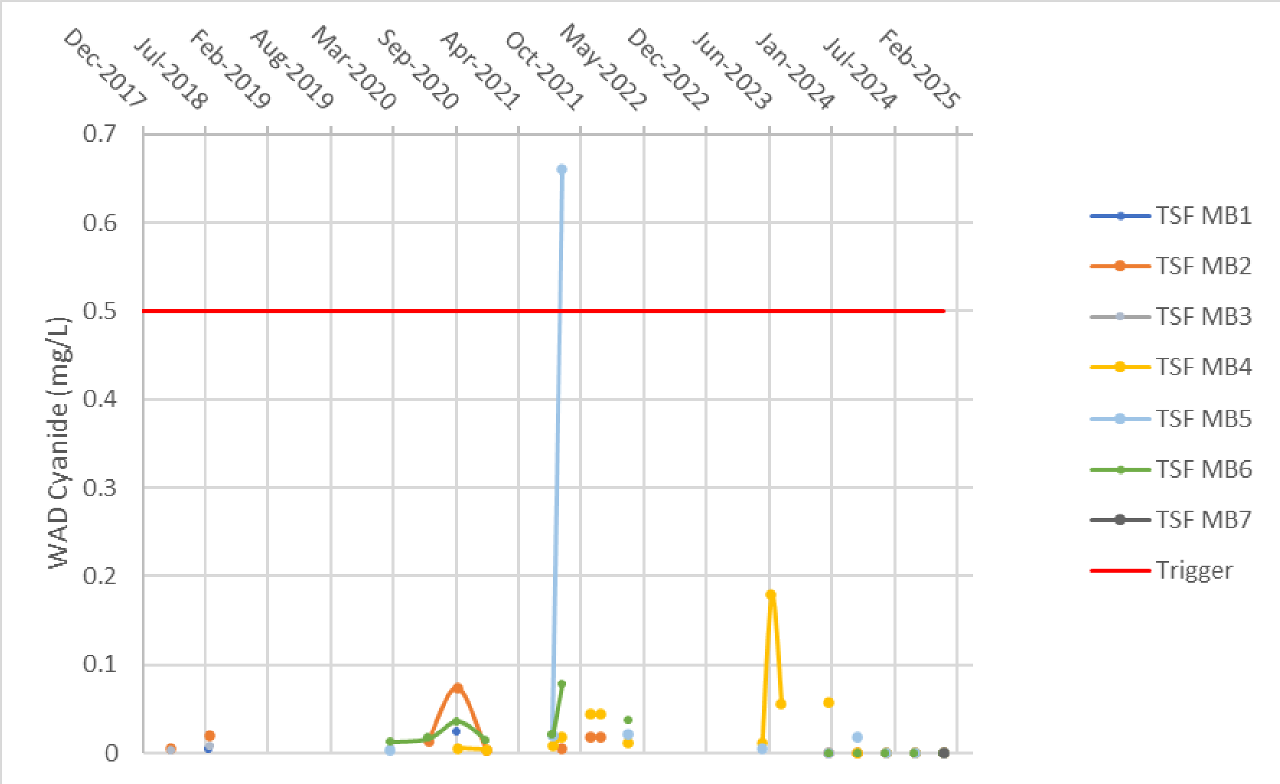

Figure 9: Historical WAD cyanide concentrations within monitoring bores surrounding the TSF Trigger value sourced from L9010/2016/1

Cobalt

Initial cobalt concentrations ranged from below LOR in monitoring bores TMB2 and TMB3 during December 2017 and 0.005 mg/L at TMB5 during June 2018. During the lifetime of the TSF, cobalt concentrations appear to have increased in monitoring bores TSF MB4 and TSF MB5 (Figure 10) and the newly installed TSF MB7, which reported a concentration of 2.1 mg/L in January 2025. TSF MB4, TSF MB5 and TSF MB7 are located at the north and northeastern side of the TSF.

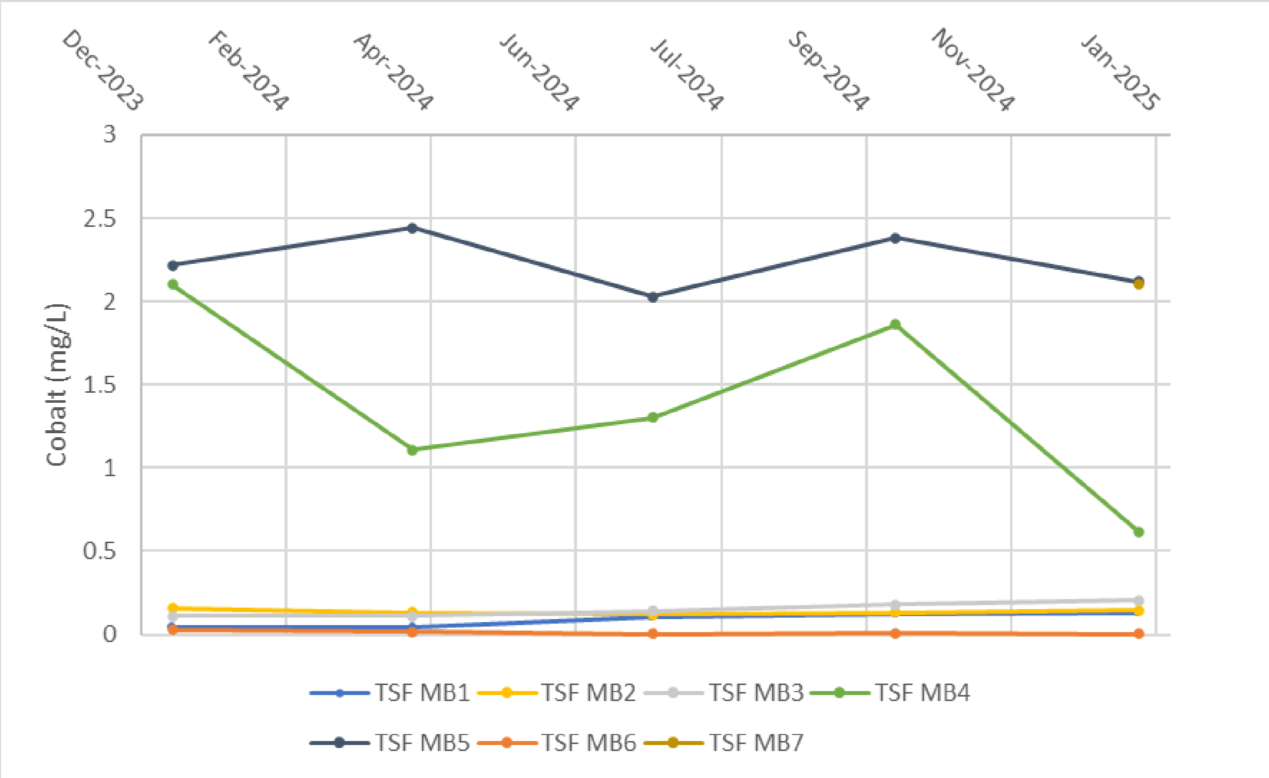

Figure 10: Recent cobalt concentrations in TSF monitoring bores

2.5.6 Groundwater management plan

The most recent GMP (GRM 2024) was submitted to the department on 15 April 2024.

Within the GMP (GRM 2024) it is mentioned that two seepage recovery bores (TSF AB01 and TSF AB03) were installed to control groundwater mounding at monitoring bore TSF MB1. The 2024 GMP (GRM 2024) recommended installation of additional seepage recovery infrastructure at the location of bores TSF MB4, TSF MB5 and TSF MB6 to control the rising groundwater expected from future tailings deposition in TSF Cell 2. The works approval holder has constructed the recommended seepage recovery infrastructure in preparation of this works approval application. The constructed seepage recovery infrastructure is presented in section 2.5.2 of this decision report. Figure 5 provides the current seepage recovery infrastructure including the proposed seepage recovery infrastructure that was constructed at the recommendation of the 2024 GMP to control the rising groundwater expected from the future tailings deposition at Cell 2 (this works approval).

