Government of Western Australia
Department of Water and Environmental Regulation

Amendment Report

Application for Works Approval Amendment

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

Works Approval Number	W6734/2022/1
Works Approval Holder	MARBL Lithium Operations Pty Ltd
ACN	637 077 608
Application Number	APP-0027293
Premises	Wodgina Lithium Project L45/443, M45/383, M45/1188, M451252, G45/321 and G45/291 MARBLE BAR WA 6760 As defined by the premises map attached to the Revised Works Approval
Date of Report	12 August 2025
Decision	Revised works approval granted

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1. Decision summary

Works approval W6734/2022/1 is held by MARBL Lithium Operations Pty Ltd (works approval holder) for the Wodgina Lithium Project (the premises), located within tenements L45/443, M45/383, M45/923, M45/1188, M45/1252, G45/321 and G45/291.

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 construction and operation of the premises. As a result of this assessment, revised works approval W6734/2022/1 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 30 January 2025, the works approval holder submitted an application to the department to amend Works Approval W6734/2022/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought:

- The storage of decant and seepage recovery water within Constellation B Pit (Figure 1) to remove fine sediments from the water prior for use at the beneficiation plant;
- The use of seepage recovery water for the conditioning of material at the Atlas non-acid forming (NAF) stockpile (borrow location) (Figure 2) for the construction of the Anson and Dragon Tailings Storage Facility (TSF) embankments (Figure 1);
- The use of seepage recovery water for dust suppression along haul roads within the Atlas TSF construction area to maintain moisture content on constructed embankment lifts; and
- Extension of the expiry date of works approval W6734/2022/1 from 9 May 2026 to 9 May 2027.

This amendment is limited only to changes to Category 5 activities from the existing works approval.

