



Application for Licence Amendment

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

Licence Number	L9056/2017/1
Licence Holder	Pilgangoora Operations Pty Ltd
ACN	616 560 395
File Number	DER2017/000318
Premises	Pilgangoora Lithium – Tantalum Project Mining Tenements M45/1256 and L45/417 MARBLE BAR WA 6760
Date of Report	13 September 2022
Decision	Revised licence granted
Licence Number	L9056/2017/1

**A/MANAGER, RESOURCE INDUSTRIES
REGULATORY SERVICES**

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

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1. Decision summary

Licence L9056/2017/1 is held by Pilgangoora Operations Pty Ltd (Licence Holder) for the Pilgangoora Lithium – Tantalum Project, also known as the Pilgan Project (the Premises), located at Mining Tenements M45/1256 and L45/417, approximately 88 km south-southeast of the town of Port Hedland and 30 km north-east of the Wodgina mine, in the Shire of East Pilbara, Western Australia.

Pilgangoora Operations Pty Ltd is a 100% subsidiary of Pilbara Minerals Limited (PLS) which operates the Pilgangoora Project in the north-eastern Pilbara region of Western Australia. The Pilgangoora Project comprises Lithium-Tantalum mining from several pits across two adjacent project areas, namely:

- Pilgangoora Lithium – Tantalum Project (The Pilgan Project) (Licence L9056/2017/1) which commenced mining in March 2018, and
- The Ngungaju Project (Licence L9036/2017/1), which commenced mining in early 2019, and was acquired from Altura Mining Limited in January 2021.

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 L9056/2017/1 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 Application summary

On 01 April 2022, the Licence Holder applied to the department to amend Licence L9056/2017/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought:

- Increase the design capacity under Category 64: Putrescible landfill from 10,000 tonnes/year to 20,000 tonnes/year. Adding a landfill area within Monster WRD. Refer to section 2.2.1 for further detail.
- Category 5: Processing or beneficiation of metallic or non-metallic ore - Tailings Management Facility (TMF) raise: Stage 2 and 3 from RL189.3m to RL 200.8m. No increase in ore processing capacity is proposed.

This amendment is limited to changes to Category 5 and 64 activities from the Existing Licence. No changes to the aspects of the existing Licence relating to Category 52, 54 or 73 have been requested by the Licence Holder.

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

Table 1: Proposed throughput capacity changes

Category	Current throughput capacity	Proposed throughput capacity	Description of proposed amendment
Category 5: Processing or beneficiation of metallic or non-metallic ore	2,000,000 tonnes per annum processed ore 1,680,000 tonnes tailings produced.	No change to production capacity	TMF raise – Stage 2 and 3 to allow additional tailings storage capacity
Category 52: Electric power generation	15.7 MW	No change	N/A
Category 54: Sewage facility	125 m ³ /day	No change	N/A
Category 64: Class II Putrescible landfill	10,000 tonnes per annum	Increase to 20,000 tonnes per annum.	Addition of new landfill within Monster WRD.
Category 73: Bulk storage of chemicals	1,036 m ³ in aggregate	No change	N/A

Increase the landfill design capacity from 10,000 tonnes/year to 20,000 tonnes/year.

The Licence Holder has proposed to construct a new landfill within the Monster WRD to dispose of waste from the Pilgangoora Lithium - Tantalum Operations. As part of this amendment, the Licence Holder has proposed to;

- increase the design capacity for Category 64 from 10,000 tonnes/year to 20,000 tonnes/year; and
- Construct and operate additional landfill within Monster WRD, as per Figure 1 below.

The Licence Holder has proposed to maintain the existing operational controls on the landfill as per Licence L9056/2017/1 (Pilbara Minerals, 2022). Figure 1 below shows the proposed location of the landfill.

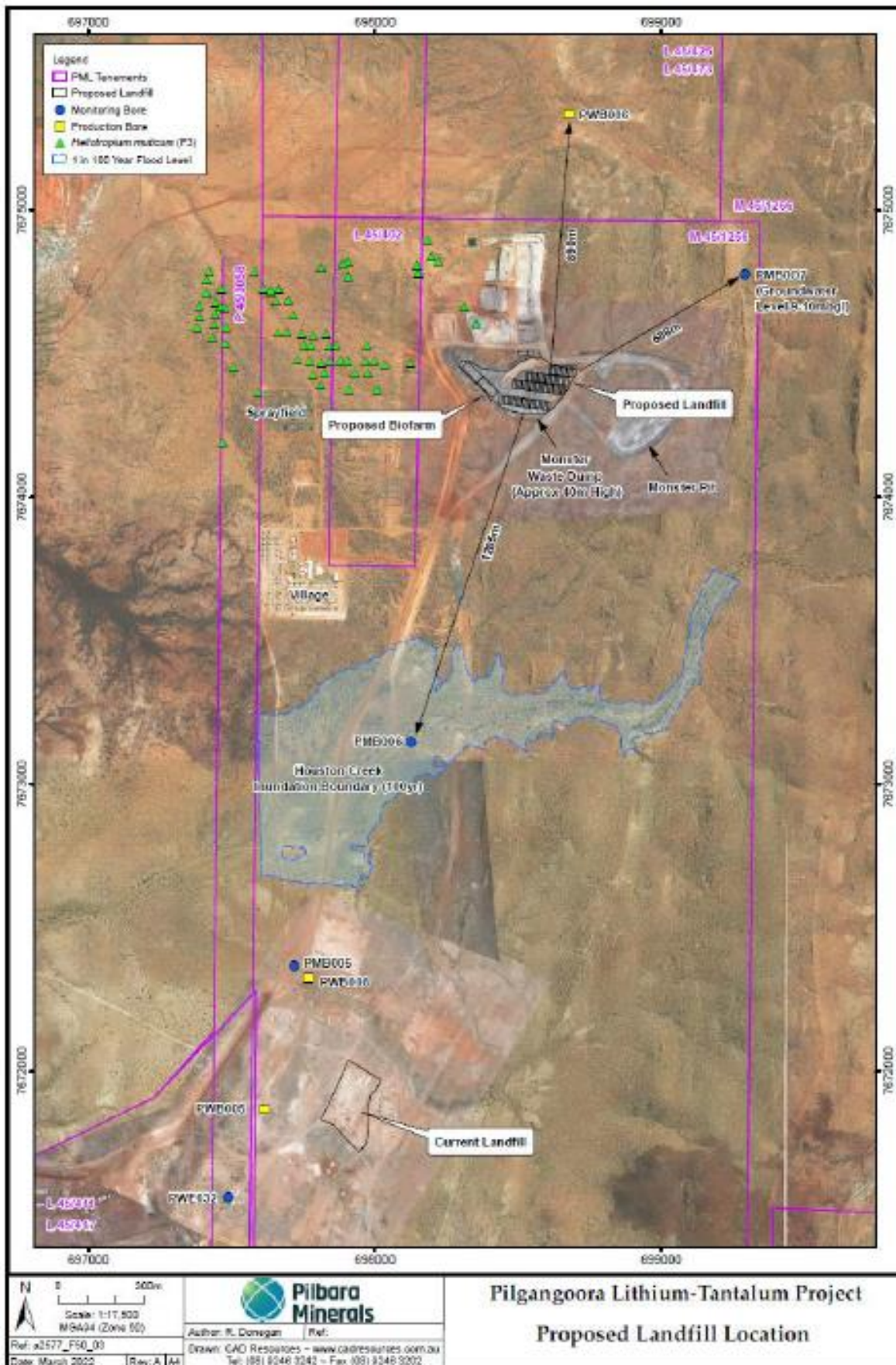


Figure 1: Landfill location

TMF raise design – Stage 2 and 3.

The Licence Holder has proposed to construct Stages 2 and 3 of Pilgangoora TMF Cells 1 and 2 and raise the Pilgangoora TMF past the currently constructed and approved Stage 1 level (RL189.3m) up to the proposed Stage 3 level (RL200.8m).

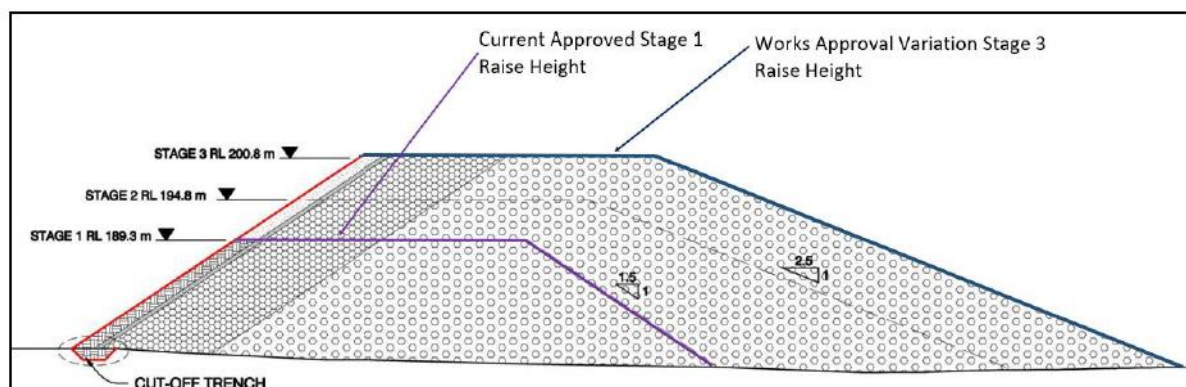


Figure 2: Proposed TMF embankment raise to Stage 3

The original TMF was designed by ATC Williams (ATCW) in 2016 with nine Stages and three Cells (ATCW, 2016). The existing Licence approved deposition into Cell 1 and 2 for Stage 1 to RL 189.3 m only.

The current TMF comprises two cells (Cell 1 and Cell 2), constructed in stages by the continuous placement of waste rock around the outer edge of the tailings impoundment and incremental placement of a low permeability inner face and granular filter zone on a six to twelve-month campaign basis.

The proposed raise to Stage 2 and 3 for both cells will now provide tailings storage for approximately three years. The Delegated Officer understands that the expected full development (nine stages and the third cell) of the existing TMF will not proceed beyond Stage 3. After completion of Stage 3 the existing TMF will be rehabilitated and closed.

TMF revisited design

Changes in tailings characteristics (% of solids is 10% less than what was considered during the original design) and beach profile (the concave tailings beach for Cell 1 and 2 are flatter than the initially predicted slopes), has triggered a revised design for the proposed Stage 2 and 3 deposition methodology (ATCW, 2022b).

Tailings are now anticipated to be produced at approximately 50% solids concentration at a rate of between 1.67 Mtpa and 2 Mtpa over a nominal three-year mine life, giving a total storage requirement of approximately 6.0 Mt. In-situ density testing was carried out on the dry tailings beach in late 2021 and indicated an average dry density of 1.45 t/m³. This measured average in-situ density value was adopted for the revised design.

A target “wet” layer thickness of a maximum 250 mm is now recommended for tailings deposition on each deposition cycle. The design report also indicates that a practical minimum pond depth at the decant tower is considered to be 0.5 m. The maximum operating pond depth should not exceed the level of the wet season storage allowance, which approximates to a maximum pond depth of 1.3 m.

As the tailings level rises in the cells, additional slotted concrete rings will be added to the decant towers, additional filter rock will be placed and the access causeway will be raised.

Drawings of proposed Stage 2 and 3 design are provided in Appendix 3.

Seepage analysis

In accordance with ATCW memorandum from 2020 (ATCW, 2020) initial seepage analyses undertaken prior to construction concluded that, due to the relatively shallow groundwater level (approximately 10 m), hydraulic connectivity between the saturated tailings and groundwater was anticipated to develop; however, the results of modelling for normal operating conditions indicated that:

- Significant lateral seepage through the embankment construction was not anticipated,
- Lateral seepage rates beneath the perimeter embankment of the TMF were likely to be very low, and
- Vertical seepage from the operating cell was expected, with seepage rates likely to be less than 1,000 m³/day (for Cell 1/2).

Further analysis was undertaken following completion of a pit dewatering assessment. The results inferred that significant lateral seepage through the embankments was unlikely and that groundwater level mounding as a result of vertical seepage would be offset by pit dewatering to different degrees.

In accordance with ATCW, it is evident, based on monitoring data and reported standing water level exceedances, that water levels have risen since commissioning of the TMF, creating a groundwater mound beneath the facility. Whilst rainfall has a significant impact on groundwater levels, vertical seepage from the TMF is also contributing to groundwater mounding. Mitigation of mounding was anticipated as a result of Central pit dewatering; however, dewatering of the pit had not yet taken place to the extent previously envisaged (ATCW, 2020).

Water ponding at the downstream toe of Cell 2 of the TMF was observed towards end March 2020 and during DWER Compliance Branch inspection of the site in 2021. At several locations the bed of a downstream creek was observed to be damp. Sampling of creek bed by DWER compliance Branch indicated high concentration of Lithium (3.6mg/L) and other analytes.

ATCW indicates the following as contributory factors to the seepage issues from Cell 2, for the life of Stage 1:

- Zone 1 clayey sand materials were excavated from the TMF impoundment by the construction contractor leaving an insufficient cover over the more permeable weathered rock foundation material.
- The excavation of drainage trenches in the floor of the Cell 2 TMF impoundment to drain decant water in an easterly direction toward the central decant outlet tower, resulted in the unintended effect of exposing the more permeable weathered rock foundation material in the floor of the impoundment.
- The poor performance of the central decant outlet tower in draining the tailings decant water from the cell, with an excessive volume of decant water being stored in the Cell and in particular, on the topographically lower western side of the Cell.

Seepage recovery trenches to recover any flows from the downstream toe of the Zone 4B materials were then installed to manage the seepage flows, with the seepage water being collected and returned to the processing plant (Figure 3). Additional shallow bores to monitor seepage were also recently installed (in yellow in Figure 3).

ATCW confirms that the vibrating wire piezometers installed beneath the TMF perimeter (at about 0.6 m depth below foundation level) have not recorded any positive water pressure, indicating that significant lateral seepage or development of an elevated phreatic surface through the embankments has not occurred (ATCW, 2020).

Review of seepage analysis for stage 2 and 3

As part of the revised design for Stage 2 and 3, ATCW has reviewed seepage analysis

undertaken to evaluate the variation in the rate of water seepage downstream of the embankment for two main scenarios (ATCW, 2022c).

Scenario one was for the end of stage 1 tailings deposition (steady-state condition), and Scenario two was for the final height of embankment (end of Stage 3) for a nominal 3 years of tailings deposition (transient condition).

Both scenarios were evaluated by simulating the geometry and condition of a typical embankment cross-section at the western end of Cell 2. The geometries developed for the SEEP/W models were based on the proposed embankment configuration and the stratigraphy identified based on the geotechnical investigations and reports conducted by ATCW.

The Scenario One - Stage 1 Tailings Deposition condition results indicate seepage flows peaking at approximately 3×10^{-7} m³/sec per meter of embankment. The Scenario Two - Stage 3 Tailings Deposition condition results indicate seepage flows peaking at approximately 5×10^{-8} m³/sec per meter of embankment.

Comparing the results, ATCW indicates that the rate of water seepage downstream of the embankment is reduced some 7-fold from Stage 1 initial conditions to the Stage 3 final height conditions. This major reduction in seepage is largely a result of tailings consolidation. Further reduction is available with the appropriate functionality of the central decant outlet tower in confining the pond to the central area of impoundment. Further reduction in seepage is also expected with the further consolidation and the corresponding reduction in the tailing's permeability of the intermediate and upper tailings materials.

Water balance is also used on site to estimate/confirm seepage rates from the facility. Water balance is a requirement of the current licence under condition 10.

Tailings Geochemical Characteristics

Geochemical characteristics of tailings were provided and assessed as part of the original licence application and subsequent amendments. The Licence holder has confirmed that TMF will not receive tailings from a different ore source during the life of the TMF raises (Stages 2 and 3). Assessment of current decant water quality and recent results of groundwater monitoring and how it has informed the risk assessment are provided in section 4.3. below.

Other infrastructure

Tailings delivery and return water pipelines

Tailings will continue to be delivered from existing tailings delivery pipeline routes (Figure 4). The slurry distribution pipework will be assembled on the embankment crest and extend around the cell's perimeter following each raised construction. Sub-aerial tailings deposition will be via spigots placed and spaced at 24m centres on the crest of the TSF cells.

Monitoring network and seepage interception trenches

The Licence Holder proposes to continue the monitoring of tailings slurry water (but sampled from decant) as per Table 7 of L9056/2017/1, and ambient groundwater as per Table 8 of L9056/2017/1. The Licence holder also proposes to continue monitoring the three additional shallow bores (installed following seepage issues identified in 2021) by adding them to Table 8 of L9056/2017/1. These bores are shown in Figure 3 below: PMB021, PMB022 (shown in yellow) and Well 5 (shown in blue on western corner of Figure 3).

As indicated above, in mid-2021, seepage trenches were constructed; namely the northern and southern seepage interception trenches, to intercept the possible TMF seepage in the alluvial channels and near surface weathered rock and convey it to a lower point in the natural alluvial channels where it was recovered and returned to the process water dam. Since this time, the southern seepage interception trench has been covered by Zone 4A material as part of the downstream expansion of the TMF embankment (Figure 3). As a result of this the seepage interception trench is currently unavailable for use.