Since the submission of the latest GMP (GRM 2024) licence L9010/2016/1 has been amended to incorporate the trigger and action values presented in Table 2. It is understood by the department during a review of the submitted annual audit compliance report (Mount Morgan 2025) for the reporting period 11 February 2024 to 10 February 2025 that the applicant is intending to amend licence L9010/2016/1. The future proposed amendment is to remove the limit of SWL for monitoring bore TSF MB5 from the licence. The justification provided is due to this bore being situated within the playa of Lake Carey and therefore is heavily impacted by seasonal weather factors. The applicant has also mentioned that the high groundwater levels have not impacted native vegetation around the TSF which is monitoring annually under licence L9010/2016/1 (section 2.6).

Table 2: TSF monitoring bores trigger and action values for the 2021 GMP (sourced from GRM 2021)

Name	Background Groundwater (mbgl)	June 2020 SWL (mbgl)	Trigger Value (mbgl)	Action Value (mbgl)	Required action
TSF MB1	9.3	9.08	4.0	2.0	Interception bores if trigger level is reached.
TSF MB2	0.6	0.38	0.5	0.0	Interception sumps already installed.
TSF MB3	0.5	0.19	0.5	0.0	Interception sumps already installed.
TSF MB4	5.3	4.30	4.0	2.0	Interception bores if trigger level is reached.
TSF MB5	1.6	0.85	1.5	1.0	Interception sumps already installed. Interception bores required.
TSF MB6	2.2	1.63	1.5	1.0	Interception sumps already installed. Interception bores required.

2.6 Vegetation monitoring

The applicant conducts annual vegetation monitoring under existing licence L9010/2016/1 at nearby vegetation areas within the zone of influence of the TSF, the initial assessment was completed in 2018 (Blueprint 2018).

The annual monitoring involves two different vegetation assessments:

- Normalised Difference Vegetation Index[2] (NDVI); and
- The Keighery (1994) criteria[3] of six different quadrants presented within Figure 11.

Blueprint completed the 2018 to 2020 annual vegetation monitoring report until they were acquired by RPM Global Holdings Ltd (RPM) in 2021. RPM has since completed the 2021 to 2023 annual vegetation monitoring reports.

Figure 12 presents the monitoring locations and change detection assessment for the NDVI to identify changes in vegetation density between October 2023 and October 2024 (RPM 2025). Results show increases in vegetation densities which could be attributable to increased rainfall in the area.

Historical quadrant monitoring results for the Keighery 1994 criteria and total approximate vegetation cover is presented in Table 3. Results indicate a decline in vegetation within all areas since monitoring began in 2018 with exception to QSE, QSW and QE. All quadrant sites appear to have experienced a loss of total vegetation cover with exception of QSW, QE and QS. When compared with historical rainfall events vegetation loss appears to be influenced by the reduction in rainfall. The most heavily impacted site appears to be the QS location however total vegetation cover appears to have increased during the December 2024 monitoring event.

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[2] spatial representation of how much chlorophyll (green vegetation/biomass) is present in the area (RPM 2025).

[3] field aspect where vegetation community name, species composition, relative vegetation density and vegetation condition is recorded.

Conclusions relating to the NDVI assessment in the 2024 vegetation monitoring report (RPM 2025) are:

- All assessment areas showed very low vegetation densities that are comparable to the Undisturbed Vegetation Area as well as the broader region. These low vegetation densities are typical of the arid northern Goldfields region of Western Australia;
- The long term NDVI time series shows significant variation in vegetation density over time and by season. All assessment areas, including the Baseline Vegetation Area reported a negative trend in vegetation density until January 2024. Elevated rainfall was recorded between January and July 2024 which has been attributed to an overall increase in vegetation across the region, including areas assessed under this report; and
- Localised NDVI change detection identified an apparent area of significantly reduced vegetation density. This area, located immediately southeast of the TSF, is devoid of vegetation and the reduction in NDVI values is attributed to newly ponded water that was not present in the 2023 assessment. All other minor variations in vegetation density between 2023 and 2024 are in line with natural variation, as observed in the Baseline Vegetation Area and broader region.

Conclusions relating to the vegetation quadrat findings include;

- Vegetation composition and densities remain similar to previous assessment years with exception of the South quadrat, there is no declining trend in vegetation condition in any quadrats; and
- The South quadrat has shown progressive deterioration in vegetation condition from good to degraded since monitoring began at this location in 2019. The decline in vegetation condition is linked to dust deposition from the Coarse Ore Stockpile, without any evidence indicating that TSF seepage is a contributing factor.

On the 24 September 2020 the Licence Holder notified the department of native vegetation loss associated with the TSF. Approximately 3.8 hectares of native vegetation the eastern side of the TSF were impacted by salt deposits from receding surface water (Figure 13). The 2020 annual vegetation monitoring report noted a slight decrease in overall biomass, as observed in the NDVI data. The reduction was contributed to climatic variation and spectral variation (humidity and haze).

The department reviewed satellite imagery in the same quadrant (QNE) and historical imagery (Figure 14 and Figure 15) indicates further salt deposition may have taken place after 2020 resulting in potential further vegetation loss. Estimated total vegetation cover in the area has decreased further from 2020 (Table 3) and identified the decrease in NDVI between 2023 to 2024 (east of the TSF) appears to occur where potential further salt deposition locations are located (Figure 12). Section 2.5.2 mentions that the recently installed seepage recovery bores may be able to prevent further vegetation loss in this area.

The department has considered the results for historical vegetation monitoring events and concludes the results indicate that vegetation health and density loss (or gain during the recent monitoring event (RPS 2025)) surrounding the TSF is not attributed to the historical operation of the TSF with the potential exception to the QNE location. The department has reviewed the information vegetation monitoring reports to assist in the risk assessment of this works approval (Section 2.7).