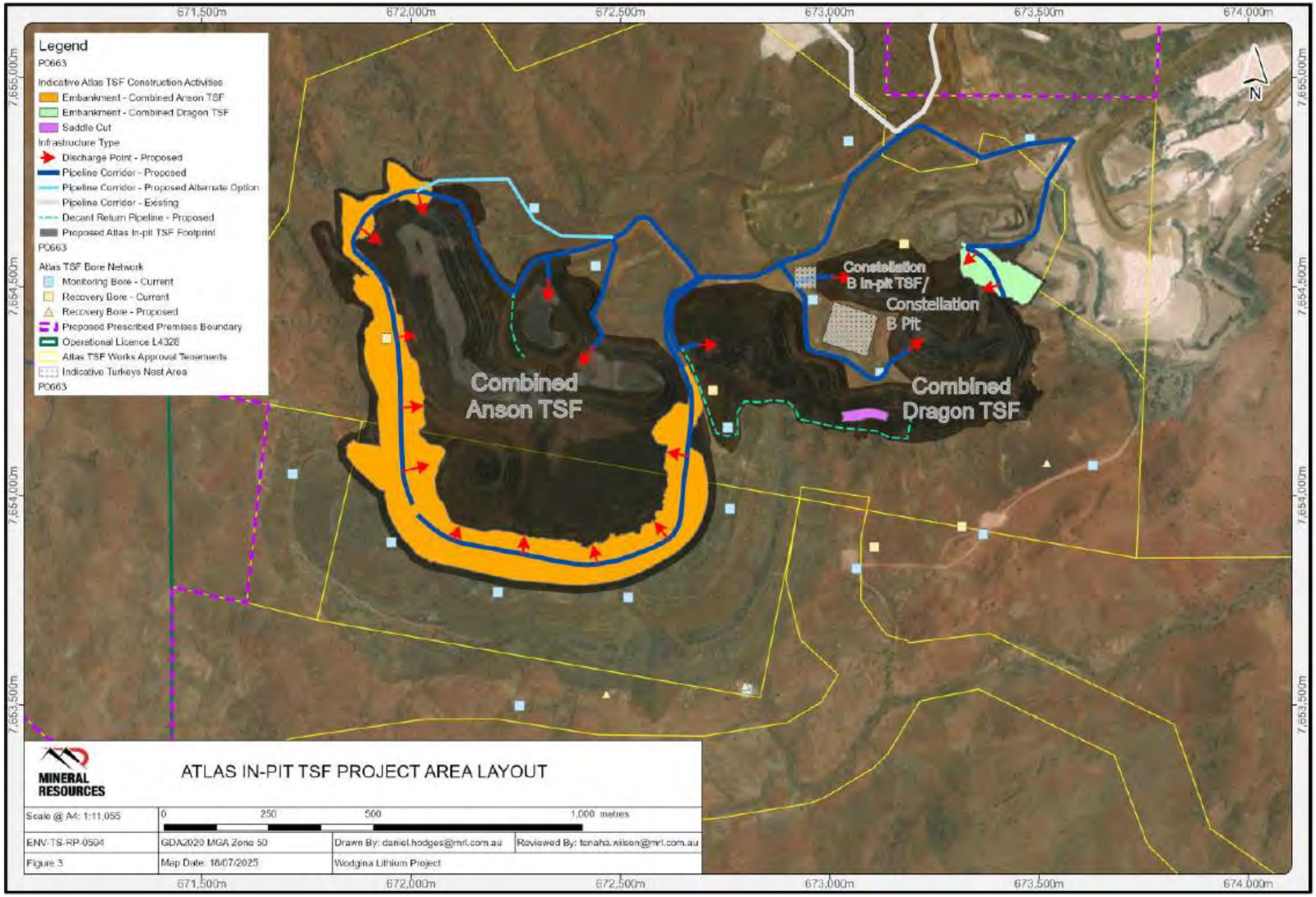

Figure 1: Anson and Dragon TSF embankment construction (Sourced from MinRes 2025)