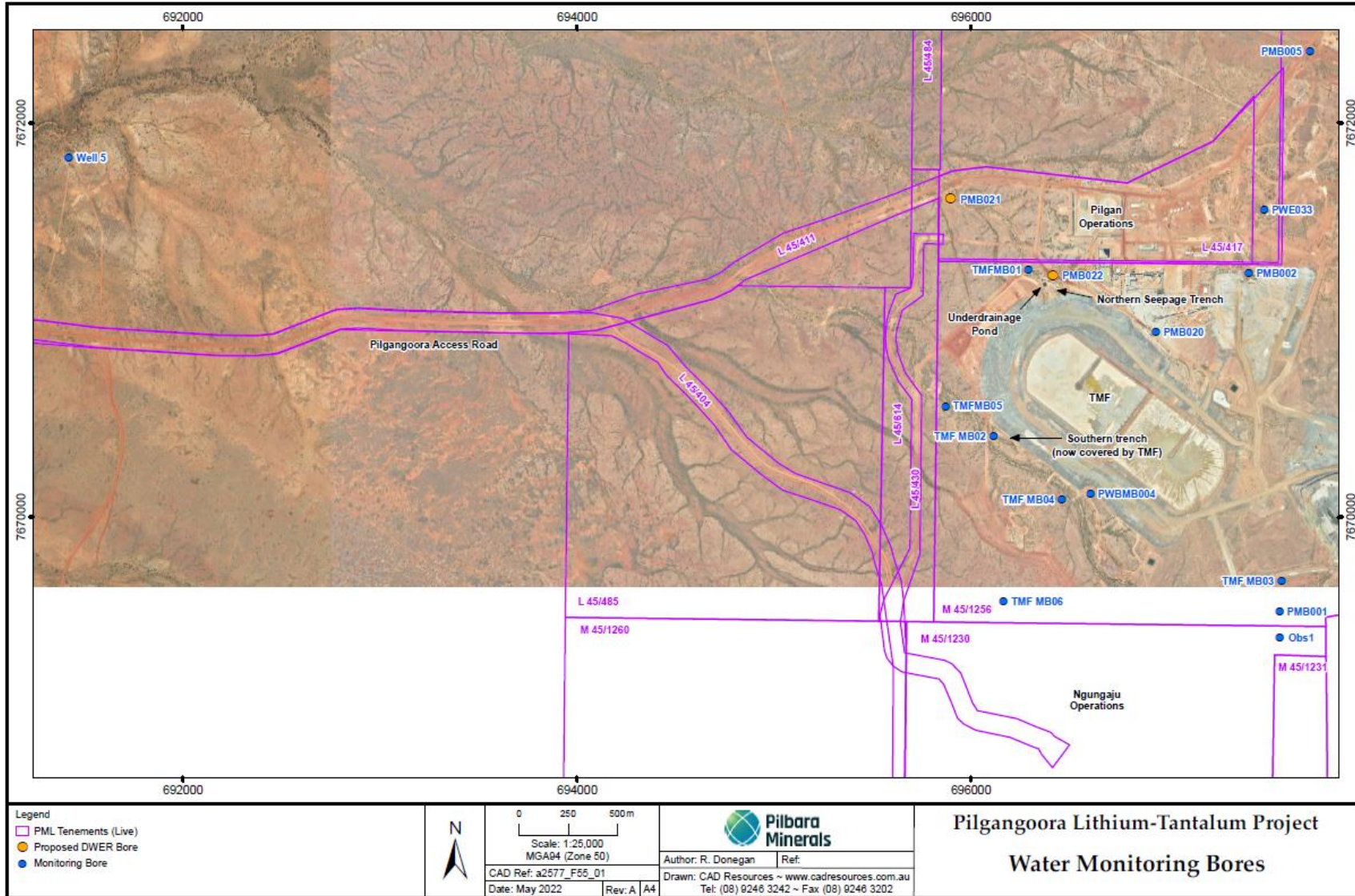


Figure 3: TMF Monitoring network, including proposed additional bores and seepage trenches.

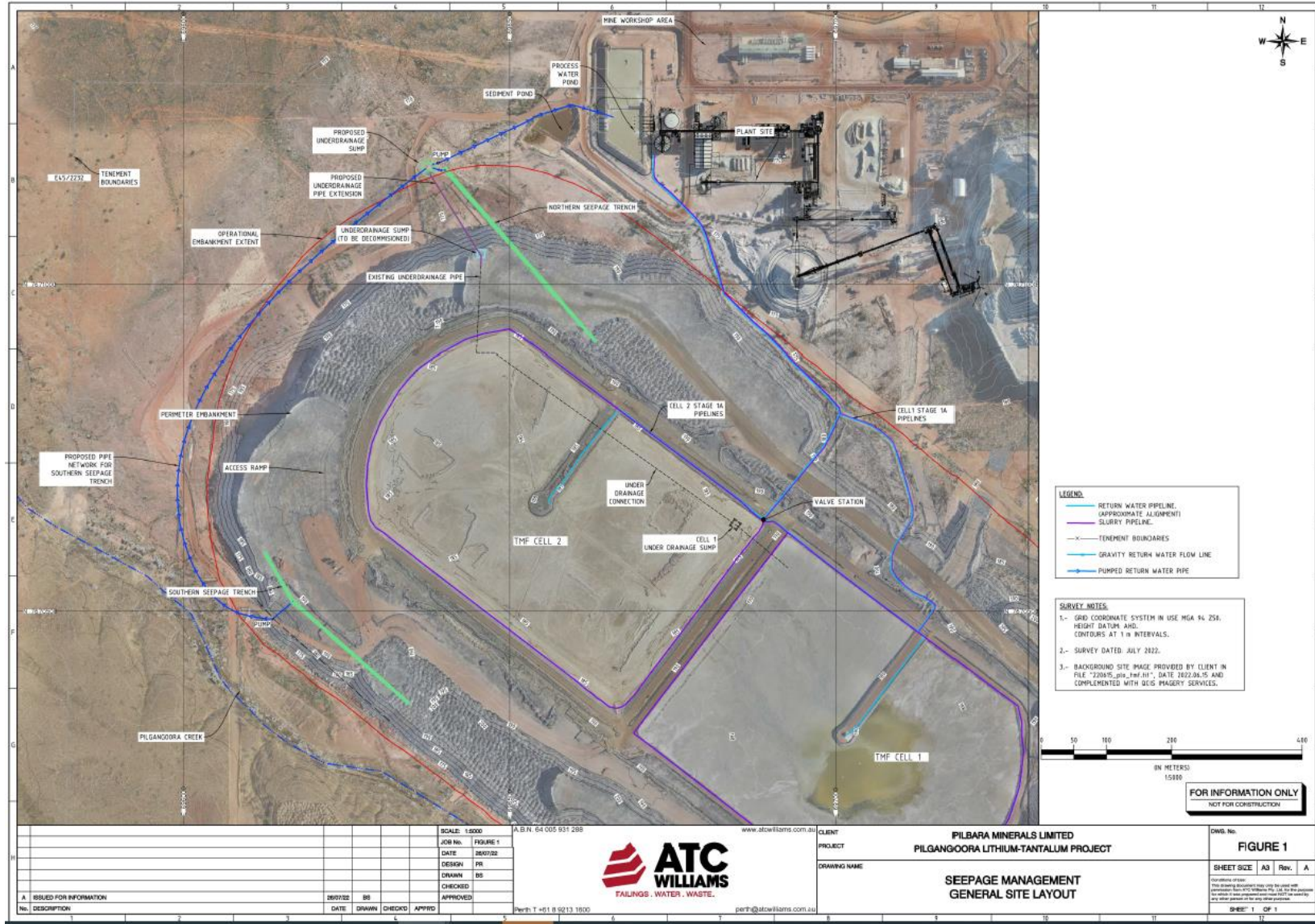


Figure 4: General configuration of pipelines and seepage management infrastructure.

Licence L9056/2017/1 August 2022

IR-T15 Amendment report template v3.0 (May 2021)

The trenches design was revisited as part of the Stage 2 and 3 design by ATC Williams (ATCW, 2022d) in July 2022. It is proposed to reinstate the southern seepage interception trench by installing a horizontal bore with a suitable conduit to drain the existing Southern Seepage trench sump as indicated in Figure 4. The concept is to drain the rockfill covered sump to a second sump outside of the rockfill zone and to pump away the seepage water using a standard electric submersible pump.

3. Technical advice received

3.1 DWER – Contaminated Sites Branch – Hydrogeologist technical advice

Internal advice from DWER's hydrogeologist from Contaminated Sites Branch was sought regarding tailings characteristics, monitoring network and suitability of seepage analysis to inform and confirm seepage rates from the TMF and proposed seepage controls. In summary the following advice was received:

- The Licence Holder has probably underestimated the environmental risks associated with seepage from the TMF. This is because it is likely that the seepage-rate from the facility has been underestimated; because inappropriate water quality criteria have been used to assess the potential impacts of seepage on environmental receptors; and because there is a mismatch between monitoring results obtained by DWER Compliance Branch with the results from existing monitoring bores on the site;
- It is likely that additional seepage control measures would be required with successive lifts for the TMF. Investigations would be required to identify the most suitable locations for these control measures before additional lifts are added to the facility; and
- The mismatch between the seepage water quality results obtained by DWER Compliance Branch and the results from existing monitoring bores at the site suggests that the current monitoring bore network is not adequate for assessing seepage from the facility. Additional geophysical investigations have been recommended to determine the location, depth and extent of seepage from the TMF. These investigations would indicate whether additional monitoring bores would be required and where they should be installed.

Details on how the technical advice above was considered in the risk assessment and addressed as part of the licence amendment are detailed in section 4.3 below.

3.2 DMIRS – Department of Mines, Industry Regulation and Safety – Environmental and Geotechnical advice

Advice from DMIRS was sought regarding proposed TMF raise and proposed landfill located within the Monster WRD.

In summary, the following advice was received:

- Mining Proposal Reg ID 63791 (since superseded by Reg ID 85615) approved construction of 9 raises to the TMF, to a total height of 60m. Approval was conditional on construction reports being provided to DMIRS upon the completion of construction of each embankment;
- The proposed landfill and associated bioremediation facilities within the Monster waste dump do not appear to have been approved via a Mining Proposal, under the *Mining Act, 1978*. DMIRS will discuss approval requirements with applicant directly;

- DMIRS is satisfied with the stage 2 and 3 design from an embankment stability point of view and construction reports submitted to date indicates that construction work carried out are in general accordance with the design intent and construction specifications; and
- DMIRS note that Pilbara Minerals, in response to DMIRS queries, has provided detail on proposed seepage management measures, which include the use of water from the TSF for dust suppression around the site. DMIRS recommends DWER to assess water quality from decant water to consider whether proposed discharge is acceptable or request additional water management measures to prevent seepage from Pilgangoora TMF.

Details on how the technical advice above was considered in the risk assessment and addressed as part of the licence amendment are detailed in section 4.3 below.

3.3 DMIRS – Department of Mines, Industry Regulation and Safety – Advice from Mines Safety Directorate

DMIRS requires the Licence Holder to have a Radiation Management Plan for the site in accordance with the requirements of the regulation 16.7 of the *Western Australian Mines Safety and Inspection Regulations 1995*. Licence Holder is also required to provide annual environmental radiation report to DMIRS.

Recent monitoring data from monitoring bores, process pond and decant water received as part of the application has been provided to DMIRS.

DMIRS has informed that decant and process water must not be used for dust suppression near camp, groundwater bore used for potable purposes or any occupied area due to radionuclides in water. Applicant also needs to consider impacts from dust suppression activities to surrounding environment (due to salinity and high metal concentration), including vegetation and migration to groundwater.

Details on how the technical advice above has been considered and addressed are detailed in section 4.3 below.

4. 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.

4.1 Source-pathways and receptors

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
Dust	Category 64: Class II <i>Putrescible and inert landfill</i> . Construction of the additional landfill cells	Air/windborne pathway	No additional controls specified. No residence or sensitive land uses within 20 km of the Premises.
Noise	Category 64: Class II <i>Putrescible and inert landfill</i> . Construction of the additional landfill cells	Air/windborne pathway	No additional controls specified. No residence or sensitive land uses within 20 km of the Premises.
Leachate	Category 64: Class II <i>Putrescible and inert landfill</i> . Increase design capacity from 10,000 tonnes to 20,000 tonnes per annum. Additional landfill constructed within Monster WRD	Seepage to soils and groundwater	The Licence Holder proposes to continue the monitoring regime under the existing Licence conditions and routine inspections. The Licence Holder proposes to extend all the operational controls from Table 6 - L9056/2017 from current landfill to the new Monster landfill.
Windblown waste	Category 64: Class II putrescible and inert landfill. Increase design capacity from 10,000 tonnes to 20,000 tonnes per annum. Additional landfill constructed within Monster WRD	Air/windborne pathway creating litter and attracting fauna	No additional controls specified.
Tailings Slurry	Category 5: Tailings pipeline leaks, ruptures or failure	Direct discharges to land	<ul style="list-style-type: none"> Continue to operate pipelines as per current licence conditions.

Emission	Sources	Potential pathways	Proposed controls
Tailings seepage	Category 5: Increased tailings seepage from increased tailings disposal	Seepage of leachate	<ul style="list-style-type: none"> • TMF Stage 2 and 3 to be constructed and operated as per designs depicted in Appendix 3. • Underdrainage systems were installed under both TMF Cells and seepage water returns have been periodically collected for the site since inception. • 2 seepage interception trenches (Northern and Southern interception trenches) have been installed to collect seepage water from the western area of Cell 2. The Southern trench design has been revisited to ensure the trench is operational as per section 2.2.3. Applicant proposes to have both trenches added into the licence as ongoing seepage controls. • Licence Holder has committed to undertake further geological and geophysical investigations to confirm seepage controls location and design. • Licence Holder has committed to undertake discharge within design assumptions (50% of solids), undertake further operator training on thickener management, and undertake ongoing removal of excess sediment from process water ponds to maintain decant pond operating levels and minimize seepage. • A new TMF decant pump (30L/s) has been installed providing an increased capacity to recover water from the TMF. • Licence Holder has committed to update TMF operations manual to address audit recommendations, additional water management controls and design requirements for Stage 2 and 3. • Licence Holder has committed to refine current water balance for the TMF to further inform seepage rates and controls.

Emission	Sources	Potential pathways	Proposed controls
Tailings material	Category 5: Overtopping of tailings from increased tailings disposal	Direct discharges to land	<ul style="list-style-type: none"> • TMF Stage 2 and 3 to be constructed and operated as per designs depicted in Appendix 3. • Licence Holder has committed to undertake discharge within design assumptions (50% of solids), undertake further operator training on thickener management, and undertake ongoing removal of excess sediment from process water ponds to maintain decant pond operating levels and minimize seepage. • A new TMF decant pump (30L/s) has been installed providing an increased capacity to recover water from the TMF. • Commitment to have the maximum operating pond depth at decant tower of 1.3 m. • Licence Holder has committed to update TMF operations manual to address audit recommendations, additional water management controls and design requirements for Stage 2 and 3. • Raised cells are designed to comply with the DMIRS storm storage and total freeboard requirements of 0.5 m. • Directional discharge control at the spigots to be managed on a daily basis to maintain an overall drainage gradient towards the pond area, prevent long term ponding in areas other than the designated decant area and minimise drying beach thickness. As far as practicable, channel flows originating from the discharge points to not be permitted to intersect on the beach. A target “wet” layer thickness of a maximum 250 mm to be deposited on each deposition cycle.

Emission	Sources	Potential pathways	Proposed controls
Dust	Category 5: Increased tailings storage within the TSF	Air/windborne pathway	<ul style="list-style-type: none"> Regular rotation of deposition within active cells to ensure the areas of dry tailings is minimised during operations. Planning lifts of the TMF to minimise excessive drying of tailings. Application of dust suppression (water) during construction. When required, use of dust suppressors/polymers to retain dust in place. Visual inspections of the TMF at least twice a day, including a visual monitoring of dust conditions. Installation of five DDGs (dust deposition gauges) within 1 km from the TMF, to assess dust quantities coming off the facility. These are collected monthly.

Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded employees, visitors, and contractors of the Licence Holder 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 because 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
Residential Premises	Wallareenya Homestead more than 30 km north of the Premises. Indee Station more than 30 km northwest of the Premises. South Hedland more than 75 km north of the Premises. Screened out receptors due to distance from prescribed activity.
Altura Lithium Operations Pty Ltd Accommodation Camp (ex-Roy Hill Infrastructure Rail Construction Camp 2)	More than 20 km from the Premises. Screened out receptors due to distance from prescribed activity.
Wodgina Mine Camp	More than 30 km southwest of the Premises. Screened out receptors due to distance from prescribed activity.
Industrial receptors	Altura Pilgangoora Project adjacent tenements (M45/1230 and M45/1231), 3 km southwest.

	<p>Wodgina Mine >30 km southwest of the Premises.</p> <p>Screened out receptors due to distance from prescribed activity.</p>
Environmental receptors	Distance from prescribed activity
Threatened/Priority Flora	<p>No threatened or priority flora has been identified using publicly available GIS datasets.</p> <p><i>Pityrodia</i> sp. Marble Bar has been identified as possible to occur in the survey area.</p>
Threatened/Priority Fauna	<p>Conservation significant species have been recorded in the survey area. These include the Rainbow Bee-eater listed under the <i>EPBC Act</i>, the Pilbara Leafnosed bat listed under the <i>EPBC Act</i>, and the Western Pebble-mouse listed under the <i>Wildlife Conservation Act 1950 (WA)</i>.</p>
Threatened Ecological Communities and Priority Ecological Communities	<p>There are no known Threatened Ecological Communities or Priority Ecological Communities within or in a 30 km radius of the Premises.</p>
Department of Biodiversity, Conservation and Attractions - Managed Lands and Waters	<p>Mungaroo Range Nature Reserve boundary is located approximately 82 km south-west of the Premises.</p>
Public Drinking Water Sources Area (PDWSA)	<p>There are no PDWSA within the Premises.</p>
RAMSAR wetland	<p>No RAMSAR wetlands within 30 km radius of the Premises.</p>
Surface water and groundwater resources	<p>There are two freshwater creeks within the Premises boundary (Houston – 120 m from proposed landfill and Pilgangoora Creek, within 100 m of TMF) that flow during high rainfall events. The Pilgangoora Creek catchment is 18.1 km² and drains in a roughly east to west direction across the Project site. This catchment ultimately reports to the Turner River downstream (west) of the Project site.</p> <p>The depth to groundwater within the vicinity of the TMF area and is around 5 m and approximately 9 m in the landfill area.</p> <p>Groundwater in the area predominantly occurs as fractured bedrock aquifers, with a regional groundwater flow direction towards the west, away from the groundwater divide (which is located to the east of the project), and locally towards Pilgangoora Creek.</p> <p>Groundwater salinities in the area are typically fresh to slightly brackish, ranging from about 400 to 3,000 mg/L Total Dissolved Solids (TDS).</p>

4.2 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 considers potential source-pathway and receptor linkages as identified in section 3.1.2. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the Licence Holder has proposed mitigation measures/controls (as detailed in section 3.1.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the Licence Holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

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

The Revised Licence L9056/2017/1 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises i.e., Category 5: Processing or beneficiation of metallic or non-metallic ore and Category 64: Class II putrescible and inert landfill operations.