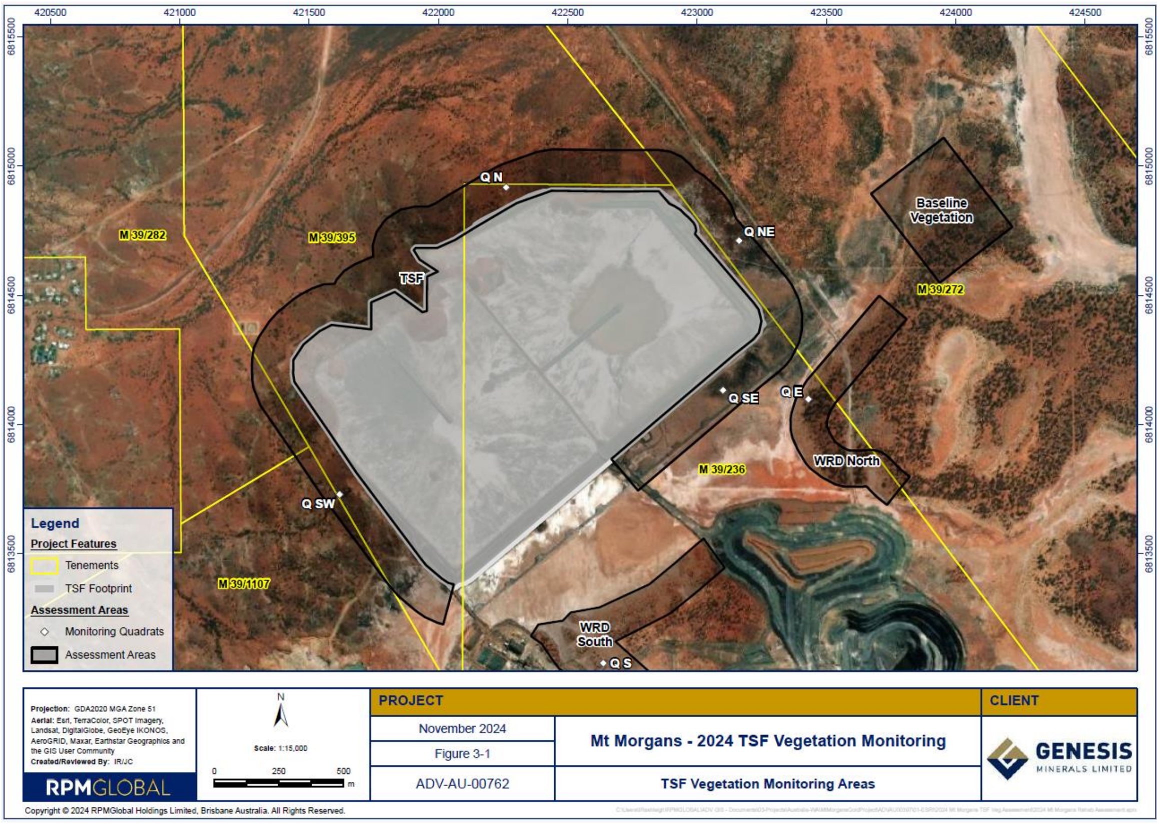

Figure 11: Vegetation quadrant monitoring locations: QSW, QN, QNE, QSE, QE and QS (Sourced from RPM 2025)

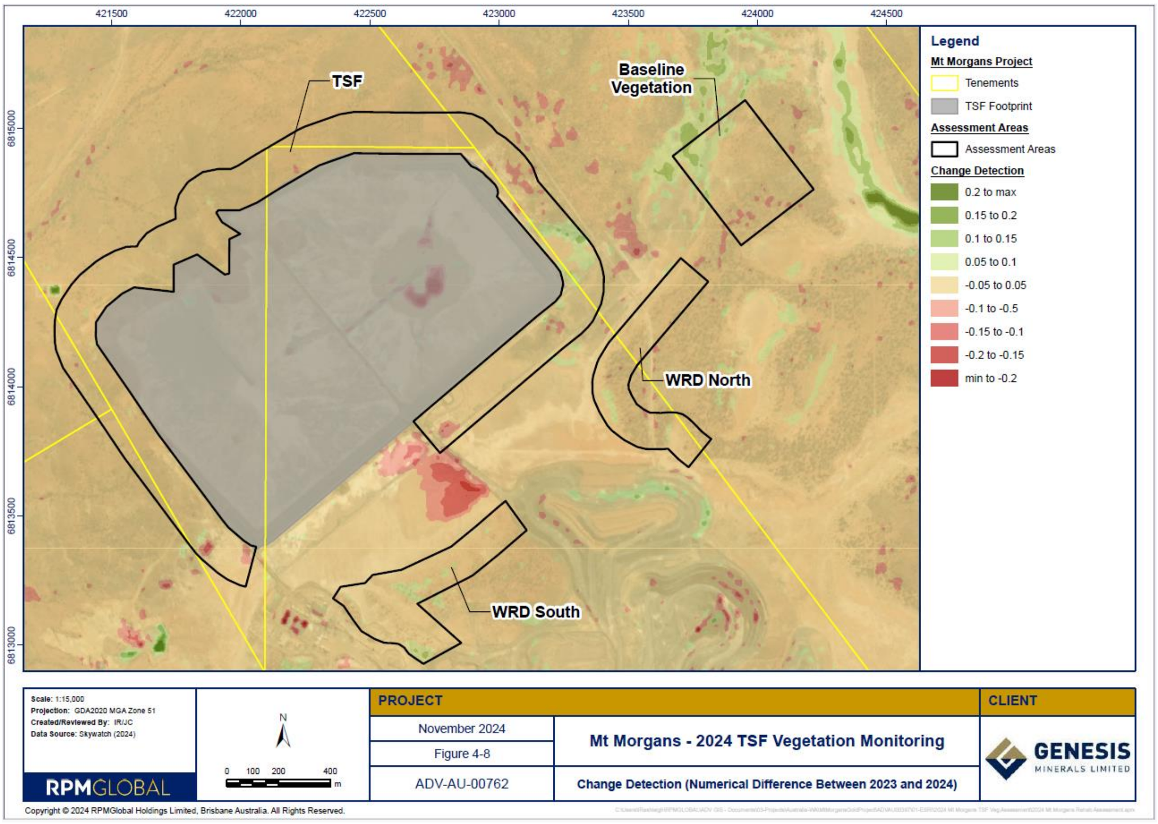

Figure 12: Vegetation monitoring locations and change detection between 2023 and 2024 monitoring events (Sourced from RPM 2025)

Table 3: Annual quadrant vegetation monitoring results (Information sourced from RPM 2025)

Quadrant	Monitoring methodology	Monitoring Date					
		August 2018	**December 2019**	**October 2020**	**August 2021**	**October 2023**	**December 2024**
QSE	[1]Vegetation Condition Rating	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)
	Total Vegetation Cover (visual Estimate only)	70%	75%	*75%*	70%	50%	50%
QNE	[1]Vegetation Condition Rating	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)	Good (3)
	Total Vegetation Cover (visual estimate only)	70%	70%	70%	60%	60%	50%
QN	[1]Vegetation Condition Rating	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)	Good (3)
	Total Vegetation Cover (visual estimate only)	60%	60%	40%	40%	40%	40%
QSW	[1]Vegetation Condition Rating	Good (4)	Good (4)	Good (4)	Good (4)	Good (4)	Very Good (4)
	Total Vegetation Cover (visual estimate only)	50%	45%	45%	45%	45%	50%
QE	[1]Vegetation Condition Rating	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)	Very Good (3)
	Total Vegetation Cover (visual estimate only)	40%	40%	40%	40%	40%	40%
QS	[1]Vegetation Condition Rating	*no data, monitoring began in 2019*	Good (4)	Good (4)	Good (4)	Degraded (5)	Degraded (5)
	Total Vegetation Cover (visual estimate only)		40%	40%	30%	30%	40%

Note 1: Vegetation condition rating in accordance with (Keighery, 1994)