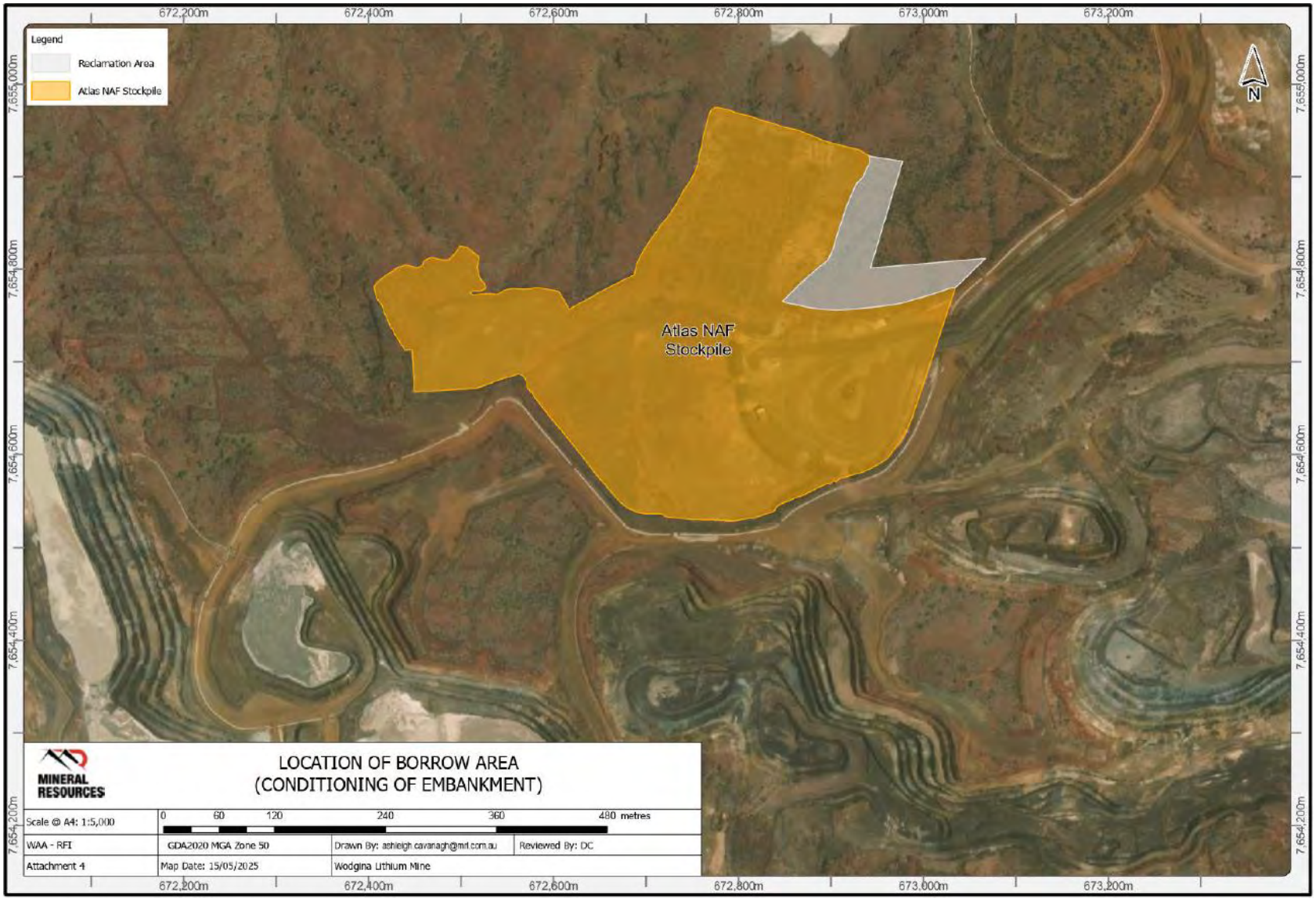

Figure 2: Atlas NAF stockpile (borrow location) and material conditioning location

2.3 Discharge of decant and seepage recovery water in Constellation B Pit.

The works approval holder has identified that there are periods where the solids within the tailings are unable to be segregated effectively from the decant water within the Anson A and B TSFs. This was caused by varying ore characteristics of the plant feed which appears to change over time. The higher concentrations of fines remain within the extracted decant water which impacts processing operations via the higher sediment load within the water. This has resulted in the works approval holder operating the active TSFs with a higher than desired pond level.

To manage the increased sediment load within the decant return water the works approval holder has proposed to discharge the decant return water generated from the Atlas TSF (comprising of Anson, Dragon and Constellation TSFs) to Constellation B Pit. The works approval holder has also proposed to discharge seepage recovery water extracted from existing and to be constructed recovery bores (REC-1, REC-4, REC-5, REC-6, REC-7, REC-8, REC-9 and REC-10) which are authorised under the current works approval and locations are presented in Figure 3. Constellation B Pit will act as a staging pond which will ideally allow sediments to settle out of the decant and seepage recovery water prior to being pumped to the processing water pond which is operated under licence L4328/1989/10.

The works approval holder has advised the department that there will be no change to the pipeline network footprint and indicative tailings discharge and decant water pump points as depicted in Figure 6 in W6734/2022/1.