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 construction and operation

Risk event number	Risk events					Risk rating ¹ C = consequence L = likelihood	Applicant controls sufficient?	Conditions ² of works approval	Justification for additional regulatory controls
	Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
Construction									
1	Cat 5: Construction activities associated with TMF raise and vehicle movement	Dust	Air / windborne pathway causing impacts to vegetation health due to dust deposition leading to reduced ability for photosynthesis and smothering	Surrounding Vegetation, including vegetation that fringes the creek bed	Refer to Section 3.1	C = Slight L = Possible Low Risk	Y	N/A	No residences or sensitive land uses within 20 km of the Premises. The Delegated Officer considers that construction works are temporary and that the provisions of the <i>Environmental Protection (Noise) Regulations 1997</i> and section 49 of the EP Act are sufficient to regulate noise and dust emissions during construction of the TMF raise.
2		Noise	Windborne noise which may disrupt nocturnal foraging behaviour	Fauna (including the Rainbow Bee-eater, the Pilbara Leafnosed bat and the Western Pebble-mouse)	Refer to Section 3.1	C = Slight L = Unlikely Low Risk	Y	N/A	
3	Category 64: Class II Putrescible and inert landfill. Construction of the additional landfill cells within Monster WRD	Dust	Air / windborne pathway causing impacts to vegetation health due to dust deposition leading to reduced ability for photosynthesis and smothering	Surrounding Vegetation, including vegetation that fringes the creek bed	Refer to Section 3.1.1	C = Slight L = Rare Low Risk	Y	N/A	No residences or sensitive land uses within 20 km of the Premises. The Delegated Officer considers that construction works are temporary and that the provisions of the <i>Environmental Protection (Noise) Regulations 1997</i> and section 49 of the EP Act are sufficient to regulate noise and dust emissions during construction of the landfill.
4		Noise	Windborne noise which may disrupt nocturnal foraging behaviour	Fauna (including the Rainbow Bee-eater, the Pilbara Leafnosed bat and the Western Pebble-mouse)	Refer to Section 3.1.1	C = Slight L = Rare Low Risk	Y	N/A	

Risk event number	Risk events					Risk rating ¹ C = consequence L = likelihood	Applicant controls sufficient?	Conditions ² of works approval	Justification for additional regulatory controls
	Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
Operations									
5	Cat 5: Deposition of tailings into raised TMF	TSF supernatant containing concentrations of elements with environmental significance (radionuclides; metals and metalloids)	Increase in Seepage / Infiltration of supernatant water through basin and embankments resulting in reduced groundwater quality.	Groundwater (>4 m bgl with west directional flow).	Refer to Section 3.1	C = Moderate L = Possible Medium Risk	N	<p><u>Conditions</u> <u>2, 3, 5, 9, 10, 11, 12, 13, 14, and 23.</u></p> <p><u>Reporting Conditions</u> <u>17 to 22</u></p>	<p>Following a review of current performance of the TMF, increase in seepage is deemed possible, with further regulatory controls being required to ensure water management within the facility is improved and risk of seepage impacting groundwater and associated ecosystems are reduced.</p> <p>Stage 2 and 3 design specifications and new controls proposed by Licence Holder are being added as a requirement in the licence.</p> <p>As per internal DWER hydrogeological advice received (refer to section 3.1 and 4.3) seepage controls need to be supported by geological and geophysical investigations in an area. These need to be undertaken to confirm seepage controls design and location prior to continued discharge of tailings.</p> <p>Monitoring networks also need review based on results from geological and geophysical investigations in the area.</p> <p>A detailed review of suitability and effectiveness of the current seepage infrastructure and monitoring network based on results of geological and geophysical investigations to be undertaken.</p> <p>Further details are provided in Section 4.3</p>

Risk event number	Risk events					Risk rating ¹ C = consequence L = likelihood	Applicant controls sufficient?	Conditions ² of works approval	Justification for additional regulatory controls
	Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
6			Groundwater mounding resulting in seepage expression on surface, impacting vegetation and reducing surface water quality.	Land/soils Surface water (100m south of TMF) including its potential hyporheic community and vegetation that fringes the creek bed.	Refer to Section 3.1	C = Moderate L = Possible Medium Risk	N	<u>Conditions 2, 3, 5, 9, 10, 11, 12, 13, 14, and 23.</u> <u>Reporting Conditions 17 to 22</u>	Following a review of current performance of the TMF, further regulatory controls are deemed required to ensure water management within the facility is improved to minimize the risk of surface expression of TMF seepage. Stage 2 and 3 design specifications and new controls proposed by the Licence Holder are being added as a requirement in the licence. Monitoring of standing water level to continue as per current licence conditions. Further details are provided in Section 4.3
7			Overtopping of tailings resulting in direct discharges to land and infiltration to soil resulting in reduced soil and surface water quality and impacting health of surrounding vegetation	Surrounding Vegetation Land/soils Surface water (100m south of TMF) including its potential hyporheic community and vegetation that fringes the creek bed.	Refer to Section 3.1	C = Moderate L = Possible Medium Risk	N	<u>Conditions 2, 3, 5, 9, 10, 11, 12, 13, 14, and 23.</u> <u>Reporting Conditions 17 to 22</u>	Following a review of current performance of the TMF, further regulatory controls are deemed required to ensure water management within the facility is improved to minimize risks related to overtopping of tailings. Stage 2 and 3 design specifications and applicant new controls proposed by the Licence Holder are being added as a requirement in the licence. Further details are provided in Section 4.3
8		Dust	Air / windborne pathway causing impacts to vegetation health due to dust deposition leading to reduced ability for photosynthesis and	Surrounding Vegetation including vegetation that fringes the creek bed.	Refer to Section 3.1	C = Slight L = Possible Low Risk	Y	N/A	

Risk event number	Risk events					Risk rating ¹ C = consequence L = likelihood	Applicant controls sufficient?	Conditions ² of works approval	Justification for additional regulatory controls
	Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
			smothering						
9	Tailings delivery and return water pipelines	Spillage of tailings and decant return water through leaks, pipeline ruptures or failure	Direct discharges to land and infiltration to soil resulting in reduced soil and surface water quality and impacting health of surrounding vegetation	Land/soils Surrounding Vegetation Surface water (it crosses the pipeline route)	Refer to Section 3.1	C = Moderate L = Possible Medium Risk	Y	<u>Conditions 2, 3, 5, 9, 10, 11, 12, 13, 14, and 23.</u> <u>Reporting Conditions 17 to 22</u>	Additional regulatory controls not considered necessary as there is no proposed change to current tailings delivery and return water infrastructure and management, apart from spigots placement in raised embankments. Conditions related to delivery pipelines and return water pipeline are in place under current licence L9056/2017/1.
10	Category 64: Class II putrescible and inert landfill. Increase design capacity from 10,000 tonnes to 20,000 tonnes per annum.	Leachate	Seepage into soils and groundwater from the base of the landfill cells	Groundwater	Refer to Section 3.1.1	C = Slight L = Possible Low Risk	Y	Condition 2, 4, 5 (Table 6)	The Delegated Officer considers that current licence conditions are sufficient to manage risk of seepage from landfill into groundwater and windblown waste.
11	Include landfill within Monster WRD	Windblown waste	Air/windborne pathway creating litter and attracting fauna	Surrounding Vegetation and Fauna	Refer to Section 3.1.1	C = Slight L = Possible Low Risk	Y	Condition 2 4, 5 (Table 6)	

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.

4.3 Detailed risk assessment – Tailings deposition into raised TMF Stage 2 and 3

Assessment of current TMF performance to inform seepage and overtopping risks

Assessment of current TMF performance was undertaken to further inform risks related to increase in seepage and overtopping of proposed raised TMF. During the assessment, the following was reviewed:

- Latest TMF audit and surveillance reports.
- Monitoring data as required by current licence conditions.
- Current seepage from the TMF and effectiveness of existing and proposed infrastructure for seepage controls.
- Seepage analysis undertaken, including suitability of site water balance to estimate and confirm seepage rates.
- Effectiveness of current monitoring network and water quality criteria being used.

Details of results of assessment of the above information and how it has informed the risk assessment of the performance of the TMF and additional regulatory controls are provided below.

Audit and Surveillance Reports

Following a review of the most recent TMF audit report from November 2021 (ATCW, 2021) and surveillance report from February 2022 (ATCW, 2022) the Delegated Officer notes:

- The audit found that several of the 25 recommendations of the prior audit had not been fully addressed by site or company management in the past 12 months.
- One of the issues of high concern of the audit and surveillance report was that the density of the tailings (percentage of solids) being deposited was less than the design assumptions. The lack of remedial action to address this and other recommendations in the past 12 months has resulted in the density of the tailings being again slightly less than design. The issue is that without appropriate attention to the percentage of solids, there can be a compromise to the individual cell capacity and the long-term storage capacity of the TMF. The Delegated Officer also understands that continually discharging at lower percentage of solids means more water into the facility and the generation of additional seepage, potentially increasing risks to the environment.
- The storm storage capacity in Cell 2 (Stage 1A) was compromised toward the end of tailings deposition into the Cell. As at 31 December 2021 the estimated remaining storage volume in Cell 1 to RL189.3 (including 500 mm freeboard) was marginal. With the Cell continuing to be used throughout January 2022, the flood storage capacity and the nominal minimum free board of 500 mm would likely be impacted. The low tailings percentage solids and the probable lower than design in-situ density of the tailings placed into a design volume based on different assumptions was the probable cause.
- Operating decant ponds are too large and should be reduced in size and volume. It is suggested that the volume of water pumped to the TMF could be reduced by increasing the percentage solids of the tailings, also the return water rate of pumping could be increased. Generally, the pond size could be better managed by improved tailings deposition.
- Further development of data to support water balance was required. The tonnage and

volume of tailings being deposited was being recorded, but the volume deposited per month per Cell was not yet being measured. Without the monthly volume being recorded the deposited in-situ density could not be assessed. Improvements to water balance were recommended.

- The current operations manual needs some revision to fully meet DMIRS requirements and address some of the operational issues raised above.

Based on the above, the Delegated Officer concluded that additional controls are required to ensure TMF performance is improved and risks to environment relating to seepage and overtopping are minimised. Following discussions with the Licence Holder during assessment of the application, commitments were made regarding improvement of water management, with additional controls proposed to be implemented to ensure TMF is operated as per design assumptions (including % of solids of discharged tailings). The Licence Holder also demonstrated that actions have been completed or are being taken to implement the recommendations made in the 2021 TSF audit report (refer to Licence Holder controls described in Table 2 above).

To ensure these improvements are incorporated as part of ongoing operations of the TMF and ensure likelihood of risk events 5, 6 and 7 in Table 4 above are not increased, current licence conditions have been amended to include the Licence Holder's proposed additional controls (please refer to section 4.4).

Current Monitoring Data

A review of the current monitoring data requested to be provided as part of the assessment of the application and provided as part of the Annual Environmental Report (AER) – (Pilbara Minerals, 2022) was performed, the following are noted:

Flotation Tailings Slurry/Decant Water Monitoring

The Delegated Officer notes that current water quality of flotation tailings slurry being deposited onto TMF has not been provided in AERs as required by the licence condition 11. Decant water quality has been monitored instead and results provided as part of the AERs. Recent exceedances against ANZECC (2000) Livestock Drinking Standard for Fluoride and Gross Alpha are noted (shown in bold on Table 5).

Table 5: TMF Decant water quality

Field	19-Dec-18	12-Feb-19	12-Aug-19	06-Feb-20	06-Apr-20	09-Aug-20	23-Mar-21	22-Apr-21	19-Sep-21	07-Feb-22	26-Jun-22
Ammonia, NH3 (mg/L)				<0.05	0.3	0.52	0.39	0.08	0.56	<0.05	0.08
Arsenic, As (mg/L)	0.005	0.019	0.009	0.005	0.02	0.008	0.006		0.009	0.011	0.008
Bicarbonate Alkalinity as HCO3 (mg/L)	240	280	400	320	330	240	320	220	160	290	230
Bismuth, Bi (mg/L)			<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	0.003	<0.001
Caesium, Cs (mg/L)			0.045	0.04	0.055	0.031	0.068		0.2	0.1	0.11
Calcium, Ca (mg/L)	240		87	72	160	110	140	130	120	100	110
Carbonate Alkalinity as CO3 (mg/L)	<1	<1		<5	<1	<5	<5	<5	<5	<5	<5
Chloride, Cl (mg/L)	360	920	330	360	370	380	420	330	330	280	280
Cobalt, Co (mg/L)	0.009	0.005	0.007	0.008	0.007	0.005	0.016		0.002	0.002	0.004
Conductivity @ 25 C (µS/cm)		6,000	2,300	2,200	3,100	2,800	3,300	2,900	3,000	2,500	2,400

Field	19-Dec-18	12-Feb-19	12-Aug-19	06-Feb-20	06-Apr-20	09-Aug-20	23-Mar-21	22-Apr-21	19-Sep-21	07-Feb-22	26-Jun-22
Fluoride by ISE (mg/L)	1.5	2.2	1.1	1.2	1.1	1.4	1.5		2.9	2.6	2.7
Gross Alpha (Bq/L)			0.684	1.06			0.848		1.03	1.23	1.11
Gross Beta (Bq/L)			0.065	0.128			0.075		0.135	0.178	0.101
Hexavalent Chromium, Cr6+ (mg/L)				<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001
Iron, Fe (mg/L)	0.16	3,000	580	38	2,700	480	760		0.38	0.75	0.45
Lithium, Li (mg/L)	18	25	8.1	4.9	14	16	19	13	18	11	15
Manganese, Mn (mg/L)	3.6	5.2	0.091	0.24	3.5	1.5	1.1		0.35	0.38	0.61
Mercury (mg/L)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005			<0.00005	<0.00005
Nickel, Ni (mg/L)	0.018		0.051	0.014	0.023	0.006	0.033		0.026	0.013	0.024
Niobium, Nb (mg/L)			<0.005	<0.005	<0.005	<0.005	<0.005		<0.005	<0.005	0.012
Nitrate, NO3 as NO3 (mg/L)	0.08	0.21	8.7	0.08	0.07	1.2	0.3	3.1	12	<0.2	9.7
Nitrite, NO2 as NO2 (mg/L)	<0.05	0.05	0.54	<0.05	<0.05	<0.2	<0.2	2.1	1.2	<0.2	1.4
pH** (pH Units)	8.2	7.8	8.2	8.2	7.8	7.9	8	7.9	7.9	8.1	8
Potassium, K (mg/L)	50		32	23	53	52	59	66	79	60	75
Radium-226 (Bq/L)				<0.039			<0.046		0.13	0.183	1.25
Radium-228 (Bq/L)				<0.13			<0.068		<0.14	0.082	<0.18
Rubidium, Rb (mg/L)			0.75	0.97	1.5	1	1.8		3.3	1.9	1.9
Sulfate, SO4 (mg/L)	1,500	2,000	400	300	910	740	930	790	830	650	690
Total Alkalinity as CaCO3 (mg/L)	200	230	330	260	270	200	260	180	130	240	190
Total Aluminium (mg/L)	0.22	1.8	0.42	0.026	0.89	0.026	0.26		0.7	0.83	1.1
Total Antimony (mg/L)	<0.001	<0.002		0.001	<0.001	<0.001	<0.001		0.001	0.001	0.004
Total Barium (mg/L)	0.12	0.15		0.14	0.17	0.12	0.099		0.011	0.013	0.01
Total Boron (mg/L)	0.57	1.2		0.48	0.57	0.54	1		0.67	0.49	0.54
Total Cadmium (mg/L)	0.0001	0.0005	0.0002	<0.0001	0.0001	<0.0001	<0.0001		0.0003	0.0001	0.0003
Total Chromium (mg/L)	0.003	0.016	0.004	<0.001	0.015	<0.001	0.003		0.002	0.002	0.002
Total Copper (mg/L)	0.008	0.008	0.005	0.012	0.007	<0.001	0.002		0.004	0.001	0.004
Total Dissolved Solids Dried at 175-185°C (mg/L)	2,800	4,300	1,400	1,300	2,200	1,900	2,200	1,900	2,100	1,700	1,700
Total Hardness (mg CaCO3/L)			660	520	870	670	710		570	520	500
Total Lead (mg/L)	<0.001	0.002	<0.001	<0.001	0.001	<0.001	<0.001		0.001	<0.001	0.001
Total Magnesium (mg/L)			110	82	110	97	85		65	64	59
Total Molybdenum (mg/L)	0.042	0.038	0.055	0.03	0.031	0.039	0.03		0.068	0.037	0.041

Field	19-Dec-18	12-Feb-19	12-Aug-19	06-Feb-20	06-Apr-20	09-Aug-20	23-Mar-21	22-Apr-21	19-Sep-21	07-Feb-22	26-Jun-22
Total Phosphorus (mg/L)				<0.05	0.06		<0.05		0.38	<0.05	0.43
Total Selenium (mg/L)	0.002	<0.002	0.003	0.003	<0.001	0.001	0.002		0.004	0.002	0.004
Total Silicon, Si (mg/L)			19	13	14	12	11		8.8	16	12
Total Silver (mg/L)				<0.001	0.001	0.002	<0.001		<0.001	<0.001	<0.001
Total Sodium (mg/L)			280	220	300	330	370		340	260	260
Total Strontium (mg/L)				0.45	0.74	0.68	0.77		0.62	0.48	0.42
Total Tantalum, Ta (mg/L)							<0.01		<0.01	<0.01	<0.01
Total Thallium (mg/L)			<0.001	0.002	<0.001	<0.001	0.003		0.004	<0.001	0.003
Total Thorium (mg/L)	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	0.003
Total Tin (mg/L)	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001
Total Uranium (mg/L)	0.008	0.003	0.014	0.035	0.022	0.019	0.033		0.026	0.035	0.027
Total Vanadium (mg/L)	0.005	0.05		0.018	0.007	0.003	0.013		<0.001	0.002	<0.001
Zinc, Zn (mg/L)	0.04		0.025	0.007	0.067	<0.005	0.058		0.009	0.006	0.014

The Licence Holder proposes to continue the monitoring of tailings slurry water (but sampled from decant) as per Table 7 of L9056/2017/1.

Internal hydrogeological advice was sought regarding monitoring of decant water instead of tailings slurry water and the suitability of this data to inform risk assessment and controls on site. Advice received indicated that the chemical composition of water that is discharged from the tailings slurry to the decant pond is not necessarily indicative of pore-water quality near the base of the tailings pile. It is recommended in addition that a shallow bore is installed between the base of the TMF and the existing interception trenches to obtain water samples that would be more representative of pore-water quality near the base of the tailings pile. A condition has been added to the licence requiring applicant to review current monitoring bore locations and determine the location of additional bore or monitoring point near the base of the TMF for ongoing tailings pore-water quality monitoring (refer to section 4.4).

As part of the Licence Holder's commitment to improve water management within the TMF and minimise water within the decant pond, it has been proposed to use decant water from TMF/process water pond and TMF seepage recovery water for dust suppression activities within the purple area shown in Figure 5 below. The Licence Holder has committed to limiting dust suppression within the area in purple (all cleared/disturbed areas) and confirmed water carts will be fitted with sprays and dribble bars that can be adjusted to reduce overspray and avoid runoff. Licence Holder expects that up to 15,000m³ per month (180,000m³ per year) will be used for dust suppression in the purple area.

DMIRS was consulted a second time (details of first consultation is provided in section 3.2 and 3.3. above) regarding Licence Holder's proposed strategy and confirmed that the use of decant or seepage water is permitted for dust suppression activities within the purple shaded area in Figure 5. DMIRS also advised that use of this water may negatively impact the environment (e.g. vegetation) due to high salinity and metal concentrations if not properly managed; and migration of the decant water to the groundwater must be considered and monitored. DMIRS

has also indicated that a copy of the safe work instructions that will be provided to the drivers tasked to carry out the dust suppression within the purple shaded area will be required to be provided to DMIRS, demonstrating controls in place to minimise impacts to surrounding environment and migration to groundwater.

In order to address DMIRS comments and minimise risks to the environment, Condition 2, Table 3 has been modified to authorise the discharge of decant/seepage water into process water pond or used for dust suppression within the purple shaded area only, as shown in Figure 5. Water carts must be fitted with sprays and dribble bars that can be adjusted to avoid overspray and runoff, minimizing risks to surrounding vegetation (Condition 5, Table 6) . The Licence holder is required to continue monitoring groundwater surrounding the TMF area (Condition 12, Table 8) and undertake quarterly visual monitoring of the vegetation condition surrounding the purple shaded area (Condition 2, Table 3). Discharge volumes of water used for dust suppression within the purple area is limited via Condition 3, Table 4. Discharged volumes must be reported via condition 10 and 23.