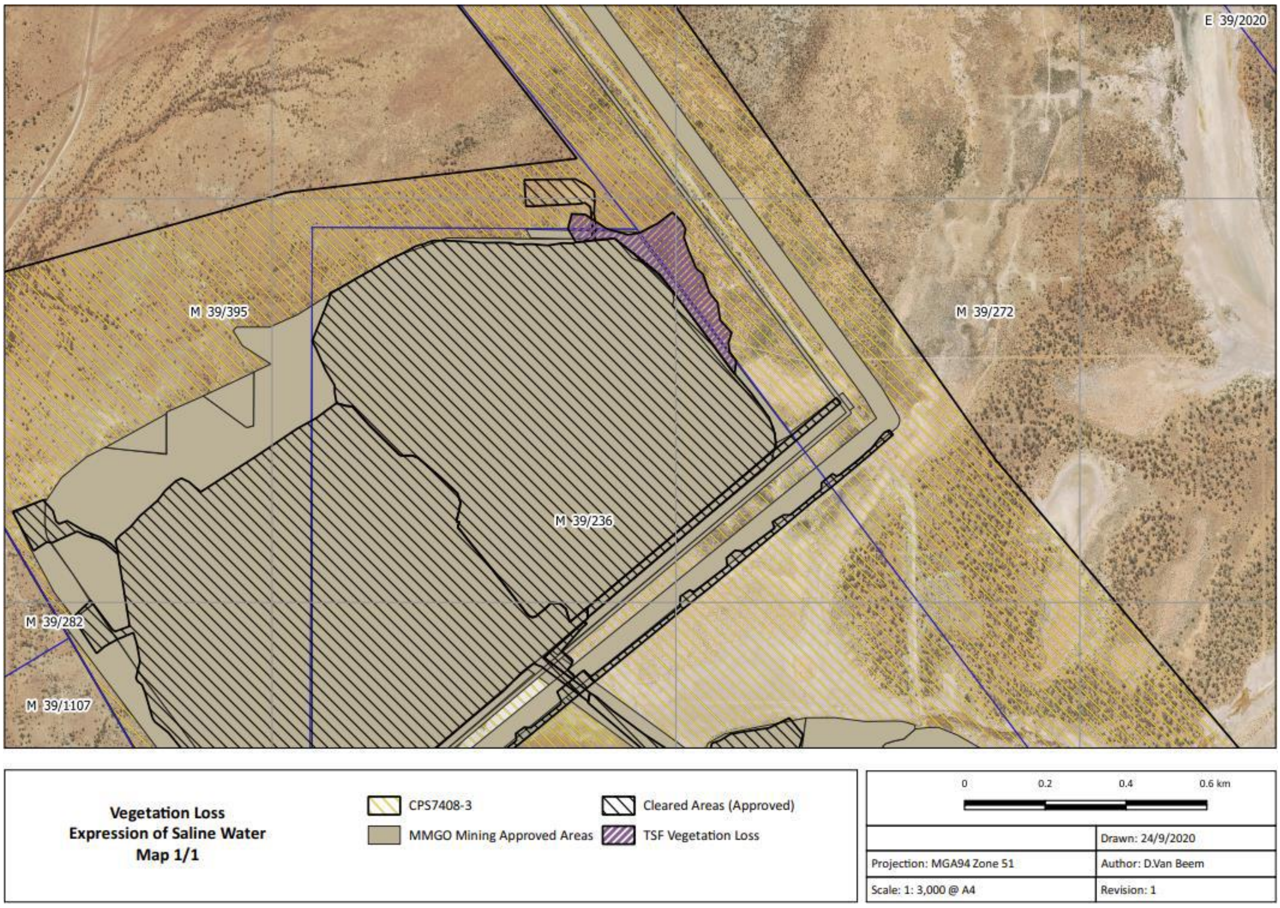

Figure 13: Vegetation loss via saline water expression

Figure 14: Historical aerial imagery of vegetation northeast of the TSF taken on 17 January 2021 (Sourced from Google Earth 2025).

Figure 15: Historical aerial imagery of vegetation northeast of the TSF taken on 7 November 2024 (Sourced from Nearmaps 2025).

2.7 Dust monitoring

Licence L9010/2016/1 requires the applicant to monitor particle matter 10 (PM_{10}) concentrations with a licence limit of 50 µg/m^3. Figure 16 and Figure 17 provides dust monitoring results from the 11 February 2024 to 10 February 2025 and 11 February 2023 to 10 February 2024 respectively.

It is noted that during both annual periods the monitor was offline and not in operation due to either: servicing, calibrations, malfunctions or awaiting equipment (GML 2024d) and (GML 2025). No limit exceedances occurred in the 2024-2025 annual period and two exceedances occurred in the 2023-2024 annual period. On 7 March 2023 the dust monitoring station recorded a concentration of PM_{10} of 160 µg/m^3 and on 13 September 2023 a result of 78 µg/m^3 was recorded. The applicant mentioned that it is unlikely that the exceedances are a result of the premises operation due to the wind direction which was southeasterly (GML 2024d).

The September event potentially can be contributed to the premises as the wind direction was predominantly north-westerly. Within the annual environmental report the applicant has mentioned that the site ceased operation on 28 March 2023 and stated that “it is unlikely that the exceedance is from the MMGP” (GML 2024d). The department considers that the exceedance may have been due to a lack of dust suppression from the premises even though operations had ceased.

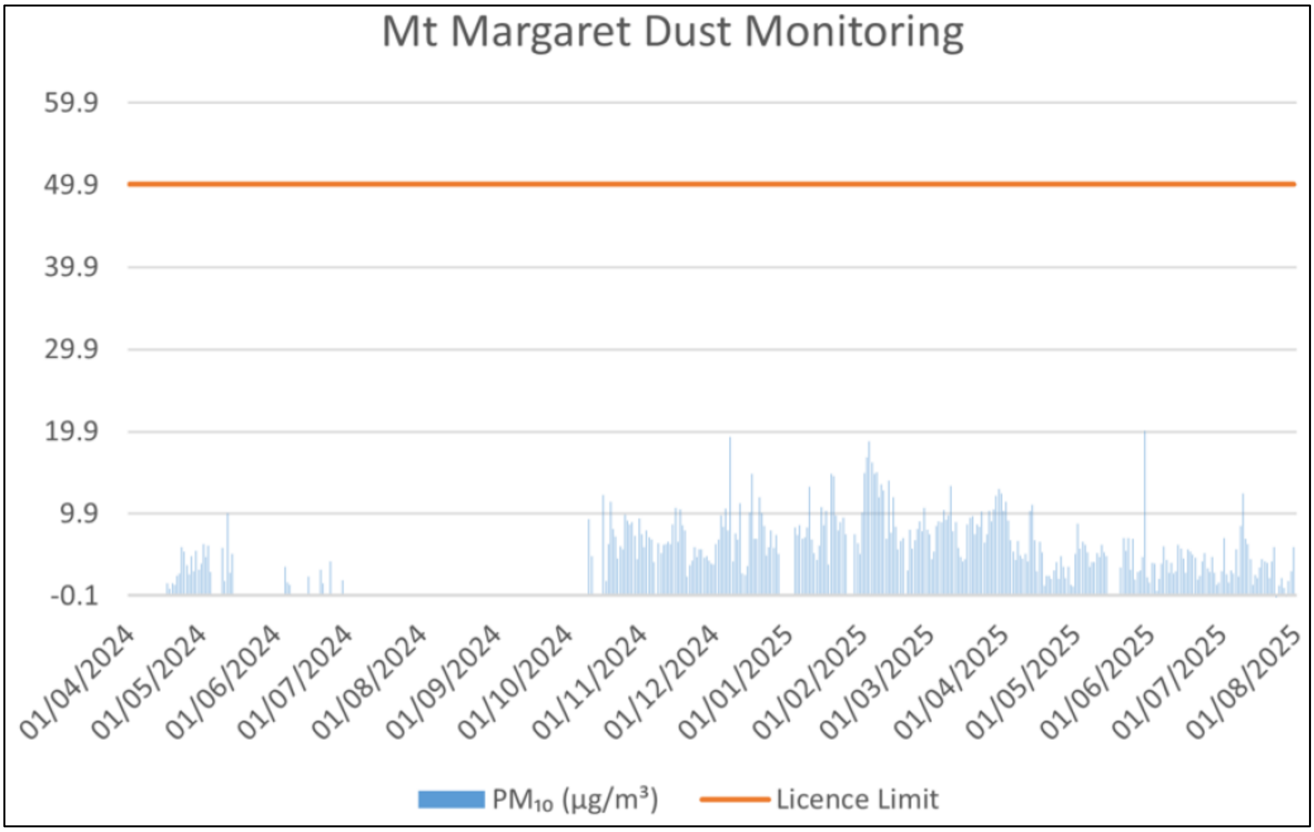

Figure 16: Dust monitoring results for the 2024 – 2025 Annual period (provided by applicant during 21-day draft review)