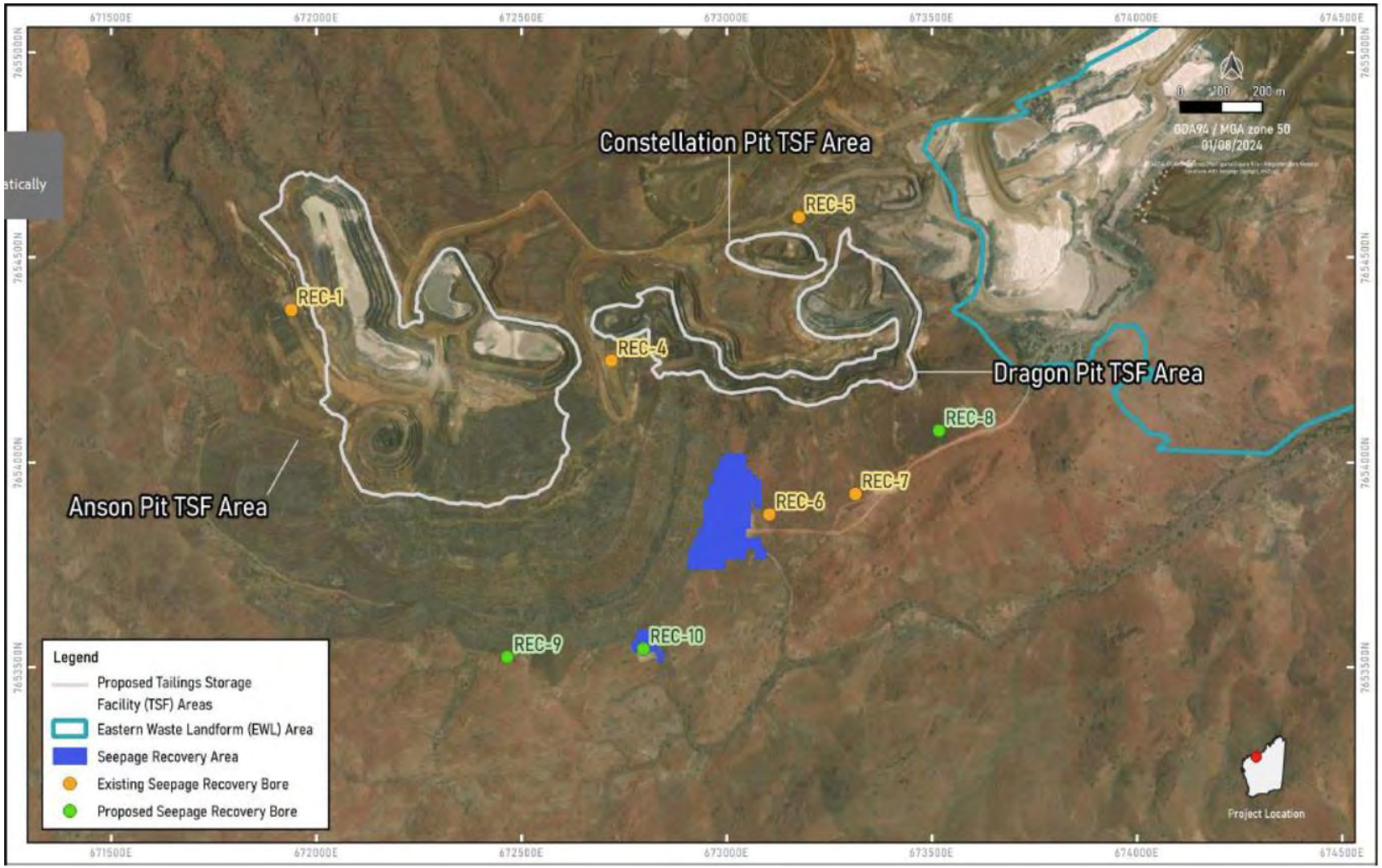

Figure 3: Seepage recovery bore locations

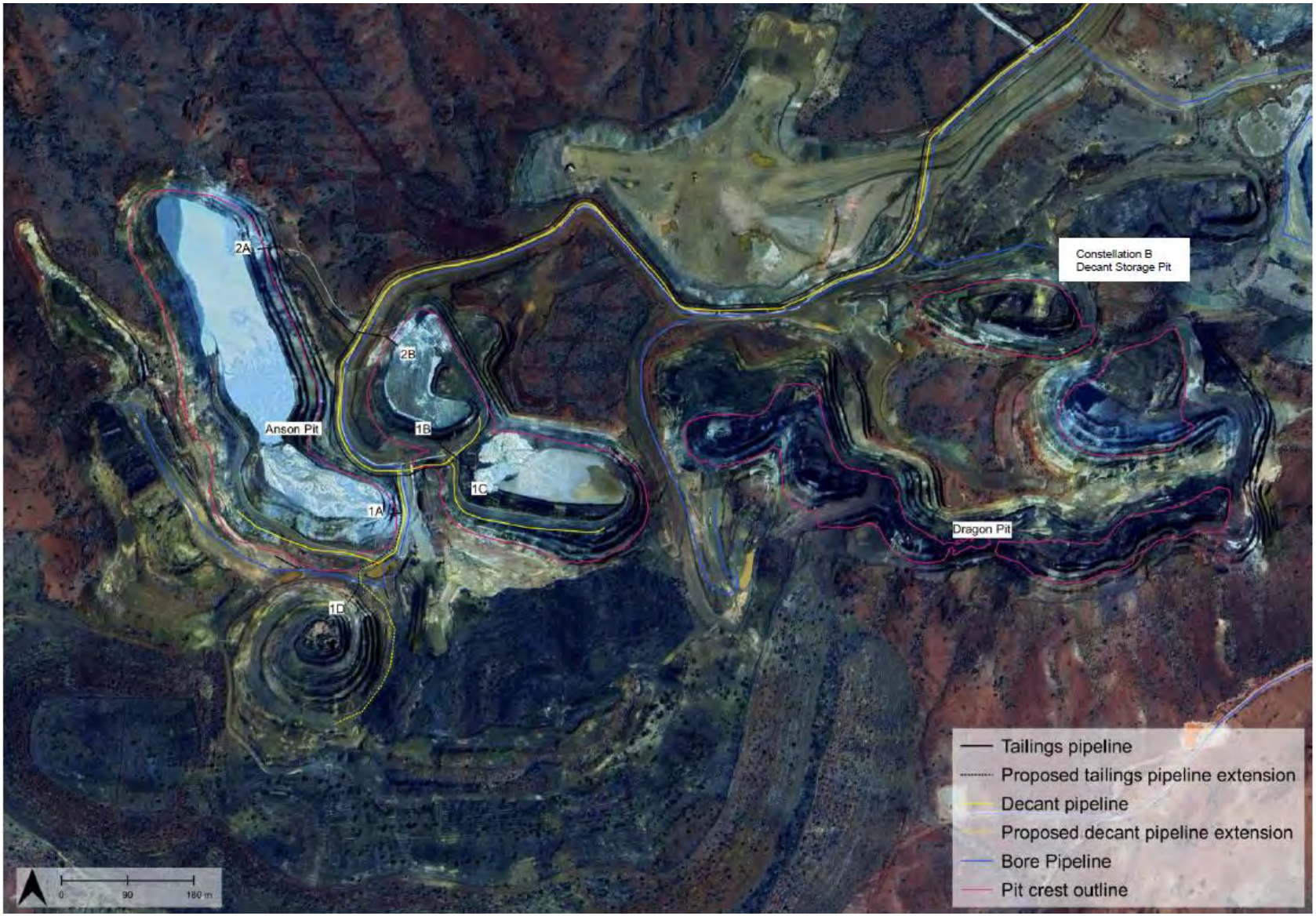

Figure 4: Decant pipeline route

2.3.1 Proposed Constellation B Pit inputs and outputs

The maximum decant input to Constellation B Pit is restricted by the capacity of the already approved decant pumps (260 tonnes per hour (or nominally 50% average annual water return)). It is understood that the works approval holder is intending to extract the settled water from Constellation B Pit using the same approved decant pump as per current works approval requirements.

The works approval holder has advised the following estimated inputs into Constellation B pit:

- Average decant feed is anticipated at approximately 120 – 180 m^3/hour (kL/hour);
- Maximum decant feed is anticipated at approximately 520 m^3/hour (kL/hour);
- Average seepage recovery water feed would be up to 0 – 18 m^3/hour (kL/hour); and
- Maximum seepage recovery water feed would be up to 108 m^3/hour (kL/hour);

The approximate Pit inputs have been considered by the department and has been presented in Table 1.

Holding capacity

The works approval holder has advised the department of the following holding capacities:

- The process water pond has a holding capacity of 5,000 kL; and
- Constellation B Pit has a holding capacity of approximately 250,000 kL.

Table 1 indicates that the estimated average inputs into the Constellation B Pit will not exceed the maximum output of Constellation B Pit and without any extraction of water from Constellation B Pit. It is estimated that it would take approximately 52 to 86 days to reach capacity under proposed average operations without any evaporation, seepage or extraction from the pit. It is observed that the maximum input into the Constellation B Pit exceeds the maximum extraction rate and under maximum operation Constellation B Pit will reach maximum holding capacity in approximately 17 days without any evaporation, seepage or extraction from the pit.