Licence Holder is also reminded of its obligations under other relevant legislation (e.g. *Mines Safety Act, 1994* and *Rights in Water and Irrigation Act 1914*) regarding monitoring of groundwater quality within the mine site area and reporting requirements.

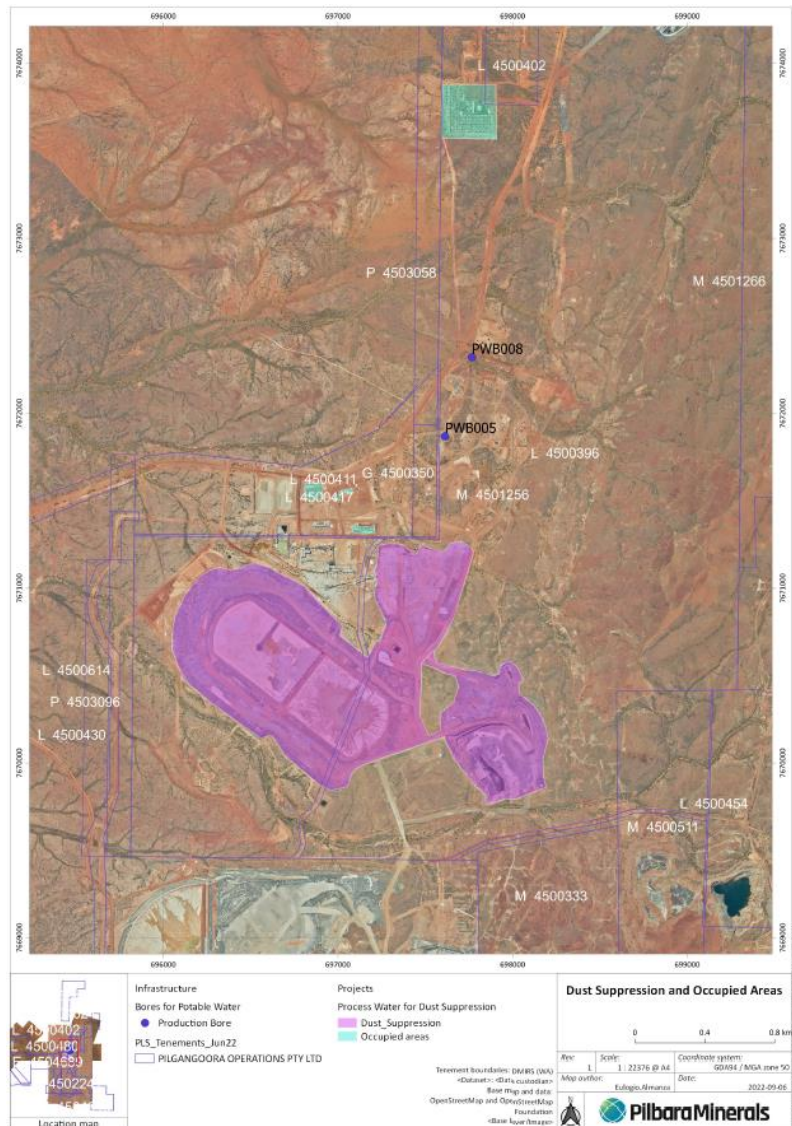


Figure 5 – Proposed dust suppression area.

Ambient Groundwater Monitoring

Monitoring of ambient groundwater is currently undertaken as per condition 12 and Table 8 of current licence on TMFMB01, TMFMB02, PMB001, PWE033, PWB005, TMFMB03, TMFMB04, TMFMB05, TMFMB06 and PWBMB004 as shown in blue on Figure 3.

The following is noted, after a review of monitoring data provided from July 2020 to July 2022 by the Licence Holder in support of the application (Pilbara Minerals, 2022):

- Limits based on the Livestock drinking water quality in ANZECC/ARMCANZ guidelines are currently imposed in the licence for pH, Nitrate, Nitrite, TDS, Sulfate, Magnesium, Aluminium, Arsenic, Boron, Cadmium, Chromium, Cobalt, Fluoride, Lead, Mercury, Molybdenum, Nickel, Selenium, Uranium, Vanadium, Zinc. For these parameters, no exceedances were noted with one exception for Fluoride reaching 2.3 mg/L in September 2021 on PWE033 (current limit is 2 mg/L).
- Triggers for Gross alpha, Gross Beta, Radium 226, and Radium 228 are also determined in the current licence. Trigger exceedances are noted for Gross Alpha on PMB001, PWBMB004, TMFMB01 and TMFMB04 and for Gross Beta on TMFMB06, TMFMB05, TMFMB04, TMFMB03, TMFMB02, TMFMB01, PWBMB004 and PMB001. There were no exceedances noted for Radium 226 and Radium 228 during the period.
- A high-level review of the monitoring data undertaken by ATC Williams as part of the quarterly surveillance report (ATCW, 2022a), shows non-compliances with monitoring regime established in the licence. The Licence Holder is reminded to ensure monitoring and associated sampling occurs in accordance with the licence requirements.

The Delegated Officer notes that the current AER does not provide an interpretation of monitoring data or compare data with previous reporting years to identify any trends. The current AER condition has been modified as part of this amendment to ensure interpretation of data is provided to DWER as required (further details are provided in section 4.4 below).

As part of the application, the Licence Holder proposed to continue the monitoring of ambient groundwater as per Table 8 of L9056/2017/1. The Licence Holder also proposed to add the three shallow bores recently installed following seepage issues identified in 2021, by adding them to Table 8 - L9056/2017/1. These bores are shown in Figure 3 above: PMB021, PMB022 (shown in yellow) and Well 5 (in blue on western corner). The proposed modifications are made as per section 4.4.

Monitoring of Standing Water Levels

Exceedances of standing water level (SWL) were also reported as part of the latest reporting documents (Pilbara Minerals, 2022), indicating that seepage and groundwater mounding is occurring. Additional controls regarding the TMF water management are deemed required to ensure seepage is minimised. These controls have been added to the licence as detailed in section 4.4 below.

Current seepage from TMF

As described in section 2.2.2 above, water ponding at the downstream toe of Cell 2 of the TMF was observed towards end March 2020 and during DWER Compliance Branch inspection of the site, in 2021. At several locations the bed of a downstream creek was observed to be damp. The investigations that were undertaken by DWER Environmental Compliance indicated that seepage from the TMF had travelled downstream of the facility in a creek. It is understood that the likely receptors for specific chemical constituents in this water are likely to be:

- Macroinvertebrates that could inhabit saturated sediments in the hyporheic zone beneath the creek bed; and

- Vegetation that fringes the creek bed.

The most sensitive receptors are likely to be the hyporheic fauna beneath the creek bed, and concentrations of chemical constituents that exceed the ANZECC/ARMCANZ trigger values for the protection of aquatic ecosystems can have the potential to cause harm to these organisms. On this basis, concentrations of arsenic, nickel and nitrate could be of environmental concern in water that was sampled by DWER Environmental Compliance downstream of the TMF.

Additionally, the concentration of lithium that was measured at this point (3.6 mg/L) could be potentially harmful to hyporheic organisms beneath the creek bed. Although it is noted there is currently no ANZECC/ARMCANZ trigger value for this metal.

Current and proposed seepage Infrastructure

In addition to existing underdrainage infrastructure (cut off drains) and as described in section 2.2.2 above, following seepage issues identified 2020 and 2021, seepage trenches were installed to capture seepage from the base of the TMF. The latest audit report (ATCW, 2021) suggests that these trenches have been effective in reducing the size of pools near the TMF, which are the surface expression of seepage in creek beds adjacent to the facility.

The trenches design was revisited as part of the Stage 2 and 3 design by ATC Williams (ATCW, 2022c) and the Licence Holder proposes to have them added to the licence as ongoing seepage controls.

Internal advice was sought regarding suitability of these trenches and whether additional seepage controls are required to minimize risks to receptors, including hyporheic organisms and vegetation that fringes creek beds.

Advice received indicates these interception trenches are considered only to be a stopgap measure, and they may not be effective in capturing the increased rate of seepage that would probably be induced as successive lifts are added to the TMF. Under these conditions, there would be an increased risk that groundwater flowlines from the TMF would pass beneath cut-off drains and interception trenches, particularly if basement rocks in the area were to contain highly permeable fracture zones (Fortuna *et al.*, 2021).

Consequently, with future lifts of the facility, additional seepage control measures may be required, including the use of bores to capture seepage or to create hydraulic barriers to prevent the movement of contaminated groundwater, or the use of engineered cut-off walls to prevent the movement of seepage in the sub-surface (Fortuna *et al.*, 2021). In order to correctly locate these seepage control measures, it would be important that fracture zones in bedrock are identified that are likely to be major conduits for groundwater flow from the TMF. This could be done by:

- Reviewing baseline geological/hydrogeological information for the area to identify all major linear structures that could potentially transmit groundwater; and by
- Undertaking ground-based geophysical investigations to directly identify current and potential seepage pathways from the TMF.

Following discussions with the Licence Holder and in response to a request for further information, the Licence Holder has informed that an electromagnetic survey has been commissioned with field works planned to be undertaken in August 2022. This assessment is expected to provide clarity on geological formations that may be present as preferential seepage paths around TMF and further inform monitoring network and seepage controls. The Licence Holder has committed to provide the results of the survey to DWER on completion for assessment. These will be added as a requirement into amended licence (further details provided in section 4.4).

Seepage analysis and Water Balance

As indicated in section 2.2.2 above, updated seepage analysis were undertaken to inform seepage rates for the TMF - Stage 2 and 3 (ATCW 2022c). ATCW indicates that reduction in seepage from the raised TMF is likely to occur with the appropriate functionality of the central decant outlet tower in confining the pond to the central area of impoundment and due to consolidation of tailings material.

Water balance is also used to estimate/confirm seepage rates from the facility. Water balance is a requirement of the current licence under condition 10.

A review of how water balance is calculated for the site was undertaken to ensure seepage rates are confirmed and appropriately used to inform seepage risks and controls on site on an ongoing basis.

The seepage rate in the water balance is the difference of the sums of the inputs to, and the sums of the outputs from the facility, where it was assumed that all of the other components of the water balance could be measured or estimated with a high level of accuracy. This is likely to be the case at the Pilgangoora site for all directly measurable components of the water balance, with the exception of evaporation.

The evaporation data that was used in the water balance assessment was taken from a Bureau of Meteorology (BoM) monitoring station that is located at some distance from the Pilgangoora mine-site. However, as evaporation rates are highly sensitive to site-specific factors, this has the potential to give misleading results, as there may be a very poor correlation between data collected at a BoM measuring station and at a mine-site (see *e.g.*, McJannet *et al.*, 2017).

Although the approach used to estimate the seepage rate from the Pilgangoora TMF is considered to be correct, it is concluded that there are large uncertainties in this estimate due to problems with measuring evaporation rates and in applying pan-factors to the surface of the facility.

These uncertainties could be greatly reduced by installing an evaporation pan on a site near the TMF, and by collecting daily to weekly evaporation data.

Following discussions with Licence Holder and considering their preference to continue using BoM at Marble Bar, the Delegated Officer considers this to be acceptable, provided the below is followed:

- (i) it is assumed that the pan factor used with these data is 0.7
- (ii) The evaporation is assumed only to take place from the surface of the decant pond, not the whole surface of the TSF.

The seepage rates are required to be estimated monthly using the equation below to ensure that the value of this parameter remains stable. Significant increases in the estimated seepage rate should trigger a review of current seepage control measures and/or a review of groundwater monitoring data, vegetation health and/or hyporheic community near the TMF to determine whether environmental impacts are likely to take place.

$$\Sigma \text{ Inputs} = \Sigma \text{ outputs} \pm \Delta s$$

$$D + R = DE + E + RE + S$$

Where:

- D = discharge rate
- R = rainfall catchment
- DE = decant
- E = evaporation from the pond area
- RE = water retained in tailings pile
- S = seepage into substrate
- Δs = change in ponding storage

Assuming that there is no change in storage in the decant pond during the operational life of the TMF, and rearranging the equation gives the following expression for the seepage rate from the facility:

$$S = D + R - DE - E - RE$$

The Delegated Officer notes that the Licence Holder has committed to review water balance parameters and methodology to ensure improvement is made in determining seepage rates on an ongoing basis. This commitment and requirements above have been added to the licence (further details are provided in section 4.4 below).

Current Monitoring Network and Relevant water quality criteria

Advice was also sought from DWER's hydrogeologist regarding suitability of current monitoring bore network and relevant water quality criteria to continue informing seepage risks and controls on site.

The advice received indicate that if hyporheic fauna have been detected in saturated creek sediments near the Pilgangoora TMF, the relevant water quality criteria to assess seepage discharges against would be the ANZECC/ARMCANZ aquatic criteria for key chemical constituents of potential concern (CCoPC).

If a hyporheic fauna is absent, the relevant water quality criteria for setting compliance limits would be the ANZECC/ARMCANZ long-term irrigation (LTV) criteria. This is because deep-rooted native vegetation that is in contact with shallow groundwater near the TMF (especially along creek lines) would then be the most sensitive environmental receptor for the discharge of seepage.

During assessment of the application, the Licence Holder was requested to assess and inform whether a hyporheic community is present within the creek bed. The Licence Holder indicated it is unlikely that a hyporheic zone community exists in the Pilgangoora creekline due to standing water levels at creek bed being at least 5m below top of casing, the creek holding water for short periods of time during the wet season and not containing a material volume of sediment that could contain standing water, with most pools being within bare basement rock.

The Delegated Officer understands that further on ground assessment would need to be undertaken to assess and confirm whether hyporheic fauna are present at nearby receptors (creeklines) and their diversity. As these have not been undertaken by the Licence Holder at this stage, and using the precautionary principle, licence conditions have been amended to ensure ANZECC/ARMCANZ aquatic criteria and long-term irrigation (LTV) criteria are used in interpretation of monitoring data. The requirement to undertake on ground assessment to confirm hyporheic community presence/absence has been added to the licence.

Currently, concentrations of CCoPC in the existing monitoring bores are below the ANZECC/ARMCANZ long-term irrigation (LTV) criteria, whereas it is understood that surface

water samples that were collected by DWER Compliance Branch were found to have elevated concentration of some CcoPC that were likely derived from seepage from the TMF.

This would suggest that the existing monitoring bore network (TMFMB01, TMFMB02, PMB001, PWE033, PWB005, TMFMB03, TMFMB04, TMFMB05, TMFMB06 and PWBMB004) might not be adequately detecting seepage from the TMF.

4.4 Risk Assessment and Regulatory Controls

Based on the information provided above, the Delegated officer considers that it is **possible** that there could be a **moderate** environmental impact from increased seepage and overtopping, due to an increase of tailings deposition into the TMF. This results in an overall risk rating of **Medium**.

A medium risk event is considered tolerable however regulatory controls are required to ensure proposed water strategies are implemented and risks are not increased.

In summary, based on the above information the following controls are added into the licence to minimise risks of increased seepage and/or overtopping:

- Condition 5, Table 6 is amended to ensure Stage 2 and 3 design parameters and additional Licence Holder's controls are included (including the commitment to operate TMF in accordance with design assumptions – i.e. % of solids; adding the two recently installed seepage trenches into seepage infrastructure controls; requirement to update TMF operations manual; commitment to increase return water pump capacity to 30L/s, limit on maximum operating pond, and commitments regarding deposition strategy);
- Water balance condition 10 amended to ensure seepage rates are calculated as described above to confirm seepage rates and inform required controls;
- Condition 11 to indicate sampling from decant water and requirement for comparison of monitoring data against long-term irrigation (LTV) trigger values and aquatic ecosystem criteria from the ANZECC/ARMCANZ Guidelines, where applicable;
- Condition 12, Table 8 is updated to include recently installed monitoring bores: PMB021, PMB022 and Well 5 and comparison against long-term irrigation (LTV) trigger values and aquatic ecosystem criteria from the ANZECC/ARMCANZ Guidelines, where applicable;
- Condition 2, Table 3 has been modified to authorise discharge of decant/seepage water into the process water pond or used for dust suppression within the purple shaded area only, as shown in Figure 5. Water carts must be fitted with sprays and dribble bars that can be adjusted to avoid overspray and runoff, minimizing risks to surrounding vegetation (Condition 5, Table 6) . Licence holder is required to continue monitoring groundwater surrounding the TMF area (Condition 12, Table 8) and undertake quarterly visual monitoring of vegetation condition surrounding the purple shaded area (Condition 2, Table 3). Discharge volume of water used for dust suppression within the purple area is limited via Condition 3, Table 4. Discharged volumes to be reported via condition 10 and 22.
- Refinement of AER condition 22 to ensure water balance data, seepage rates and review of seepage controls are undertaken and provided as part of the AER and AER includes review and interpretation of monitoring data (including comparison against previous years, trigger limits and relevant criteria from ANZECC/ARMCANZ guidelines – where available); and
- New condition 23 imposed requiring review of current monitoring network and seepage controls based on further geophysical and hydrogeological assessment as described above. Also, based on the results of the geophysical surveys and on ground assessments, a shallow bore or a suitable monitoring point near the base of the TMF is required to be installed to obtain water samples that would be more representative of pore-water quality. The Licence Holder is also required to confirm seepage

environmental receptors, based on investigations to be undertaken and ground assessment.

Further modifications to the current monitoring network and seepage controls might also be required as a result of further investigations that may trigger the requirement for a revised risk assessment and licence amendment.

5. Consultation

Table 6 provides a summary of the consultation undertaken by the department.

Table 6: Consultation

Consultation method	Comments received	Department response
Department of Mines, Industry Regulation and Safety (DMIRS) advice on application sought on 03/06/2022; 6/07/2022; 17/08/2022; and 07/09/2022	DMIRS replied on date 14 July 2022, 22 July 2022, 26 August 2022 and 9 September 2022. See section 3.2, 3.3, and 4.3 above	Refer to Section 4.3 above.
Works Approval/Licence Holder was provided with draft amendment on 23 August 2022	Refer to Appendix 2	Refer to Appendix 2

6. 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.

6.1 Summary of amendments

Table 7 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 7: Summary of licence amendments

Condition no.	Proposed amendments
Cover page	Increase assessed production / design capacity of 64 to 20,000 tonnes per annum. Change registered business address. Update premises figure reference.
Table 1, Definitions	TMF stages updated
Condition 1, Table 2	Change in conditions numbers, inclusion of reference to Schedule 2 and addition of decant and seepage water.
Condition 2, Table 3	Authorisation of discharge of decant water into process water pond and use for dust suppression within Figure 7 area and addition of landfill trenches within Monster WRD. Update of discharge point locations.
Condition 3, Table 4	Limiting discharge volumes for dust suppression activities within authorised area shown in Figure 7, Schedule 1.
Condition 5, Table 6	Addition of Stage 2 and 3 for Cell 1 and 2, additional TMF infrastructure and commitments. Landfill capacity changed to 20,000tpa.