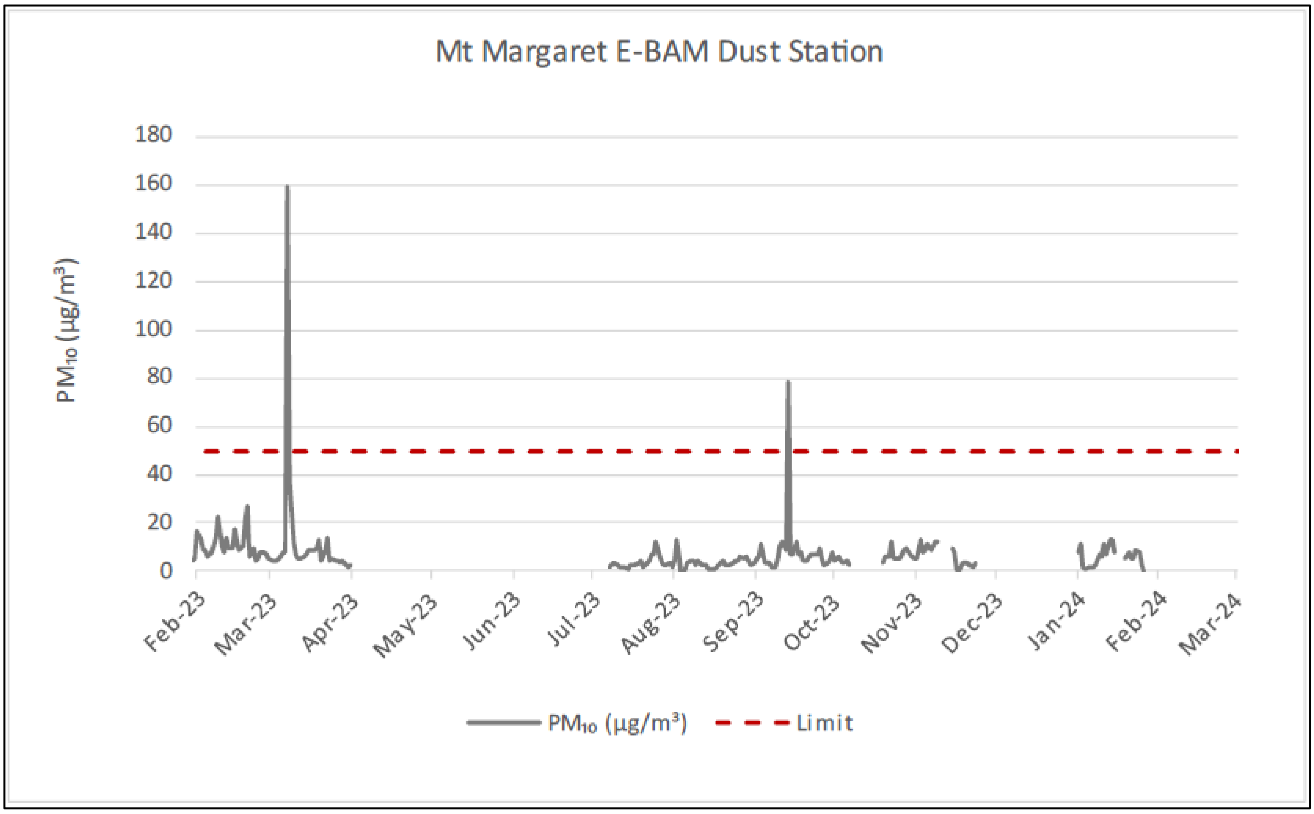

Figure 17: Dust monitoring results for the 2023 – 2024 Annual period (sourced from GML 2024d)

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 2020a).

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

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises construction and operation which have been considered in this decision report are detailed in Table 4 below. Table 4 also details the control measures the applicant has proposed to assist in controlling these emissions, where necessary.

Table 4: Proposed applicant controls

Emission	Sources	Potential pathways	Proposed controls
Construction			
Dust	Construction activities increasing height of TSF including movement of plant and earthworks.	Air / windborne pathway	• Dust suppression used when required including regular watering of unsealed surfaces and control of vehicle movements and speeds; • Ground disturbance suspended during high winds; • Maintained and graded roads and tracks; • Vehicles and mining equipment will keep to the designated roads; • Regular inspections undertaken to evaluate the effectiveness of point source dust control emissions and corrective action implemented where necessary; and • Existing dust monitoring station at Mt Margaret Community to monitoring PM_{10} concentrations.
Noise			• Construction will only occur during daytime hours; • Vehicles and plant regulator maintained; and • Mufflers and noise attenuating equipment installed and maintained (where possible).
Time-limited operations			
Dust	Tailings deposition within the TSF	Air / windborne pathway	• Regular inspections undertaken to evaluate the effectiveness of point source dust control emissions and corrective action implemented where necessary; • Tailings deposited moist/wet and in a sequence to maintain a wet beach; and

Emission	Sources	Potential pathways	Proposed controls
			• Tailings surface below the crest of embankments limiting wind exposure. • Existing dust monitoring station at Mt Margaret Community to monitoring PM10 concentrations.

Tailings and decant water	Tailings deposition into the TSF	Seepage
		and/or
		Groundwater (hypersaline) expression followed by stormwater runoff
			• Existing cut-off trench (compacted clayey low permeability materials) to restrict potential seepage under the perimeter embankment;
			• TSF is lined with in-situ clay to a permeability of 2.6 x 10^{-8} m/s limit seepage to groundwater;
			• Underdrainage system is installed within each cell and located along the southern perimeter embankments;
			• Upstream slopes of the perimeter embankments were lined with a bituminous geomembrane liner to reduce erosion of the upstream zone and reduce seepage through the embankment;
			• Supernatant water removed via decant pump deployed within a central decant structure in each cell and transported to the plant for reuse in processing;
			• Cyclic tailings deposition to reduce tailings drying time and maintaining supernatant pond away (>100 m) from the perimeter embankments;
			• Installed seepage recovery infrastructure including:
			    ○ Seepage collection sumps (SP01-SP07);
			    ○ Seepage interception trenches; and
			    ○ Seepage recovery bores (TSF AB01, TSF AB03-TSF AB10).
			• Monthly and quarterly groundwater monitoring under licence L9010/2016/1;
			• Groundwater level and WAD cyanide limits on monitoring bores under licence L9010/016/1; and
			• If groundwater monitoring indicates adverse impacts, risk assessment will be conducted by a qualified specialist and recovery bores may be installed where required.

		Overtopping of TSF	• Freeboard maintained to capture rainfall from a 1-in-100 year 72-hour annual exceedance probability (AEP) event; and • Daily visual inspections of TSF freeboard.

Emission	Sources	Potential pathways	Proposed controls
		Leaks/spills through pipelines	• Tailings and associated return water pipelines bunded within V drains sufficient to ensure all solids and liquors captured and not released to the environment between routine inspections; ○ If no dedicated bunding is in place pipeline is part buried. • Pipelines are double skinned PE100 and constructed and installed in accordance with AS4130, AS413 and according to the Plastics Industry Pipe Association of Australia Limited (PIPA) Guidelines POP003; • Sections of pipeline that traverse the Lake Carey tributary are raised on a causeway with secondary pipeline casing; • Daily visual inspections of tailings and decant return pipeline; and • Flow sensors monitoring devices and diversion valves installed on pipelines to detect leaks.

3.1.2 Receptors

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

Table 5 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 2020b)).

Table 5: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	Distance from prescribed activity
Aboriginal community: Mt Margaret Community	Located approximately 950 m west of the northwestern corner of TSF Cell 2.
Mt Margaret Community drinking water bores **[Screened Out]**	Located approximately 10.5 km northeast of the Mt Margaret Community and approximately 9 km northeast of the prescribed premises boundary. **Screened out due to distance to receptor.**
Environmental receptors	**Distance from prescribed activity**
Native vegetation	Native vegetation appears to be approximately 390 m southeast of the TSF.
Playa/Claypans (and native fauna)	The playa/claypans are present immediately to the south and east of the TSF. The claypans form ephemeral saline wetlands after heavy rainfall events and often contain a diverse range of invertebrates when flooded (Timms *et al.*,