Table 1: Constellation B Pit inputs and outputs

	Hour (kL)	Day (kL)	[1]Month (kL)
Average decant feed input	120 – 180	2,880 – 4,320	86,400 – 129,600
Average seepage recovery water input	0 – 18	0 – 432	0 – 12,960
Total input (Average)	120 – 198	2,880 – 4752	86,400 – 142,560
Maximum output	260	6,240	187,200
Maximum decant feed input	520	12,480	374,400
Maximum seepage recovery water input	108	2,592	77,760
Total input (Maximum)	628	15,072	452,160
Maximum output	260	6,240	187,200

Note 1: Month is calculated at 30 days

2.3.2 Seepage assessment

Groundwater modelling and seepage assessments to predict the potential seepage impacts from Constellation B Pit TSF for the disposal of tailings had previously been undertaken during the initial works approval which was granted in May 2023. A revised assessment of seepage impacts and groundwater model by AQ2 Pty Ltd (AQ2) was undertaken to approve the Atlas TSF Above-Ground expansion. The model was developed to simulate potential seepage from the Atlas TSF (AQ2 2022a) and prediction of groundwater mounding and travel pathways and times for seepage from the TSF area. AQ2s (2022a) key conclusion was that with the operation of existing and planned seepage recovery bores at combined total pumping rate of around 60 to 100 kL/day, seepage from Constellation B Pit would be constrained to the immediate mine area with no surface water expression of groundwater/seepage over the life of the mine.

To support the discharge of decant and seepage recovery water into Constella B Pit the works approval holder consulted AQ2 to assess potential impacts from discharging decant water to the Constellation B Pit. AQ2 (2024) concluded the following via a memorandum:

- The storage of decant water in Constellation B Pit does not pose any additional water management or environmental risk to that determined for tailings deposition;
- Groundwater seepage recovery system (existing and planned for tailings deposition) is adequate to recover as much seepage as is practical and to reduce water table mounding (and thus the potential for the surface expression of the water table);
- The existing Operational Monitoring and Mitigation Plan for the Atlas Pits TSF is suitable for the effective monitoring and management of any seepage from Constellation B Pit.

AQ2 (2024) noted that the original model was “very” conservative and adopted the “worst case” predictions. The model assumed that all pits in the Atlas TSF was filled and maintained to their maximum operating levels from day 1 until the end of tailings deposition. In addition, the model did not consider water loss from decant return water or evaporation.

The model permeability simulated seepage from the pits as if they were full of water (decant) during operations and not tailings providing the maximum potential predicated seepage rate due to the absence of solids.

2.3.3 Water quality results

Recent water quality results for decant and seepage recovery water indicate that the seepage recovery water extracted from recovery bores REC-1 to REC-7 generally report higher concentrations of lithium than the surrounding groundwater monitoring bores. Figure 5 presents the reported lithium concentrations from decant and seepage recovery water surrounding the Atlas TSF. The average (0.4 mg/L) and maximum (4.9 mg/L) lithium concentrations reported at surrounding groundwater bores is also presented in Figure 5. The highest concentration of lithium in surrounding groundwater was reported at TINMB05d located approximately 600 m northeast of Constellation B Pit. Figure 6 presents the location of the seepage recovery bores and monitoring bores surrounding the Atlas TSF.