	Requirements for water cart and visual inspection of vegetation surrounding dust suppression areas added.
Condition 10	Rewording of the condition to ensure relevant parameters are considered and evaporation and seepage rate calculated as per Schedule 3. Decant and seepage water volumes used for dust suppression also to be considered in the water balance.
Condition 11	Sampling to occur at Decant ponds from TMF (Cell 1 and 2)
Condition 11, Table 7	Change in location of sampling.
Condition 12	Change to compare the results of monitoring with the long-term irrigation (LTV) trigger values and aquatic ecosystem criteria applied from the ANZECC/ARMCANZ Guidelines, where applicable.
Condition 12, Table 8	Add proposed additional bores PMB022, PMB021 and WELL 5. Remove reference to monitoring bore PMB002.
Condition 22, Table 11	Refinement of AER condition requirements to ensure water balance data, seepage rates and review of seepage controls are undertaken and AER includes date and location of sampling, and interpretation of monitoring data (including comparison against previous years, trigger limits and relevant criteria from ANZECC/ARMCANZ guidelines – where available). Environmental incidents and failure of equipment to be described. Reporting of results of quarterly visual monitoring of vegetation condition surrounding dust suppression area.
Condition 23	Condition added with a requirement of review current monitoring strategy and seepage controls infrastructure, based on geophysical and hydrogeological assessments and identification of TMF seepage receptors.
Schedule 1: Maps Figure 2	Figure 2 with location of sediment ponds updated.
Schedule 1: Maps Figure 4	Figure 4 added to show location of landfill within Monster WRD.
Schedule 1: Maps Figure 5	Figure 5 added showing General configuration of pipelines and seepage management infrastructure.
Schedule 1: Maps Figure 6	Figure 6: Location of TMF bores updated.
Schedule 1: Maps Figure 7	Authorised area for dust suppression added.
Schedule 2, Table 13	Increase assessed premises production / design capacity of CAT 64 to 20,000 tonnes per annum.
Schedule 2, Table 14	Plan reference modified to include reference to Schedule 1 and 4.
Schedule 2	Revised reference to Primary Activity infrastructure location in Schedule 1 and 4.
Schedule 3	Water Balance - Evaporation and Seepage Rate Calculation added.
Schedule 4	Drawings from Cell 1 and 2 – Stage 2 and 3 added.

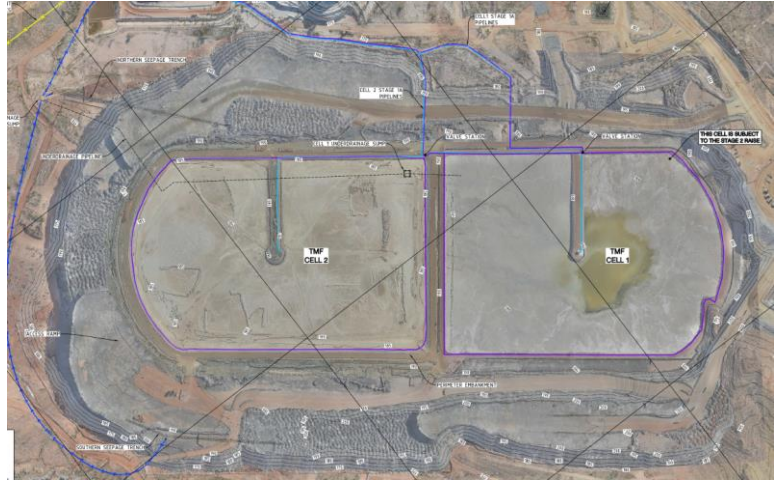
References

1. ATC Williams, November 2016, "Pilgangoora Lithium-Tantalum Project: Tailings Management Facility – Feasibility Study Design", Ref. 115275.01 R02 Rev0
2. ATC Williams, May 2020, "Memorandum: Pilgangoora TMF Seepage Management", Ref. 115275.18 M01 Rev 1
3. ATC Williams, November 2021, "Pilgangoora Lithium Tantalum Project Geotechnical Audit for Tailings Storage Facility – September 2020 to August 2021", Ref. 115275.23
4. ATC Williams, February 2022a, "Pilgangoora Lithium Tantalum Project Quarterly Surveillance Report", Ref. 115275.20
5. ATC Williams, May 2022b, "Pilgangoora Lithium-Tantalum Project Tailings Management Facility Stage 2 and Stage 3 Design Report", Ref. 115275.025 Rev A
6. ATC Williams, May 2022c, "Memorandum: Tailings Management Facility – Stage 2/3 Raise", Ref. 115275.25M04
7. ATC Williams, July 2022d, "Subject: Proposal for reinstatement of Southern Seepage Interception trench of TMF", Ref. 115275.28 P01 Rev A
8. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
9. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Joondalup, Western Australia.
10. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Risk Assessments*, Joondalup, Western Australia.
11. Fortuna, J., Waterhouse, J., Chapman, P. and Gowan, M., 2021. Applying practical hydrogeology to tailings storage facility design and management. *Mine Water and the Environment*, **40**, 50-62.
12. McJannet, D., Hawdon, A., van Niel, T., Boadle, D., Baker, B., Trefry, M. and Rea, I., 2017. Measuring evaporation from a mine void lake and testing of modelling approaches. *Journal of Hydrology*, **555**, 631-647.
13. Pilbara Minerals 2022, Pilgangoora Lithium-Tantalum Project, L9056/2017/1 Licence amendment application and supporting information, West Perth, Western Australia.
14. Pilbara Minerals 2022, Pilgangoora Operation Pty Ltd "Annual Environmental Report L9056/2014/1 Reporting Period 07/07/2020 - 30/06/2021", West Perth, Western Australia.

Appendix 1: Application validation summary

Amendment to licence	<input checked="" type="checkbox"/>	Current licence number:	L9056/2017/1		
		Relevant works approval number:	W6051/2017	N/A	<input type="checkbox"/>
Date application received		01/04/2022			
Applicant and Premises details					
Applicant name/s (full legal name/s)		Pilgangoora Operations Pty Ltd			
Premises name		Pilgangoora Operations			
Premises location		The premise boundary consistent with Prescribed Premise Licence L9056/2017, Schedule 1, consists of mining tenement M45/1256 and L45/417			
Local Government Authority		Shire of East Pilbara			
Application documents					
HPCM file reference number:		DER2017/000318-1			
Key application documents (additional to application form):		<p>Appendix 1 – Licence amendment application – supporting information</p> <p>Appendix 2 – Proposed fee calculation</p> <p>Appendix 3 TMF Feasibility Study Design Nov16 (115275.01r02).</p> <p>Appendix 4 Probabilistic Seismic Hazard Analysis</p> <p>Appendix 5 Drawings of Stages 2 And 3</p> <p>Additional information provided as part of the Validation RFI:</p> <ul style="list-style-type: none"> - Technical Memorandum from ATC Williams (Ref. 115275.25 M02); - Pilgangoora Lithium Tantalum Project Quarterly Surveillance Report (Ref. 115275.20 R3); - Stage 2 and 3 Final Design Report (115275.025 Rev A) and Appendices; - Tailings Management Facility Feasibility Study Design (2016); - TMF Annual Audit Report 2021 (Ref. 115275.23); - Drawing Sets for Stage 2 and 3, of Cell 1 and Cell 2; 			
Scope of application/assessment					

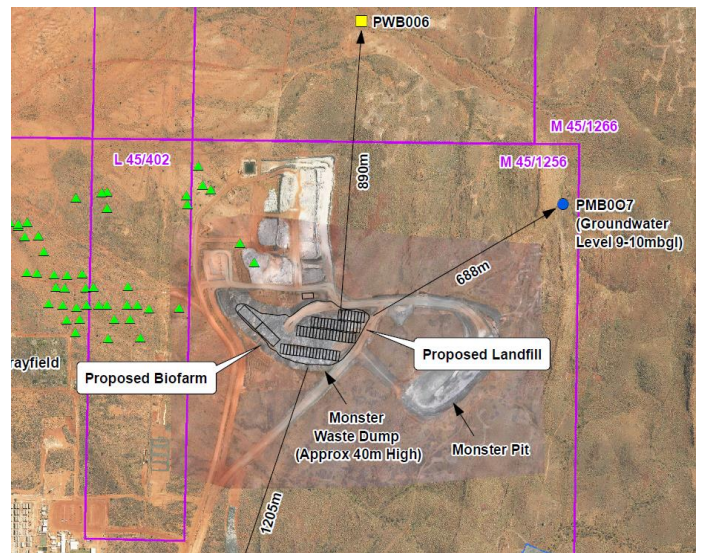
This Licence Amendment application seeks approval for the construction of two additional lifts on the Tailings Management Facility (TMF) at Pilgangora (extending life of the facility to 3 years), and an additional landfill located on the current footprint of the Monster Waster Rock Dump (WRD).



Summary of proposed activities or changes to existing operations.

Additional CAT 64 - landfill

POPL seeks approval to build a landfill within the Monster WRD, along with a Bioremediation pad, for the same waste types of their current landfill at Pilgangora. It is anticipated that approximately 20,000 tpa of waste will be disposed of into the landfills within the site (an 10,000 tonnes per year increase).



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

Table 1: Prescribed premises categories

Prescribed premises category and description	Assessed production or design capacity	Proposed changes to the production or design capacity (amendments only)
Category 5: Processing or beneficiation of metallic or non-metallic ore	2,000,000 tonnes per annum processed ore	No change to production capacity
Category 52: Electric power generation	15.7 MW	No change
Category 54: Sewage facility	150 m ³ /day	No change to production capacity
Category 64: Class II Putrescible landfill	20,000 tonnes per annum.	Increase of 10,000 tonnes per annum
Category 73: Bulk storage of chemicals	1,036 m ³ in aggregate	No change

Legislative context and other approvals

Has the applicant referred, or do they intend to refer, their proposal to the EPA under Part IV of the EP Act as a significant proposal?	Yes No	
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes No	
Has the proposal been referred and/or assessed under the EPBC Act?	Yes No	
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes No	Mining lease / tenement Expiry: 15/12/2037
Has the applicant obtained all relevant planning approvals?	Yes No N/A	
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes No	CPS No: CPS8175/1 Applicant indicated that additional clearing is not required.
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes No	

Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes No	Licence/permit No: GWL183354
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes No	Name: Pilbara Type: Proclaimed Groundwater Area and Surface Water Area Has Regulatory Services (Water) been consulted? Yes No N/A Regional office: North West
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes No	
Is the Premises subject to any other Acts or subsidiary regulations (e.g. <i>Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004, State Agreement Act xxxx</i>)	Yes <input checked="" type="checkbox"/> No	<i>Radiation Safety Act 1975</i> and subsidiary legislation Transport of radioactive material in Western Australia is legislated by the <i>Radiation Safety (Transport of Radioactive Substances) Regulations 2002</i> <i>Dangerous Goods Safety Act 2004</i> <i>Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007</i> Environmental Protection (Controlled Waste) Regulations 2004 <i>The Mining Act 1978</i> <i>The Aboriginal Heritage Act 1972</i>
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes No	
Is the Premises subject to any EPP requirements?	Yes No	

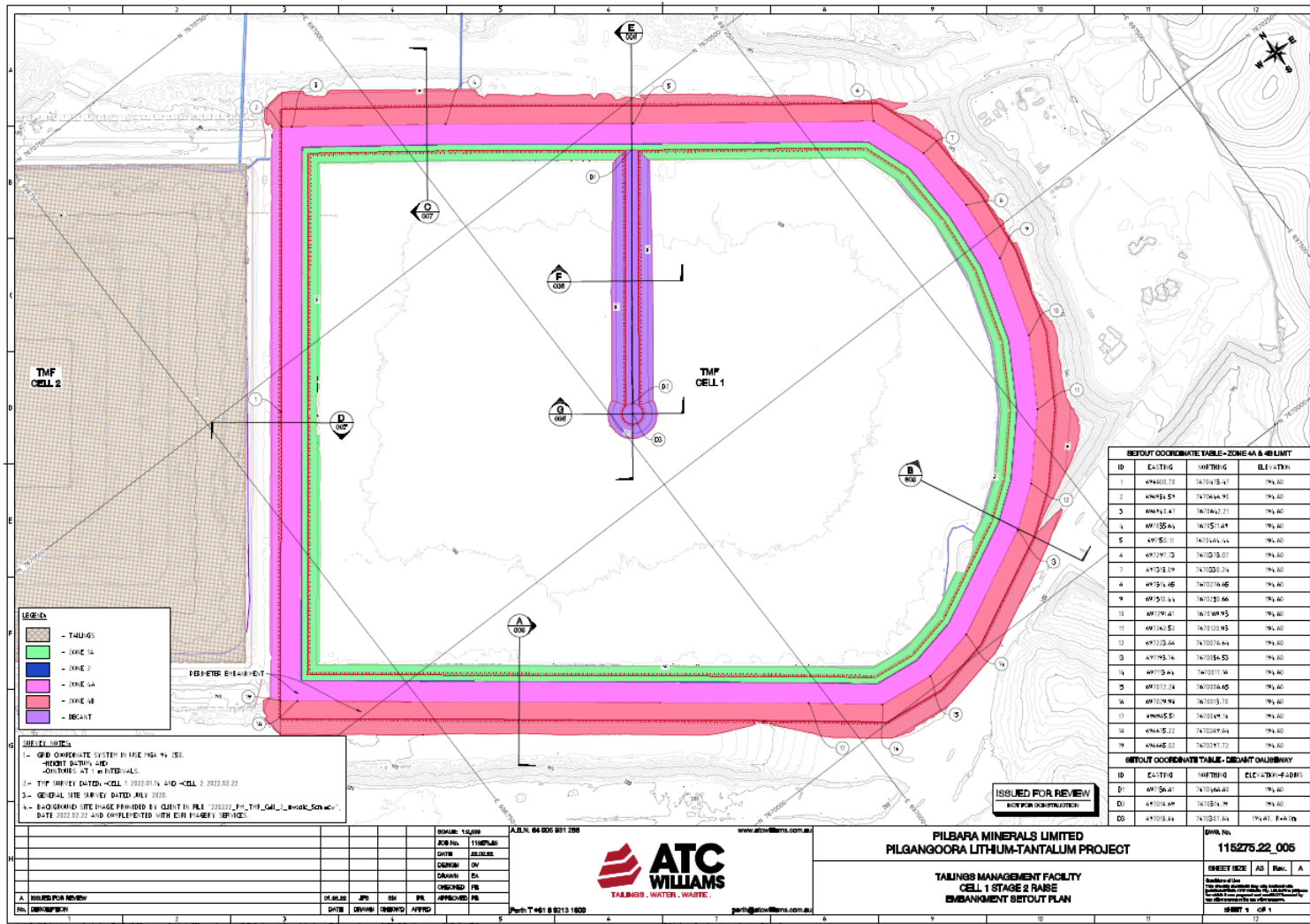
<p>Is the Premises a known or suspected contaminated site under the <i>Contaminated Sites Act 2003</i>?</p>	<p>Yes No</p>	<p>Not shown in Geocortex.</p>
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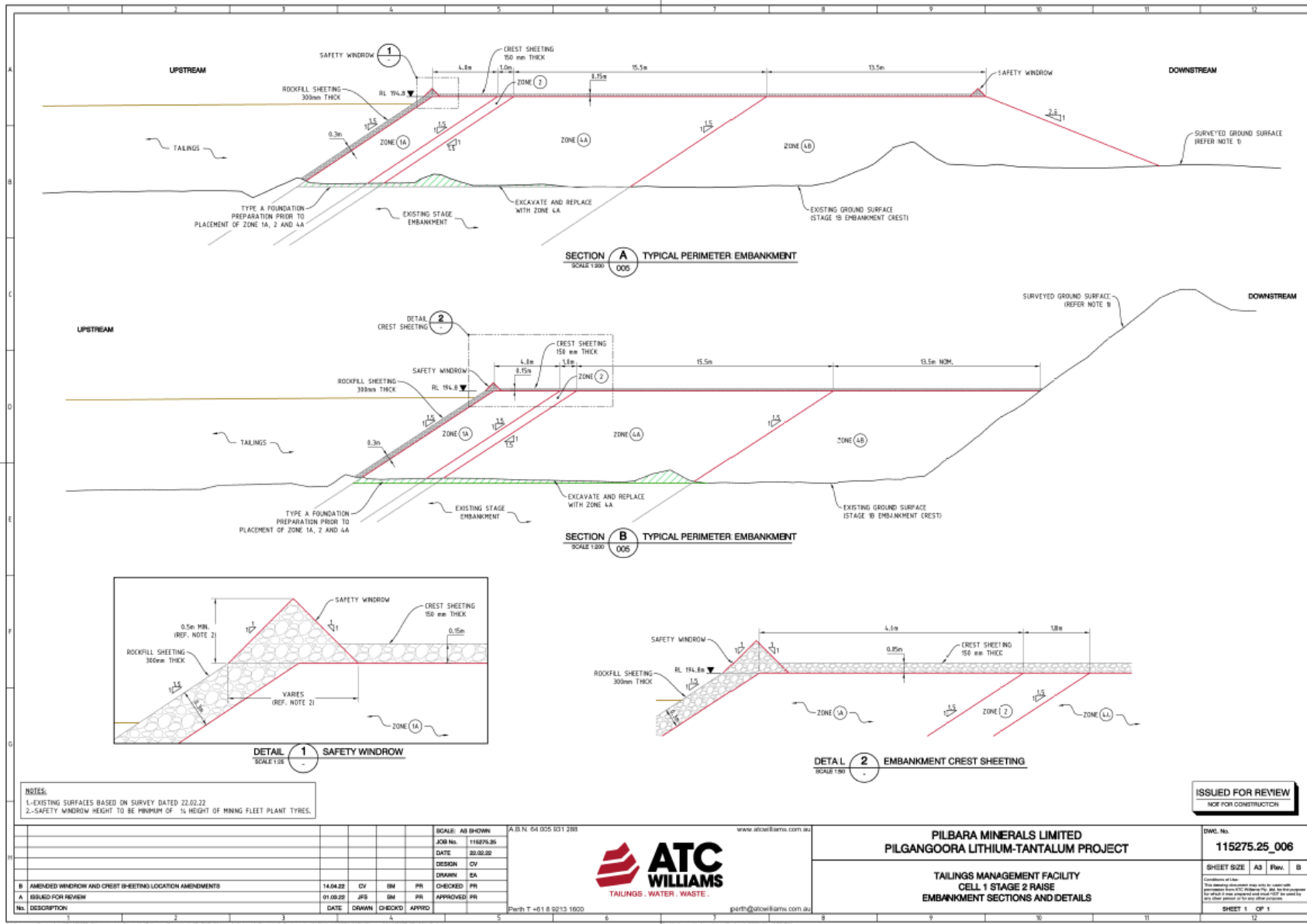
Appendix 2: Summary of Licence Holder’s comments on risk assessment and draft conditions