	2006). The claypan adjacent to the TSF is potentially an ephemeral wetland.
Priority fauna	Priority 1 invertebrate species: *Branchinella simplex* identified within the Lake Carey system (MWH 2015).
Lake Carey	Lake Carey shoreline is located approximately 4.2 kms south of the TSF. Lake Carey has a significant ecological value and during flood events can become a highly productive ecosystem and is considered a Specified Ecosystem.
Underlying groundwater	Prior to tailings deposition groundwater depth ranged between 0.5 to 9.3 meters below ground level (mbgl). Since tailings deposition started, groundwater levels at the TSF have increased close to the ground surface (Figure 3 and Figure 4) with groundwater expressions occurring in places. In January 2024, groundwater levels range from 0.24 mbgl (TSF MB2) to 10.72 mbgl (TSF MB1). Groundwater Total Dissolved Solids (TDS) ranged from 150,000 to 180,000 mg/L at the playa (southern and eastern portion of the TSF) and 5,800 mg/L to the northwest corner of TSF Cell 1. Localised groundwater flows in a southeasterly direction (GLM, 2024a) towards Lake Carey.
Threatened Ecological Community (TEC) Mount Morgan calcrete aquifer **[Screened Out]**	The Mount Morgans calcrete groundwater assemblage (P1) is located approximately 600 m northeast cross gradient of the TSF (GML 2024b). The calcrete aquifer is screened out as a receptor due to the hydrological assessment indicated that it is "impossible" for the TSF mound to extend towards to the calcrete aquifer (Gensis 2024b). Ground surface elevation along the corner closest (north) to the aquifer is between 399 and 400 mRL while the aquifer is approximately 400 mRL (GML 2024b). Localised groundwater flows in a southeasterly direction towards Lake Carey reducing the potential for impacts to the aquifer. Technical review carried out by the department also suggests that it is unlikely that seepage from the TSF will impact the nearby calcrete aquifer and groundwater mounding is expected to be very localised around the TSF.
Cultural receptors	**Distance from activity / prescribed premises**
Cultural Heritage Places	There are a total of 14 registered heritage places whose public boundary is located approximately

	within a 1 km radius of TSF (Figure 18). The sites include the following uses: artefacts / scatter, repository, cache, mythological, water source, skeletal material / burial, man-made structure and camp. The closest cultural heritage place public boundary intersect the existing TSF and is located within the playa lake.
Registered heritage place – ACH-1157 – The Swimming Hole (Healing Pool) – Creation / Dreaming Narrative; Water Source **[Screened Out]**	The Swimming Hole is commonly referred to as the "Healing Pool" and is located approximately 1.5 km northeast of the TSF. The departments technical experts do not consider that the raising of the height of the TSF would impact the heritage places water levels, water quality or temperatures. Groundwater mounding of the water table from the increase in TSF height would be restricted to the immediate vicinity of the facility due to the general low hydraulic conductivity of the tailings and regolith materials in the area.

Figure 18: Registered cultural heritage places surrounding the prescribed premises boundaries

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020a) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

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

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 6.

Works approval W2910/2025/1 that accompanies this decision report authorises construction and time-limited operations. The conditions in the issued works approval, as outlined in Table 6 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

A licence amendment is required following the time-limited operational phase authorised under the works approval to authorise emissions associated with the ongoing operation of the premises i.e. category 5 activities. A risk assessment for the operational phase has been included in this decision report, however licence conditions will not be finalised until the department assesses the licence application.

Table 6: Risk assessment of potential emissions and discharges from the premises during construction and operation

Risk events					Risk rating [1]	Applicant controls sufficient?	Conditions[2] of works approval	Comments or justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**	**C = consequence** **L = likelihood**			
Construction								
Construction of additional embankment lifts of TSF cells 1 and 2 from 414 to 418 mRL	Dust	**Pathway:** Air/windborne pathway from the source to the receptor. **Impact:** Decline in health and/or amenity of the receptor.	• Mt Margarat Community (950 m)	Refer to Section 3.1	C = Minor L = Unlikely **Medium Risk**	Y	N/A	Dust monitoring is a current condition for licence L9010/2016/1 which the applicant operates the TSF under. The department has reviewed recent PM_{10} dust monitoring results (section 2.7) from the monitoring station located within the Mt Margaret Community and notes that exceedances of the licence limits and health guidelines do not generally occur.. The department considers that the applicants proposed controls and existing conditions within licence L9010/2016/1 are suitable to manage dust emissions from construction of the TSF embankment raise.
	Noise				C = Minor L = Rare **Low Risk**	Y	N/A	The applicant has mentioned within the application that minimal to no rock breaking will occur during the proposed construction phase. The majority to noise contributing to noise emissions will be through the operation of vehicles during construction. The application has mentioned that operations will only occur during the daytime. The department considers that the applicants proposed controls, works approval conditions and existing conditions within licence L9010/2016/1 are suitable to manage the potential emissions from construction of the TSF raise.
Time-limited-operations								
Operation of TSF cell 1 and cell 2 with maximum embankment height of 418 mRL (Stage 4).	Tailings, decant and/or seepage recovery water	**Pathway:** Overtopping of TSF causing discharge of emission/s to ground. **Impact:** Direct contact with receptors degrading environmental values.	• Surrounding native vegetation (390 m) • Playa systems • Cultural Heritage Places	Refer to Section 3.1	C = Moderate L = Unlikely **Medium Risk**	Y	Condition 6: Time limited operations requirements (freeboard); and Condition 7: Inspection requirements.	The applicants proposed minimum freeboard is designed to be sufficient to capture rainfall of a 1-in-100 year 72-hour AEP event. In accordance with the TSF design report CMW (2024) a provision of a minimum of 0.7 m freeboard is included which comprises of: • Operational height (vertical height between the tailings beach and embankment crest of 0.3 m); • Beach freeboard of 0.2 m; and • An allowance for the 1:100 years AEP, 72-hour AEP event of approximately 0.2 m. The department also notes that existing licence L9010/2016/1 requires a freeboard of 0.5 m or a 1-in-100 year 72-hour AEP event (whichever is greater) for the TSF. The department has adopted the same freeboard requirement from licence L9010/2016/1 for works approval W2910/2025/1. The department notes that the applicant has proposed (Table 4) a daily inspection of the TSF freeboard. Licence L9010/2016/1 requires 12 hourly inspections of the freeboard during operation and therefore the department has adopted the requirement of 12 hourly inspections in the works approval.
			• Lake Carey • Priority fauna (within Lake Carey)		C = Minor L = Unlikely **Medium Risk**	Y		
		Pathway: Leaks and/or spills from pipelines leading to or from the TSF.	• Surrounding native vegetation (390 m) • Lake Carey and Playa Systems		C = Minor L = Possible **Medium Risk**	Y	Condition 6: Time limited operation requirements (pipeline bunding and flow sensors requirements); and Condition 7: Inspection	The department considers the applicants proposed controls, and existing conditions within licence L9010/2016/1 to be acceptable to manage this risk event. The department also notes that applicant proposes (Table 4) a daily inspection of tailings and decant recovery pipelines. Licence L9010/2016/1 requires 12 hourly inspections of the