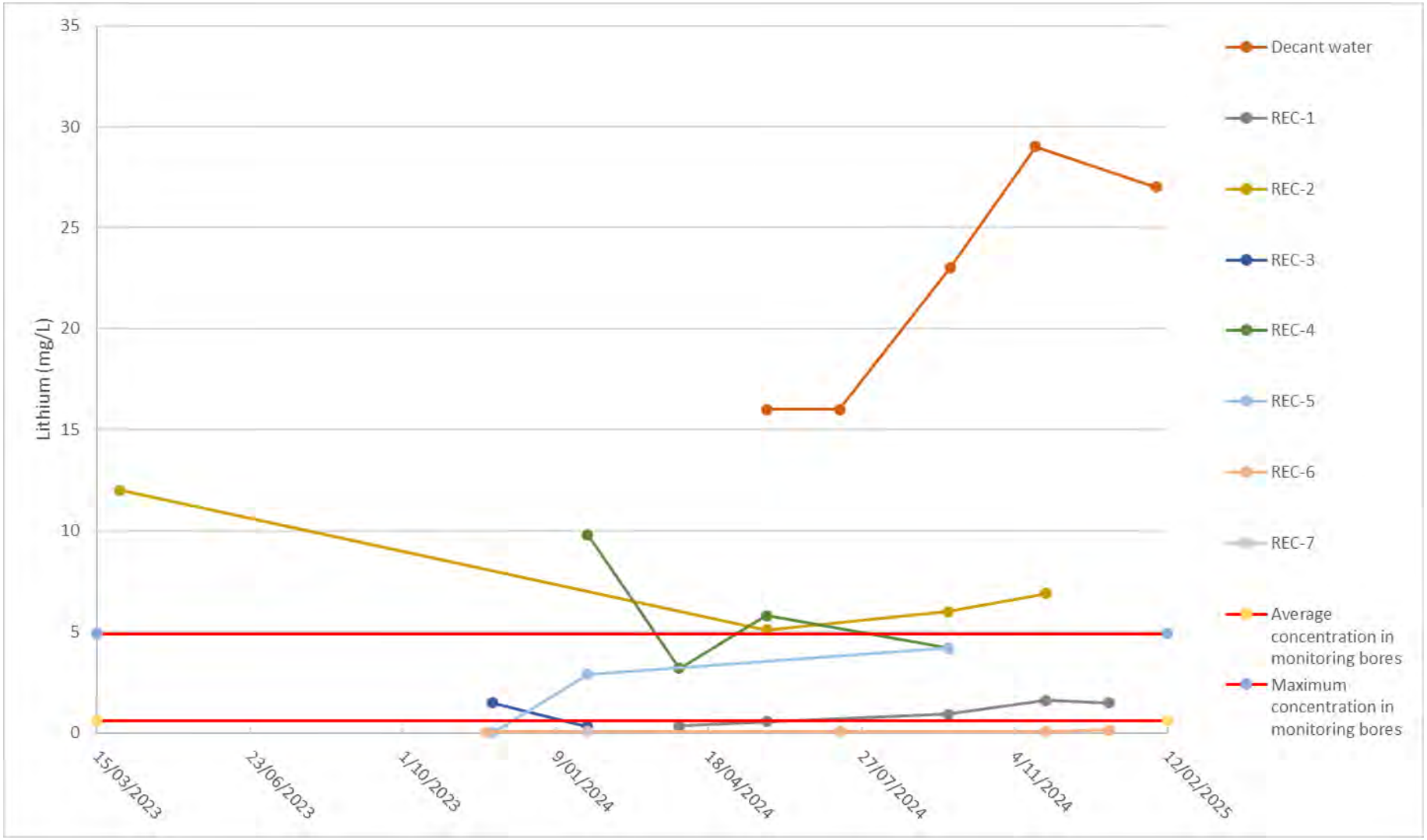

Figure 5: Lithium concentrations in decant and seepage recovery water from the Atlas TSF including average and maximum lithium concentrations in monitoring bores surrounding the Atlas TSF