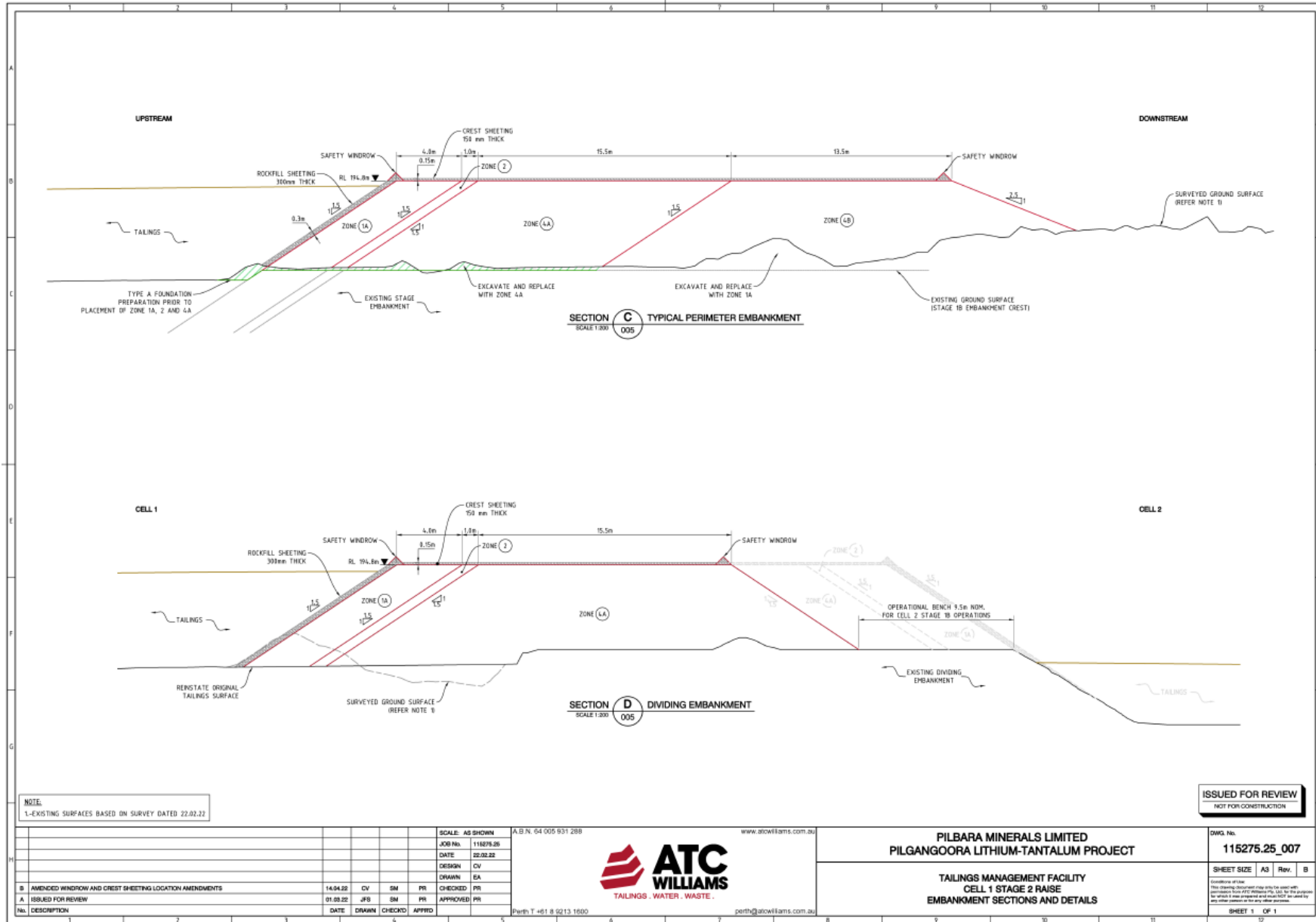
Condition	Summary of Licence Holder’s comment	Department’s response
N.A	Request to modify registered business address in accordance with extract from ASIC	Registered business address modified.
Table 1 - Definitions	Request to correct RL for TMF 2 and 1 Stage 2 and 3.	RLs have been corrected.
Condition 5 - Table 6: Process Water Pond	Reinstate the wording “or used for dust suppression”. This would allow continuation of the emergency control in place to maintain adequate freeboard and avoid overflows of the Process Water Pond.	Wording reinstated, however use of process water pond water for dust suppression authorised within shaded purple area shown in figure 5 above only.
Condition 17	Proposed Condition 17 removes the ability to use Decant water, Process water, or seepage water for dust suppression activities on the Premises. Inability to utilise excess water would create a water imbalance in the operation circuit, with a consequence being an increase in the potential risk of uncontrolled releases to the environment.	Condition removed. Condition 2, Table 3 has been modified to authorise discharge of decant/seepage water into process water pond or used for dust suppression within the purple shaded area only, shown in Figure 5. Water carts must be fitted with sprays and dribble bars that can be adjusted to avoid overspray and runoff, minimizing risks to surrounding vegetation (Condition 5, Table 6) . Licence holder is required to continue monitoring groundwater surrounding the TMF area (Condition 12, Table 8) and undertake quarterly visual monitoring of vegetation condition surrounding the purple shaded area (Condition 2, Table 3). Discharge volume of water used for dust suppression within the purple area is limited via Condition 3, Table 4. Discharged volumes to be reported via conditions 10 and 22.
Condition 24c	The proposed location for the additional shallow monitoring bore between the existing TMF cut-off drains and the base of the TMF is not suitable as it has been fully covered with	Proposed underdrainage discharge point is within a sump located near the base of the TMF. Representability of sample can be compromised due to

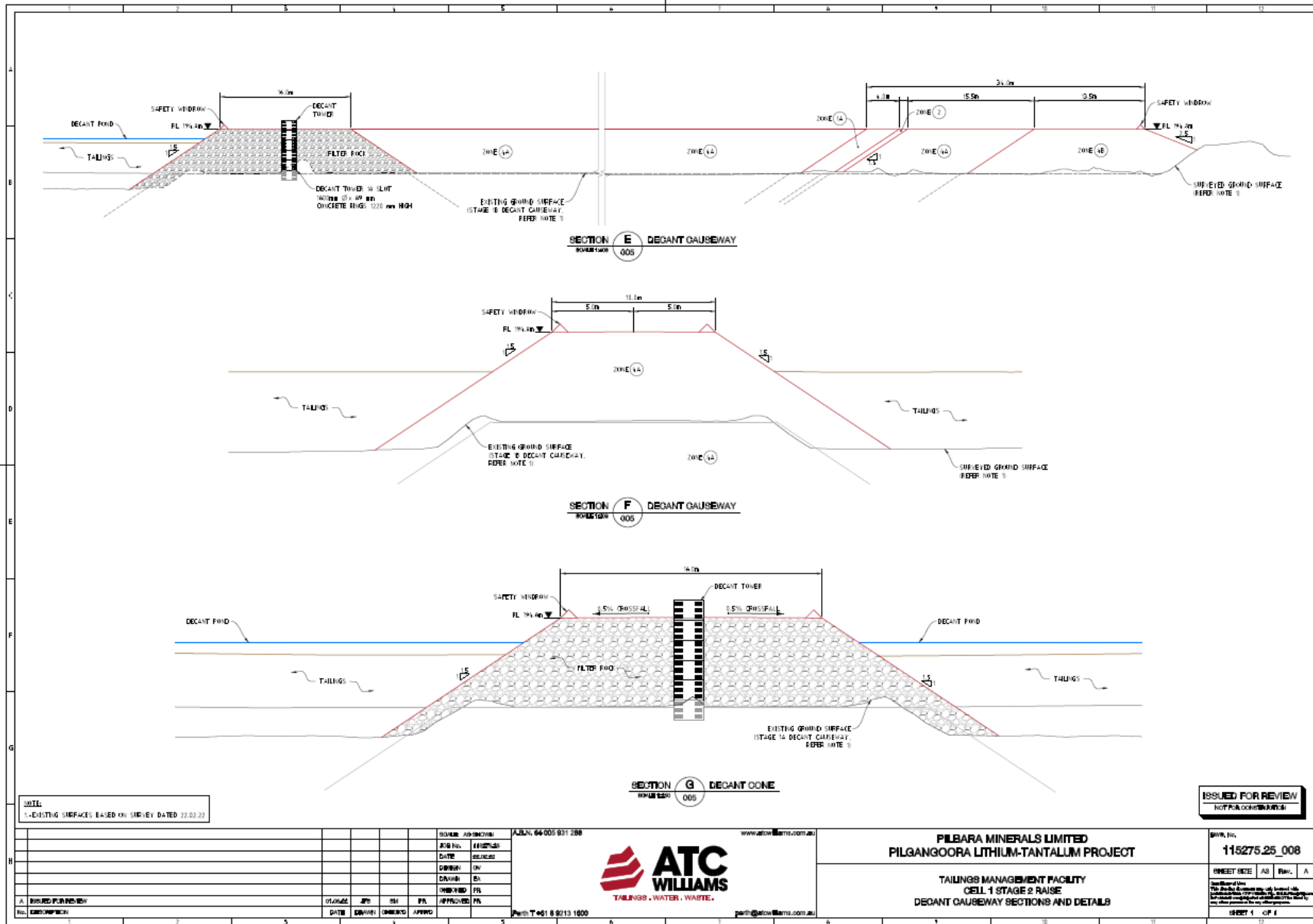
Condition	Summary of Licence Holder's comment	Department's response
	Waste Rock. Pilbara minerals proposes to conduct sampling from the existing TMF underdrainage discharge point.	evaporation and/or contact with air. Suitability of this discharge point needs to be assessed by a hydrogeologist to confirm representability of sample to indicate tailings pore-water at the base of the facility. Condition 23 (previously numbered 24) has been modified to ensure a suitable monitoring location is identified for ongoing monitoring of tailings pore water at the base of TMF.