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions[2] of works approval	Comments or justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
		Impact: Direct contact with receptors degrading environmental values.	• Cultural Heritage Places				requirements.	pipelines during operation and therefore the department has adopted the requirement of 12 hourly inspections in the works approval.
	Leachate (containing metals and/or WAD cyanide)	**Pathway:** Seepage of leachate through base and walls of TSF mixing with groundwater and flowing along hydraulic groundwater flow or resulting is groundwater expression of seepage impacted waters followed by stormwater runoff. **Impact:** Can cause groundwater contamination, mounding/surface expression, a reduction in ecological health	• Surrounding native vegetation (390 m) • Groundwater	Refer to Section 3.1	C = Moderate L = Possible **Medium Risk**	Y	Condition 6: Time limited operation requirements.	As the TSF increases in height, seepage and downward pressure on the groundwater is expected to rise, potentially leading to groundwater mounding/ and or contamination. The additional seepage recovery infrastructure installed by the applicant prior to this works approval (section 2.5.2) will aid to mitigate additional impact on nearby native vegetation from groundwater mounding. One exceedance of WAD cyanide has been recorded during TSF operations and appears to have been appropriately managed. The applicant's current monitoring program under Licence L9010/2016/1 (condition 3.5.1) will track any changes to groundwater levels during the time-limited operational phase. Condition 3.5.2 of the licence requires effective management of groundwater mounding in the vicinity of the TSF bellow trigger values. Should existing recovery bores prove insufficient to maintain groundwater levels below the licensed standing water level limits, further drains or recovery bores may be required. Overall, the department considers the applicant's proposed controls adequate to manage this risk event.
			• Playa systems/claypans (and native fauna) • Lake Carey (and native fauna) • Priority fauna (within Lake Carey)		C = Moderate L = Possible **Medium Risk**	N	Condition 6: Time limited operation requirements; and **<u>Condition 10: Passive sampler water runoff monitoring requirements</u>**.	See section 3.3.
			• Registered Heritage Place: ACH-1157 – The Swimming Hole (Healing Pool)		**No pathway**	N/A	N/A	During the consultation period for this application comments were received by Umanity group on behalf of Wangkatja Tjungula Aboriginal Corporation RNTBC (summarised in Table 7) regarding concerns around the potential impact of the TSF embankment raise on the healing pool registered heritage place located approximately 1.5 km northeast of the TSF (concerns regarding changes to water level / water quality and temperature). The impact to this receptor from the embankment raise has been considered carefully (including seeking input from internal technical experts) and it is the departments' view that raising the height of the TSF will have no impact on water levels, water quality or temperatures in the Healing pool. This is because increased mounding of the water table caused by raising the height of the TSF would be restricted to the immediate vicinity of the facility. This is due to the generally low hydraulic conductivity of the tailings and of regolith materials in this area. Without the presence of suitable drainage structures, this could cause groundwater to emerge at the land surface near the toe of the TSF. However, these effects would be very localised, and would be unlikely to affect water levels, water quality or temperatures in Healing Pool which is located 1.5 km away. It is considered that there is therefore no pathway for seepage

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions[2] of works approval	Comments or justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
								from the TSF to impact this receptor. Further discussion around other matters raised in the comments (that are outside the scope of this works approval) received by Umanity group on behalf of Wangkatia Tjungula Aboriginal Corporation RNTBC is outlined in Table 7.
	Dust	**Pathway:** Air/windborne pathway **Impact:** Impacts to human health / amenity	• Mt Margarat Community (950 m)	Refer to Section 3.1	C = Minor L = Unlikely **Medium Risk**	Y	N/A	Dust monitoring is a current condition for licence L9010/2016/1 which the applicant operates the TSF under. The department has reviewed recent PM_{10} dust monitoring results (section 2.7) from the monitoring station located within the Mt Margaret Community and notes that exceedances of the licence limits and health guidelines do not generally occur. The department considers that the applicants proposed controls, and existing conditions within licence L9010/2016/1 are suitable to manage the potential emissions from time limited operations of the TSF.

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

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

3.3 Detailed risk assessment for Risk Event: Surface expression of groundwater (from mounding of groundwater table around TSF)

3.3.1 Description of risk event

There is a potential for an increase in seepage to be emitted from the TSF as a result of the proposed embankment raise. An increase in embankment height at the TSF will likely cause further groundwater mounding leading to surface expression. Episodic surface runoff from the area near the TSF would have the potential to cause adverse environmental impacts on claypans that are located between the facility and Lake Carey.

Surface expression near the TSF has recorded concentrations of elevated cobalt which is the main contaminant of most concern to the invertebrate fauna in claypans. Cobalt concentration of 0.993 mg/L (Table 1) have been recorded, while groundwater monitoring bores TSF MB04 and TSF MB05, located in the north-eastern area of the TSF, have reported higher concentrations. The peak cobalt concentration of 2.44 mg/L was recorded at TSF MB05 in April 2024 (Figure 10).

As outlined in section 2.5.3 of this report groundwater expression containing high concentrations of cobalt may occur again at the premises. Following rainfall, a first flush[4] stormwater runoff event may occur transporting the impacted surface expression water downstream to receptors within the nearby Playa lake/claypans and/or Lake Carey. Although cobalt concentrations in runoff are expected to be significantly diluted during such events, they may still pose a risk to receptors during the first flush event.

The claypans form ephemeral saline wetlands after heavy rainfall events often contain a diverse range of invertebrates when flooded (Timms *et al*., 2006). The transport of the cobalt concentrations could potentially impact invertebrates within the Playa Lake/clay pans and/or Lake Carey which provide a beneficial food source for surrounding fauna and migratory birds.

3.3.2 Applicant proposed controls

The applicants proposed and current controls to manage impacts caused by groundwater expression is presented in Table 4. Overall, the primary controls and management of this risk event is limited to the management and interception of seepage emitted from the TSF.

SEEP/W modelling (mentioned in section 2.5.4) showed that if the underdrainage is operational the phreatic surface[5] within the tailings will remain low preventing significant increases in groundwater levels along the north-western area of the TSF, although groundwater levels may still increase along the north-eastern portion of the TSF (GLM 2024b). If the underdrainage is not operational significant increase in groundwater levels may occur around the TSF. Groundwater levels to the north-western portion of the TSF could rise to 1 mbgl (GLM 2024b) in addition to potential impacts to native vegetation to the northeast.

To facilitate the potential increase in groundwater levels surrounding the TSF and reduce the likelihood of impacts to native vegetation and nearby receptors the applicant has pre-emptively constructed seven additional seepage recovery bores. The additional seepage recovery bores are located at the northeast and southwest corners of the TSF with the majority constructed at the northeastern portion of the TSF as discussed in section 2.5.2.

[4] First flush event is the initial portion of runoff from a rainfall event.

[5] Boundary between the saturated and unsaturated zones in the ground (within the tailings/embankment of the TSF).

3.3.3 Risk rating

The department has assigned a **Moderate** consequence rating to this risk event as low level offsite impacts on a local scale may occur.

As illustrated in Figures 3 and 4, baseline groundwater levels around the TSF have historically been naturally shallow, particularly in the southern and eastern portions of the TSF. This makes the area susceptible to groundwater mounding and surface expression. Groundwater expression caused by seepage has occurred previously during TSF operations (refer to Section 2.5.3). As a result, the likelihood rating for this risk event has been assessed as **Possible**.

In accordance with the *Guideline: Risk Assessments* (DWER 2020a) a moderate consequence combined with a possible likelihood, results in a **Medium** risk rating. This rating is considered acceptable but typically is subject to regulatory controls. Accordingly, the department has decided to impose additional conditions to manage this risk event (see Section 3.3.4).

The risk rating will be reassessed upon submission of an application for continued operation beyond the time-limited operations of TSF Cell 1 and/or Cell 2 at 418 mRL (Stage 4) under Licence L9010/2016/1. A review of operational performance and compliance will inform the department's decision and the outcome of the specified action (refer to Section 3.4)

3.3.4 Additional regulatory control

The department considers the current groundwater monitoring program for the Mt. Morgans TSF appropriate for detecting changes in groundwater quality due to seepage. However, during the assessment of the works approval application, a previously unidentified potential pathway to impact native fauna in the Playa lakes/claypans and Lake Carey was identified.

With the planned embankment raises and increased operational height of the TSF, groundwater surface expression has the potential to occur. To better understand potential risks to environmental receptors (invertebrates within the playa system), the department has imposed a specified action under the works approval.

Given the likelihood of further groundwater expression, the department has required the applicant to conduct a targeted sampling event to capture first flush water samples using passive siphon samplers and sampling methodology in accordance with Mackay, A.K. and Taylor, M.P., (2011) (available online). Specifically, the applicant must install two passive siphon samplers, one upstream and one downstream of the TSF in an ephemeral creek. These samplers will collect the initial runoff following a significant rainfall event, providing critical water quality data to assess potential downstream impacts. The applicant is required to submit a report of the findings to the department by 1 April 2026.

4. Consultation

Table 7 provides a summary of the consultation undertaken by the department.