Appendix 3: Proposed TMF raise designs Cell 1 – Stage 2 raise

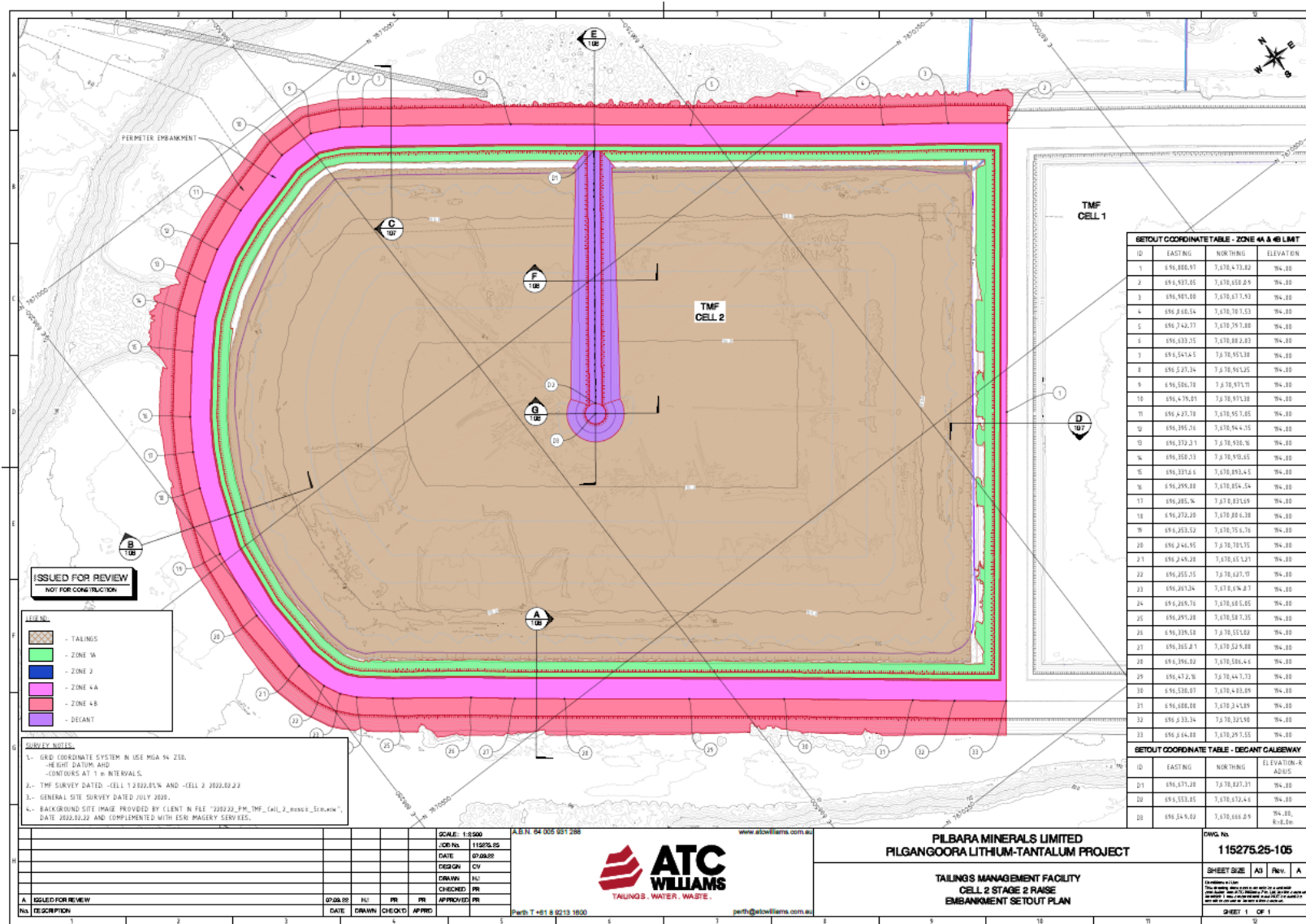


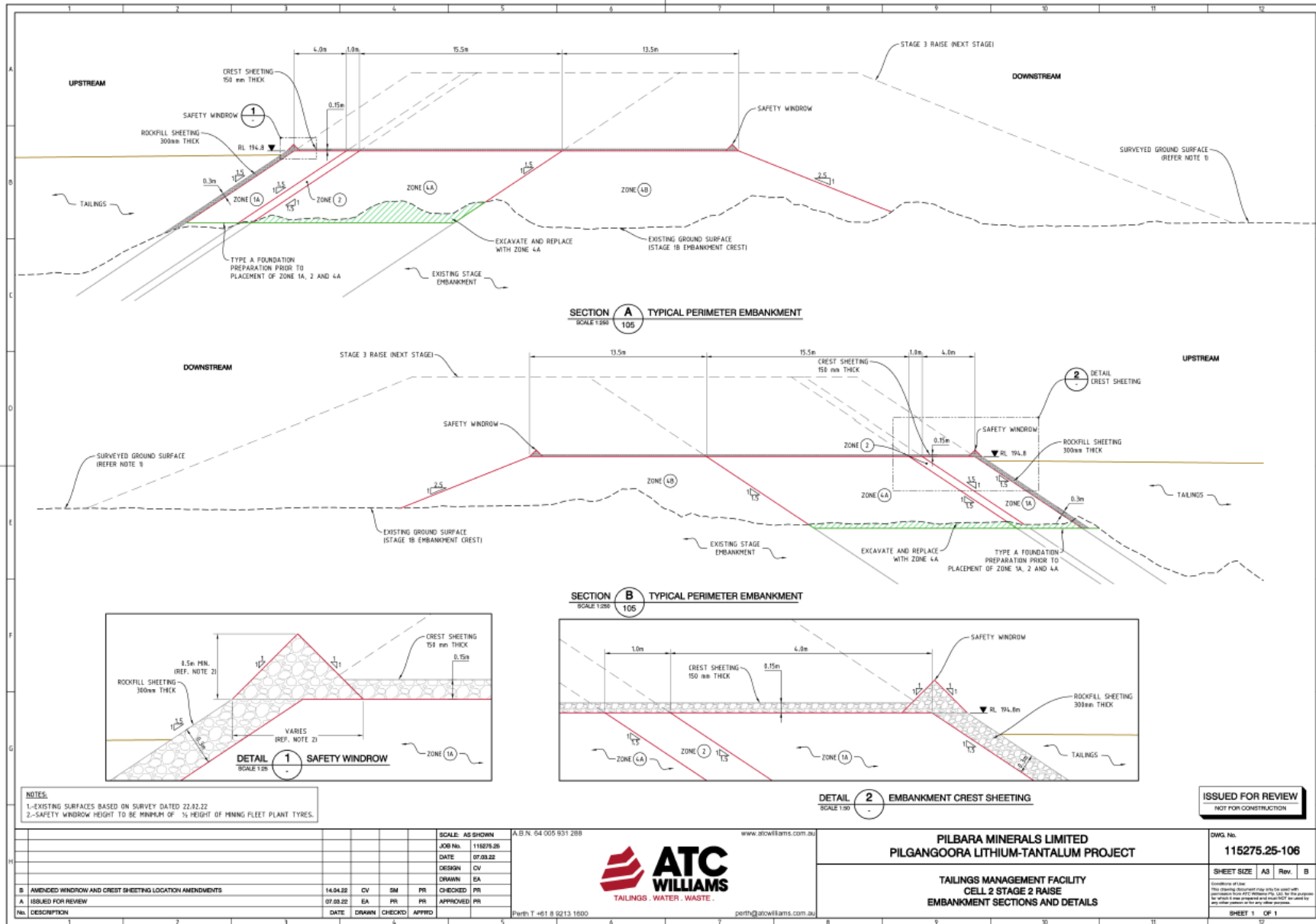


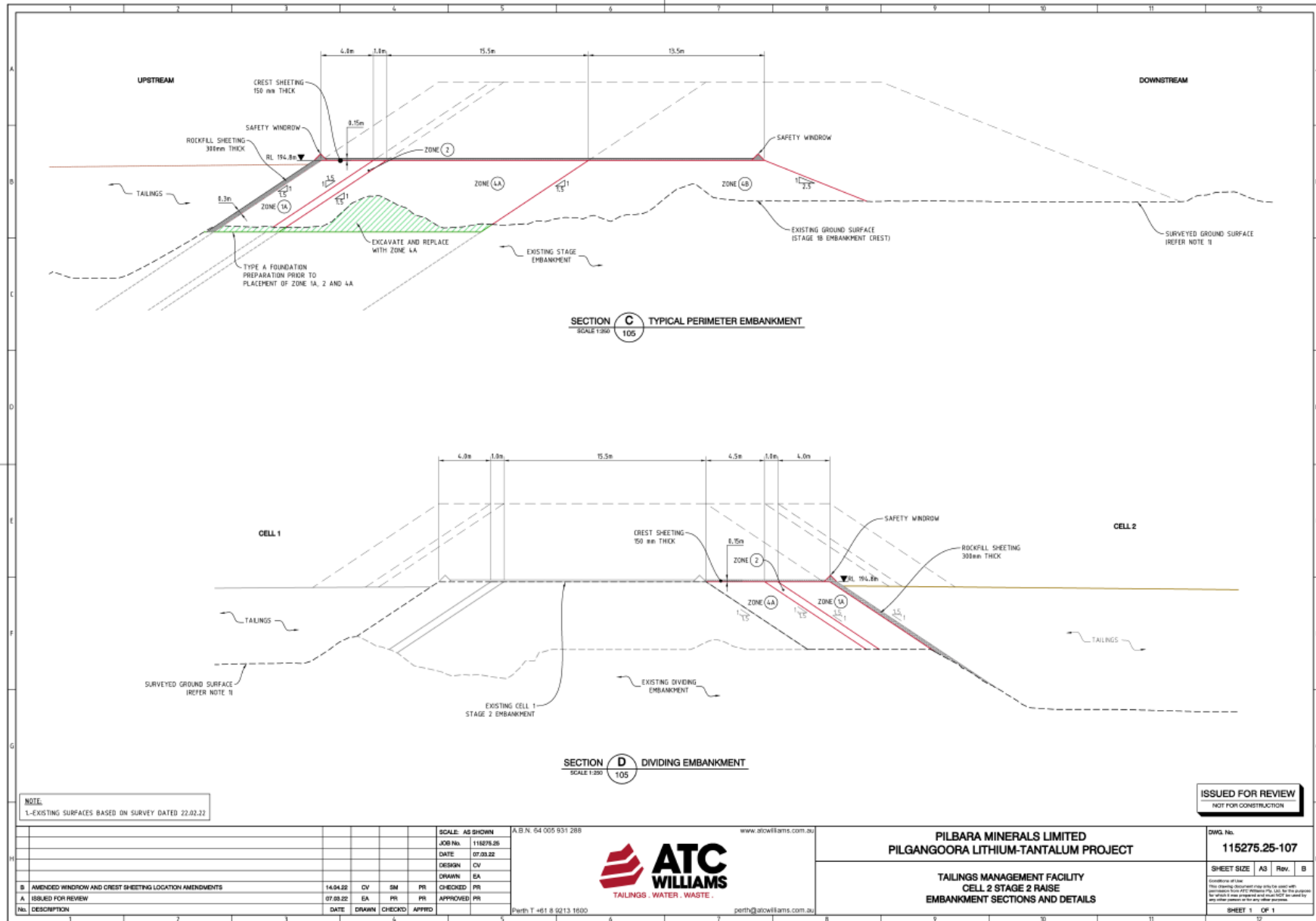


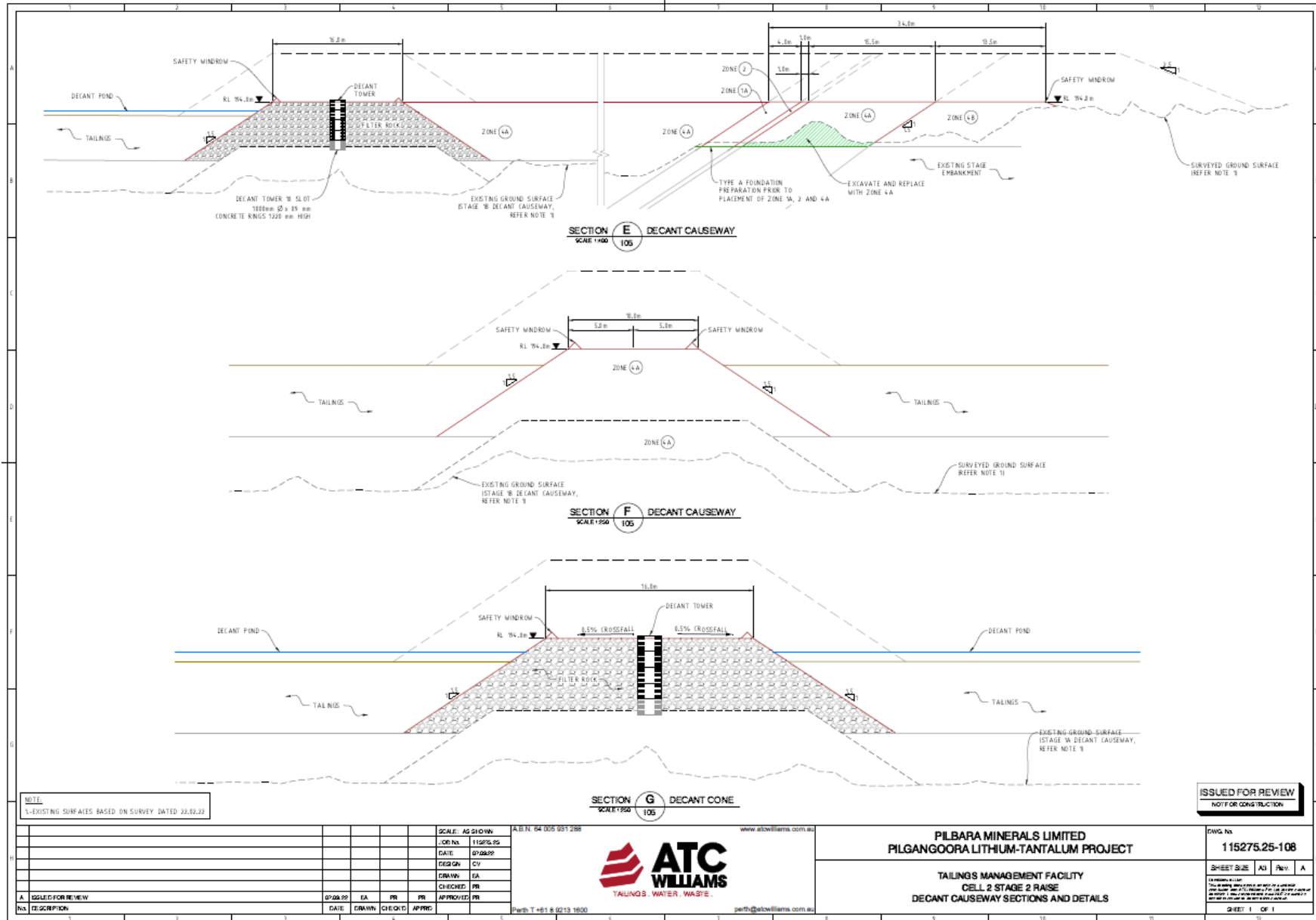


Cell 2 – Stage 2 raise

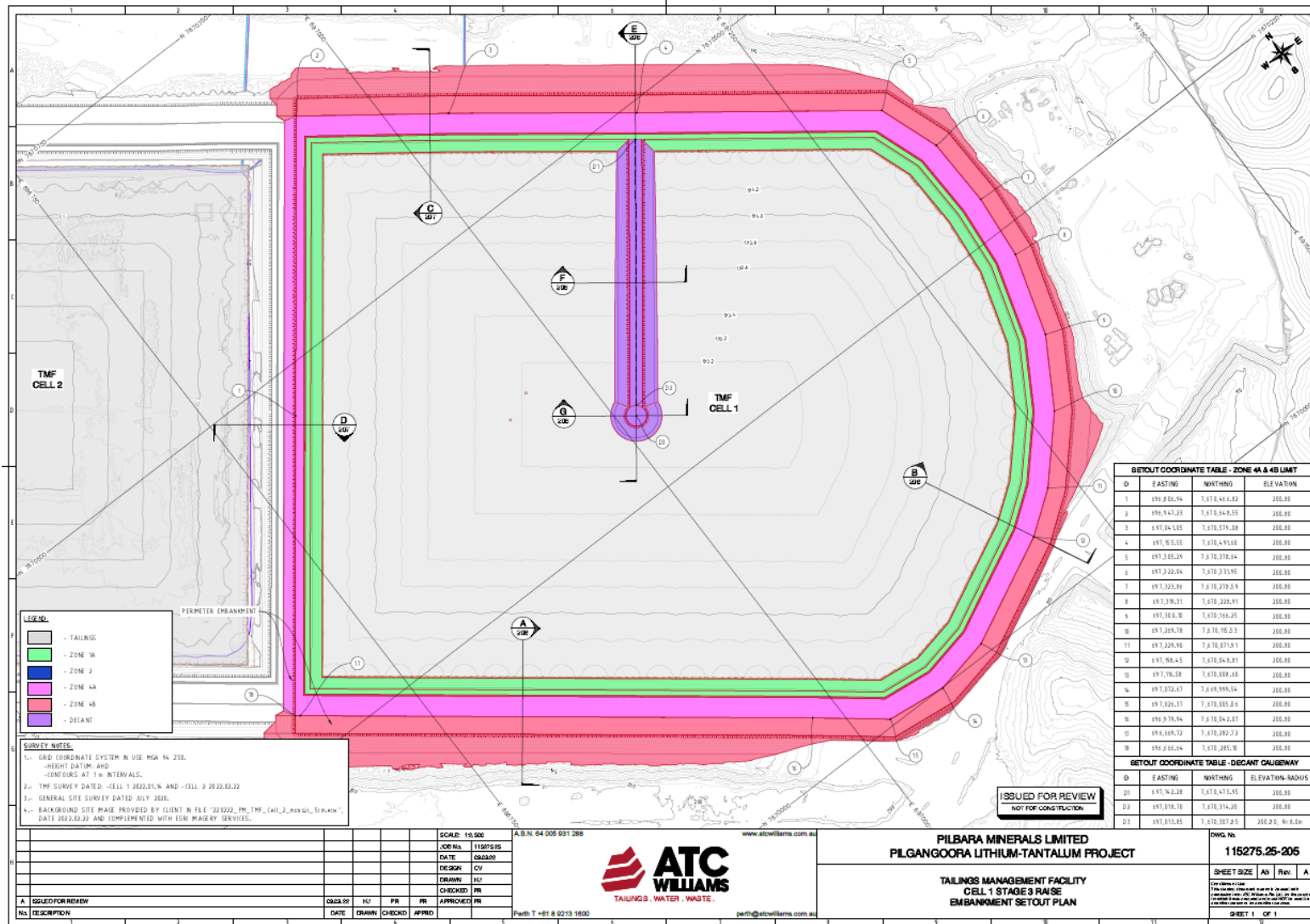


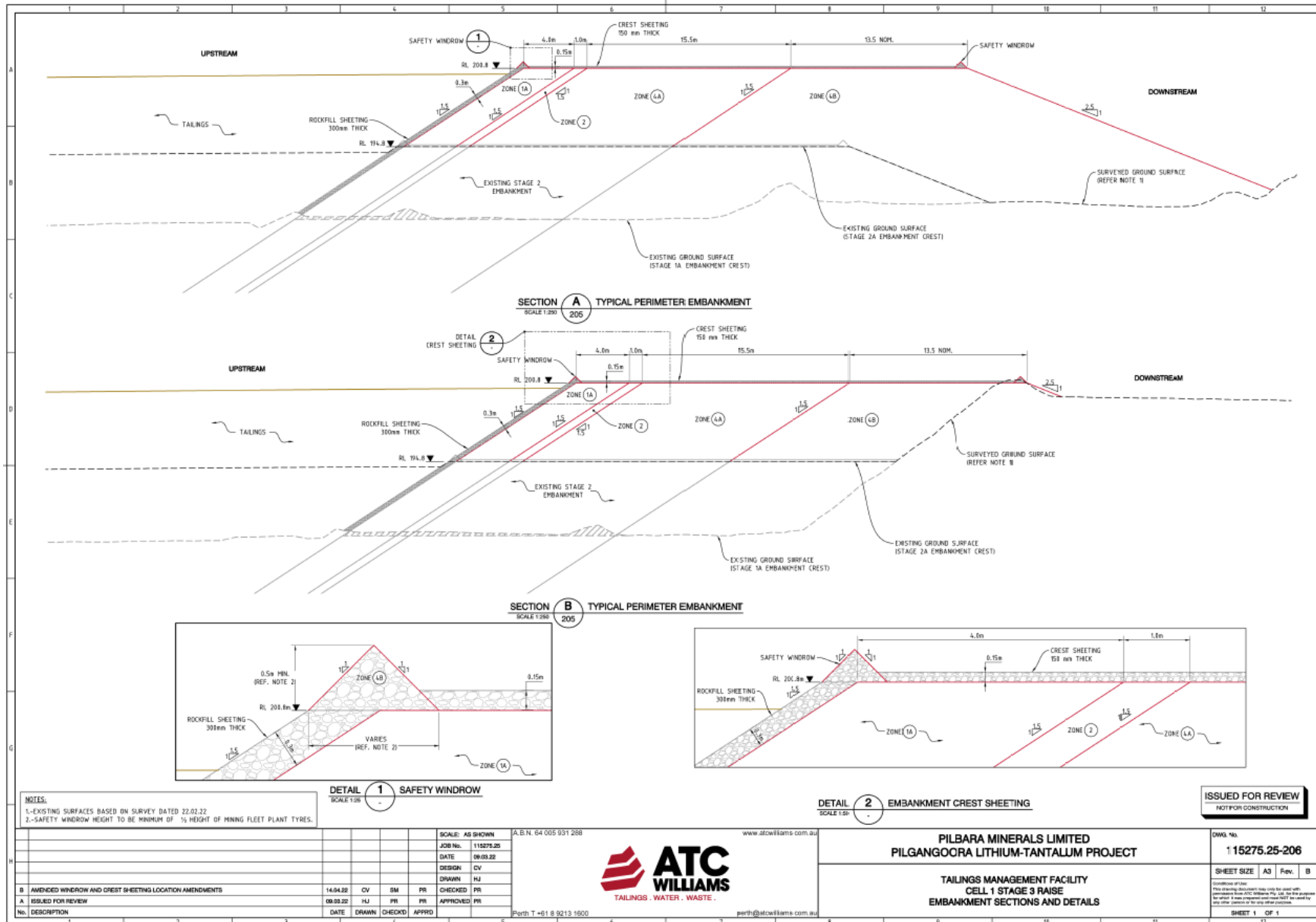


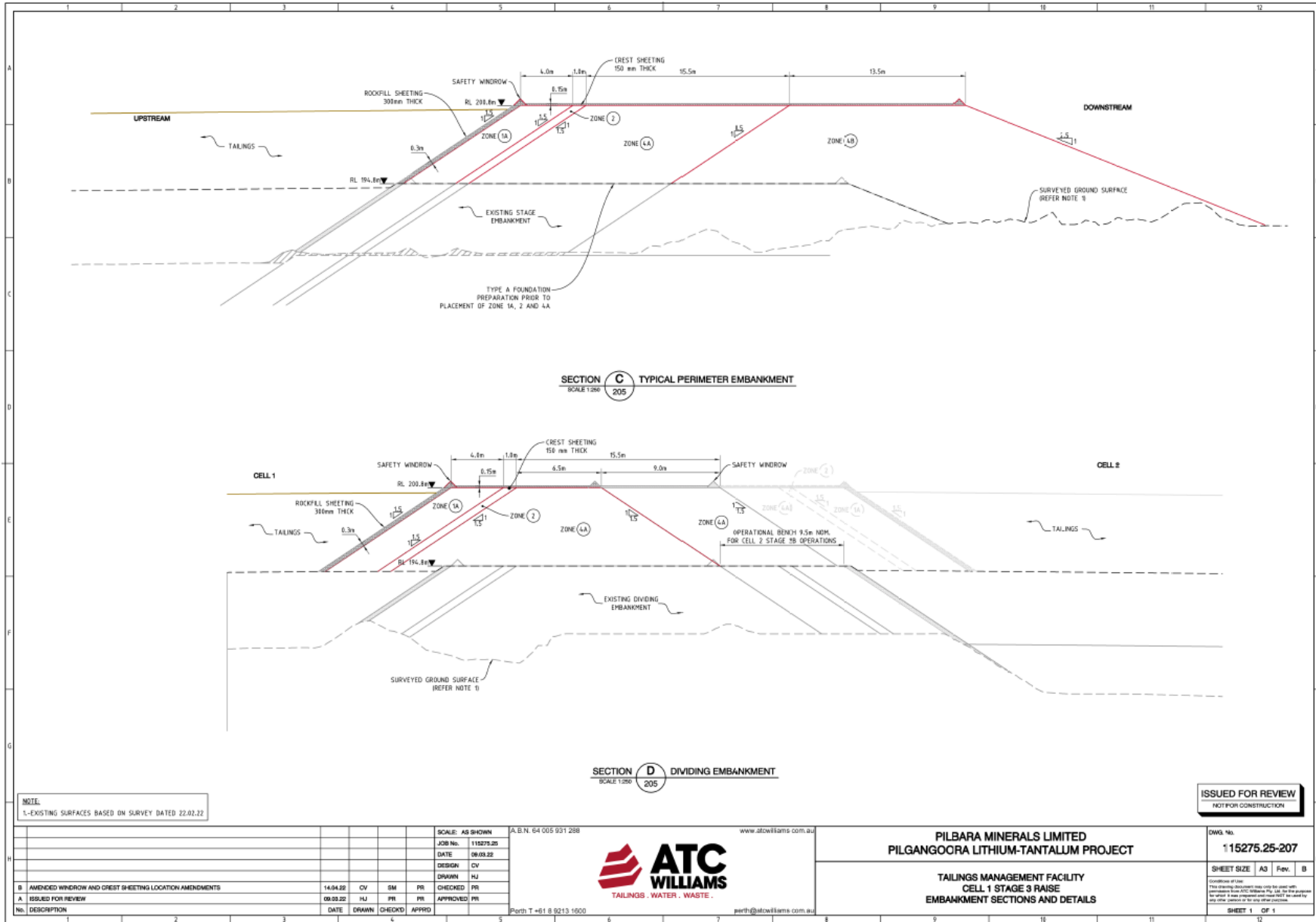


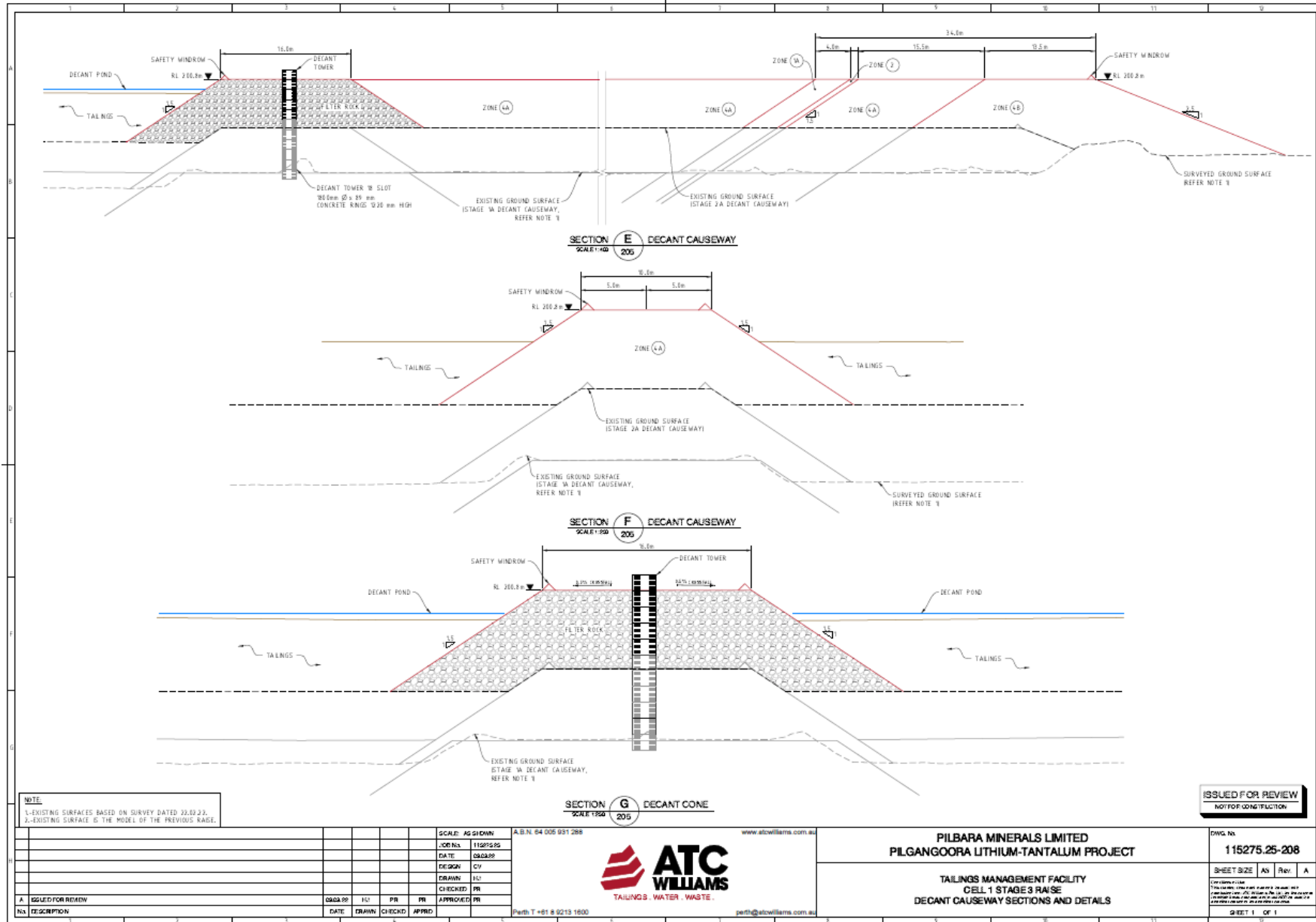


Cell 1 – Stage 3 raise

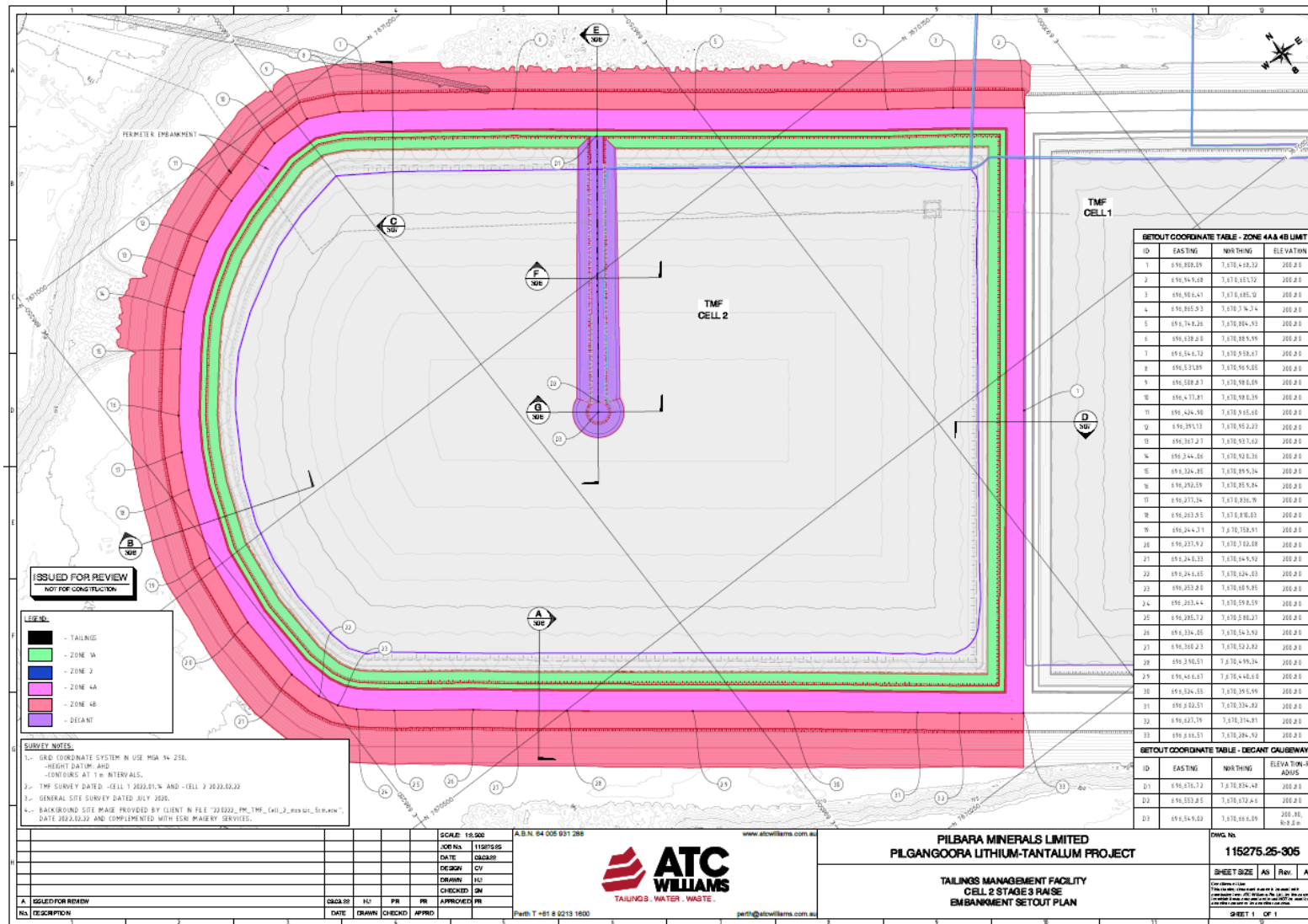


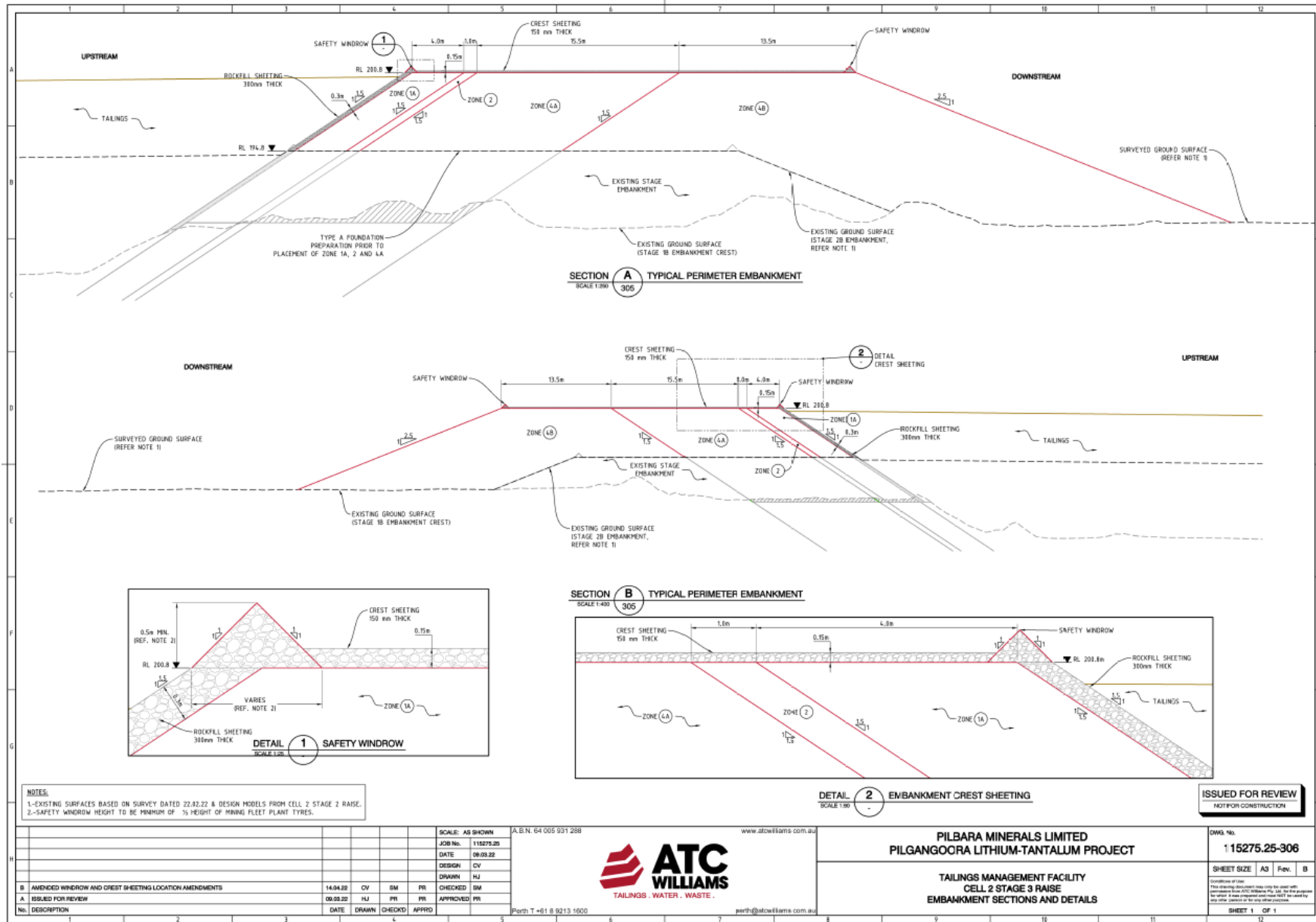






Cell 2 – Stage 3 raise





NOTES:
 1-EXISTING SURFACES BASED ON SURVEY DATED 22.02.22 & DESIGN MODELS FROM CELL 2 STAGE 2 RAISE.
 2-SAFETY WINDROW HEIGHT TO BE MINIMUM OF 1/3 HEIGHT OF MINING FLEET PLANT TYRES.

NO.	DESCRIPTION	DATE	DRAWN	CHECKD	APPROV
B	AMENDED WINDROW AND CREST SHEETING LOCATION AMENDMENTS	14.04.22	CV	SM	PR
A	ISSUED FOR REVIEW	09.03.22	HJ	PR	PR

SCALE: AS SHOWN	A.B.N. 64 005 931 288	www.atwilliams.com.au
JOB No: 115275.25		