Table 7: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website on 21 March 2025 and advertised in the West Australian on 24 March 2025.	None received	N/A
Local Government Authority (Shire of Laverton) advised of proposal on 26 March 2025.	None received.	N/A
Department of Mines, Petroleum and Exploration (DMPE) was advised of the proposal on 26 March 2025.	Response from DMPE (previously DEMIRS) was received on 7 April 2025. DMPE provided the following comments: • The Mining Proposal associated with the TSF embankment lift was approved on the 26/03/2025 (Reg ID 128557); • During assessment, consideration was given to the geotechnical design (by DEMIRS geotechnical officer), hydrological management and risk to environment with proposal found to meet DEMIRS environmental objectives. As with all DEMIRS approvals they are conditional on other legislative approvals; It was determined that operation of facility and protection of the environment would be satisfactorily managed by DWER works approval and existing DEMIRS tenement conditions; and • During the assessment of the mining proposal (REG ID 128557), there were concerns about seepage management of the TSF. DEMIRS geotechnical and environmental officers inspected the facility on 16 December 2024. During the inspection no evidence of ongoing seepage was identified, and	Noted.

Consultation method	Comments received	Department response
	the facility was being adequately managed at time of inspection.	
Australian Movement for Outback Survival Aboriginal Corporation (AMOS) was advised of proposal on 26 March 2025.	None received.	N/A
Wangkatja Tjungula Aboriginal Corporation RNTBC was advised of proposal on 26 March 2025.	Response from Umanity group on behalf of Wangkatja Tjungula Aboriginal Corporation RNTBC was received by the department on 24 April 2025. A summary of comments that were provided are presented below: 1. Healing Pool holds significant cultural value to the traditional owners of the area, and its sensitive and unique environmental values are an integral part of this; 2. The Healing Pool is a registered heritage place and overlaps with a Priority 1 Threatened Ecological Community. 3. Healing Pool (Registered heritage place) public boundary overlaps with the TSF footprint and the department has previously not assessed the Healing Pool as a groundwater sensitive receptor to groundwater abstraction and contamination from mining activities; 4. The TSF expansion, related mining operations, mine dewatering and extraction activities are impacting the Healing Pool. Especially dewatering of pits and groundwater abstraction from borefields, are creating hydraulic sinks that divert groundwater away from the Healing Pool, leading to a decline in water levels 5. The TSF is causing groundwater mounding due to seepage from the TSF and impacting the local water balance (including physical and chemical properties) around the Healing Pool; 6. The Healing Pool is dependent on the deeper paleo channels and fractured rock aquifers to received its groundwater and geothermal influxes;	The Department acknowledges the cultural significance of the Healing Pool heritage place to the Traditional Owners and has therefore given careful consideration to all submissions provided by the Umanity Group on behalf of the Wangkatja Tjungula Aboriginal Corporation RNTBC. The scope of the works approval application is limited to the proposed increase in the TSF embankment height. Table 6 in the decision report outlines the departments assessment of risk events associated with these works. Impacts from elevated cyanide in groundwater, surface expression and groundwater mounding on vegetation has been assessed. As outlined in Table 6 of this decision report, seepage and mounding around the TSF at Mt Morgans mine site is unlikely to affect the Healing Pool site situated approximately 1.5 km northeast of the TSF. This is due to the highly localised nature of seepage and groundwater mounding and the groundwater flow direction. Based on internal expert advice it is considered that changes in water levels at the Healing Pool is likely not from mining activities but instead from changes to rainfall and evaporation patterns. The comments referencing Kais (2024) suggests that the Healing pool receives groundwater discharge and heat from a deep geothermal source, potentially impacted by mine dewatering at the Mt Morgans mine site. The department undertook a technical review of this information and notes that the assessment of geothermal connection of the healing pool and the conceptual model (hydrogeological connectivity) is unlikely to be correct due to: Unreliable Thermometric Data:

Consultation method	Comments received	Department response
	7. Evidence of cyanide levels above the safe threshold have been reported to the department in the groundwater surrounding the TSF; 8. Significant vegetation deaths in the area surrounding the TSF due to groundwater mounding at the site; 9. The applicant has a history of non-compliances with operating in the premises; and 10. It is strongly recommended that these agencies (DWER, DEMIRS and Department of Planning, Lands and Heritage (DPLH) apply a stop-works order on mining activities within a 2 km radius of the Healing Pool, while it is assessed as a sensitive receptor to emissions that affect groundwater.	• Water quality data from a shallow pool in the area was used for the sodium-potassium (i.e., Na-K) geothermometer equations to infer that at least some of the water was derived from a deep geothermal source. It is considered highly unreliable when the subsurface heat source has a temperature that is less than about 200°C (Sagoe and Li, 2020). This is the case in this region, where temperatures at a depth of about 4 kilometres have been estimated to be about 110-120°C (Haynes *et al*., 2015); • Na-K thermometric methods usually require that sodium: potassium ratios in water are relatively constant. This is not the case in the salt lake environment in the vicinity of Healing Pool, where the precipitation of potassium-containing minerals like alunite, jarosite and carnotite would significantly change this ionic ratio in hypersaline groundwater; Limited Hydrogeological Connectivity • Hydrogeological investigations that have been carried out by the Geological Survey of Western Australia, the Water and Rivers Commission and by mining proponents have indicated there is generally only a limited hydraulic connection between deep fractured bedrock aquifers and shallow aquifers in calcrete and in alluvial and colluvial material in the region. This is because fresh bedrock in the region is generally overlain by a thick (typically about 30 metres thick) weathered profile that consists of clayey materials that have a low hydraulic conductivity; Alternative Heat Source Explanation • Elevated temperatures in Healing Pool are more plausibly explained by solar heating. Surface water ponds that contain hypersaline water and a vertical salinity gradient are capable of storing large amounts of heat from solar radiation, similar to engineered solar ponds used in industrial applications (Esmaeilion *et al.,* 2021). The Healing pool therefore likely functions as a natural solar pond. In addition, the works approval holder provided a report to the department outlining the findings of a hydrogeological

Consultation method	Comments received	Department response
		investigation that was carried out by Pennington Scott consultants. The investigation looked at the potential impacts on the Healing Pool site from the operation of the Mt Morgans mine site (which includes dewatering of pits). Key findings from the assessment include: • Hydrogeological Disconnection: The Healing Pool is separated from deeper palaeochannel aquifers by low-permeability shale, making hydraulic connectivity with Mt Morgan mine infrastructure highly unlikely. • Climatic Influence: Water levels in the Healing Pool are primarily driven by rainfall and surface runoff. A severe drought during the operational period (2017–2023) explains the observed decline in water levels. • Numerical Modelling: Groundwater drawdown from the Jupiter Pit and Borefield does not extend near the Healing Pool, which is located 3,000–8,000 m away. Groundwater chemistry also shows no evidence of connectivity. • No Geothermal Influence: Elevated water temperatures are consistent with solar heating in hypersaline conditions, not geothermal upwelling. The department determined from its technical review that the hydrogeological investigations that were undertaken by Pennington Scott consultants are considered to be technically sound. Additionally, the conceptual hydrogeological model that was produced for the area is consistent with the results of regional hydrogeological investigations that were historically carried out by the Geological Survey of Western Australia and the Water and Rivers Commission. Based on available evidence, the department does not support the view that the Healing Pool site is hydraulically connected to the Mt Morgans mine site and considers it unlikely that mine dewatering or TSF seepage will impact the thermal or hydrological characteristics of the Healing pool site.
Applicant was provided with draft documents on 28 August 2025.	The applicant responded to the department on 9 September 2025. No comments were provided on the draft works approval or the decision report. The applicant did provide some additional information at the	N/A

Consultation method	Comments received	Department response
	request of the department which has been adopted in the works approval and decision report.	

5. Conclusion

Based on the assessment in this decision report, the delegated officer has determined that a works approval will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

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