DATE: 09.03.22		
DESIGN: CV		
DRAWN: HJ		
CHECKED: SM		
APPROVED: PR		



PILBARA MINERALS LIMITED
PILGANGOORA LITHIUM-TANTALUM PROJECT

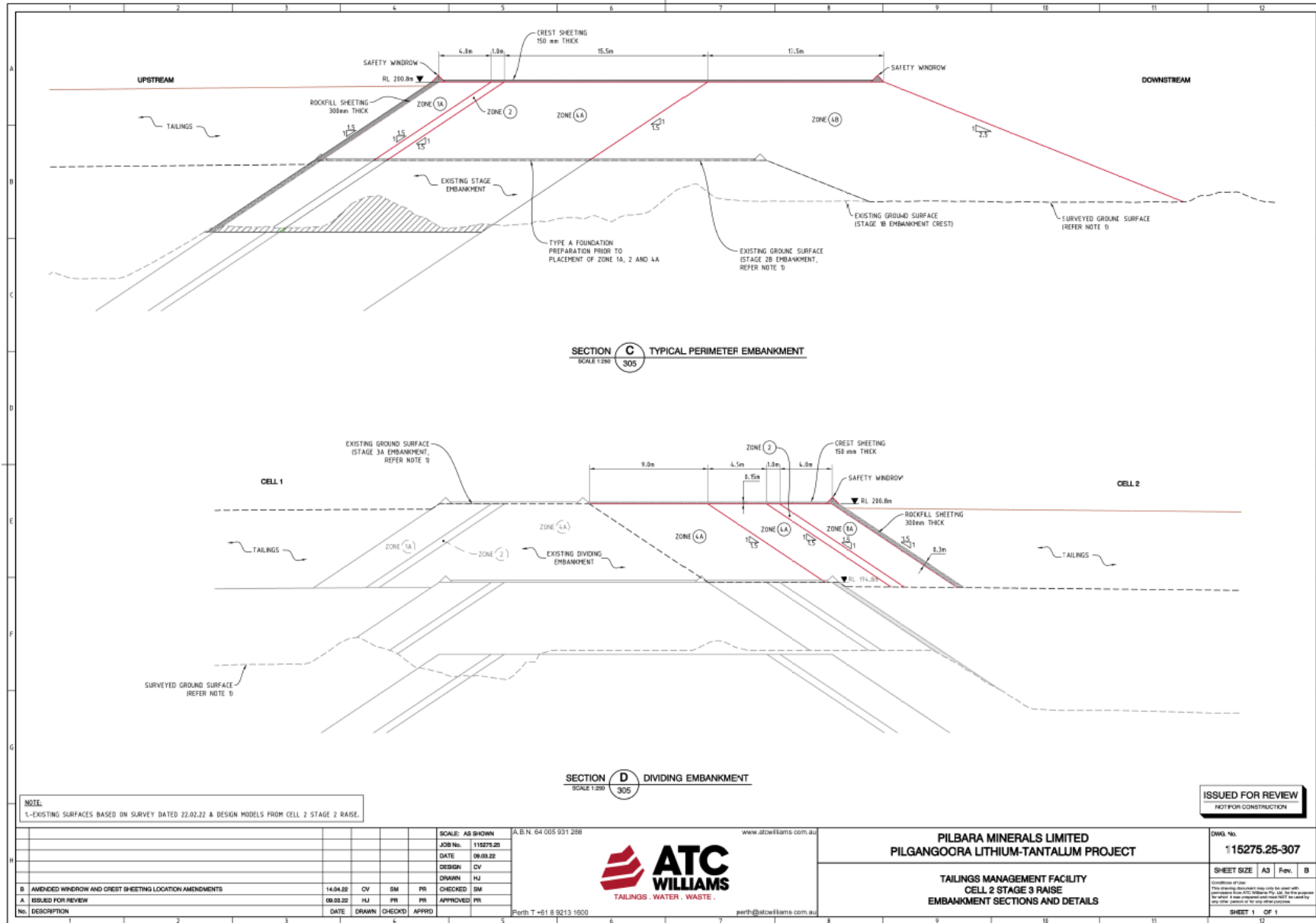
TAILINGS MANAGEMENT FACILITY
CELL 2 STAGE 3 RAISE
EMBANKMENT SECTIONS AND DETAILS

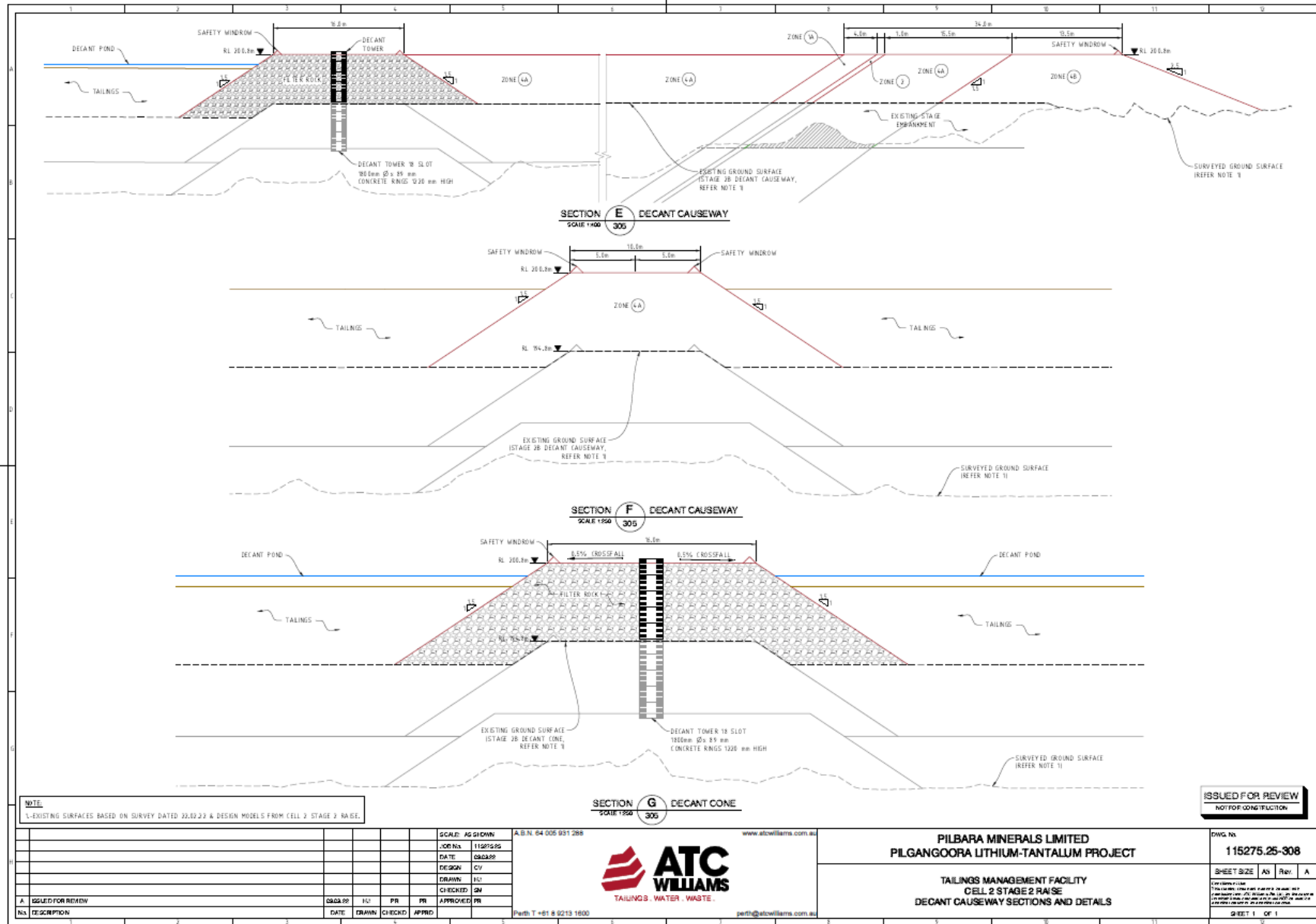
DWG No: 115275.25-306

SHEET SIZE: A0 | Rev: B

DATE: 09.03.22

Perth T +61 8 9213 1800 | perth@atwilliams.com.au





ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

NOTE
1-EXISTING SURFACES BASED ON SURVEY DATED 22.02.22 & DESIGN MODELS FROM CELL 2 STAGE 2 RAISE.

SCALE: AS SHOWN	A.B.N. 64 005 931 288	www.atcwilliams.com.au
JOB No. 115275.25		
DATE 09/03/22		
DESIGN CV		
DRAWN JIC		
CHECKED SM		
APPROVED PR		
DATE	DRAWN	CHECKED
		APPROVED



PILBARA MINERALS LIMITED
PILGANGOORA LITHIUM-TANTALUM PROJECT

TAILINGS MANAGEMENT FACILITY
CELL 2 STAGE 2 RAISE
DECANT CAUSEWAY SECTIONS AND DETAILS

DWG No.	115275.25-308
SHEET SIZE	A3 Rev A
DATE	09/03/22
BY	JIC
CHECKED	SM
APPROVED	PR