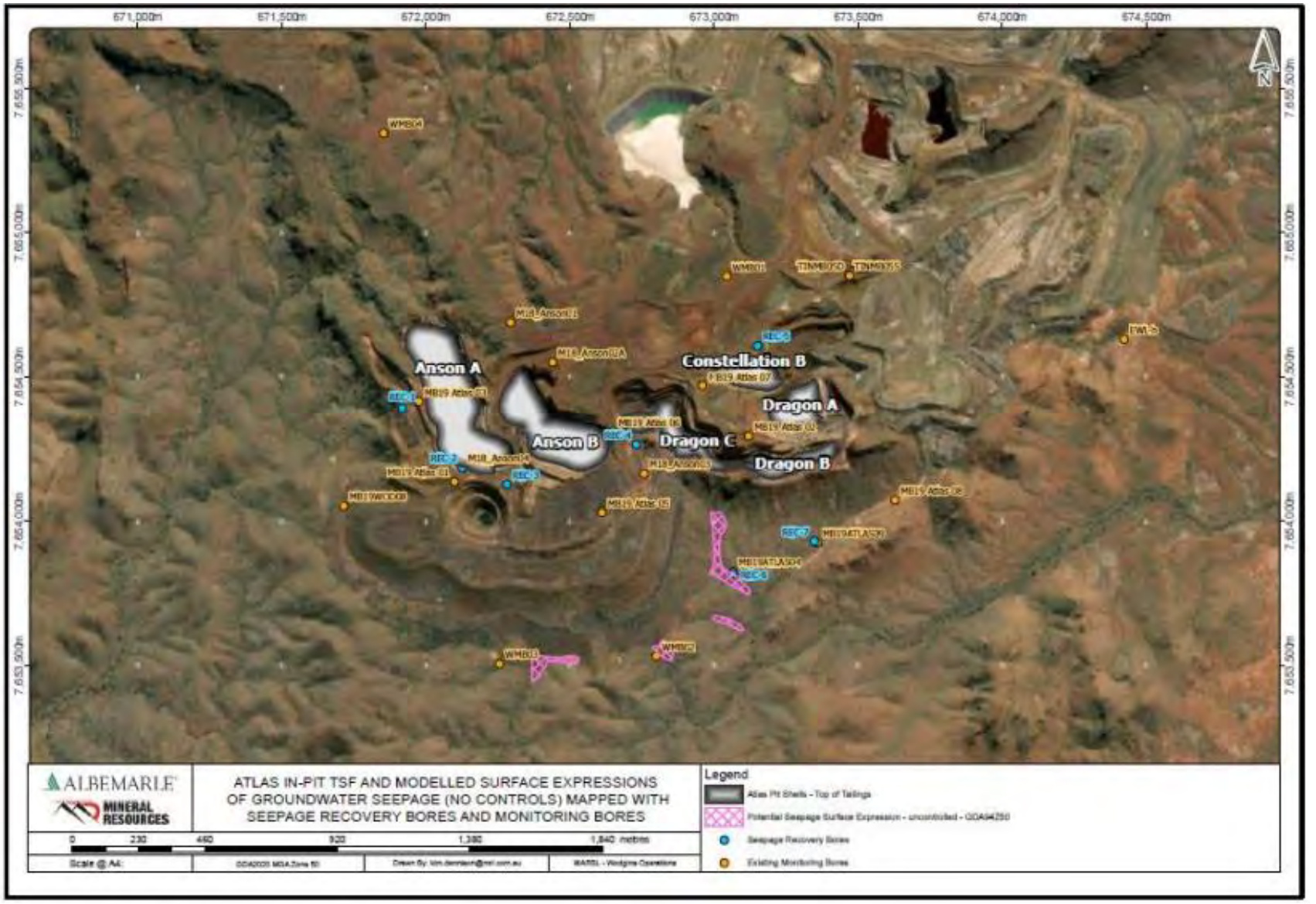

Figure 6: Seepage recovery bores and monitoring bore locations

2.4 Use of seepage recovery water for construction purposes

On 13 March 2024 the works approval holder submitted an application to expand the Atlas TSF by 6.2 million cubic meters (Mm^3) via expanding part of the TSF above ground via constructing embankments (Figure 1). The following embankments and changes to the original works approval were granted to the amended works approval on 9 September 2024:

- Combine Anson A, B and C pits with construction of an embankment;
- Combine Dragon A, B and C pits by construction of the Dragon Saddle embankment on the east; and
- Increase final tailings deposition height from RL 286 to RL 290m.

Within this works approval amendment application, it is proposed to utilise seepage recovery bores surrounding the Atlas TSF (Figure 3). The purpose of this proposal is to achieve the required water demand for the embankment construction, to reduce the distance water needs to travel to be used for dust suppression and material conditioning and improving the efficiency of the water use and cost.

The proposed use of the seepage recovery water will only be used for the construction of the Combined Anson TSF embankment and the Combined Dragon TSF embankment (Figure 1). The applicant has estimated the construction phase of the embankments is to take approximately 12 months.

The seepage recovery water will be discharged at the [1]Turkeys Nest (Figure 1) within the Atlas TSF area and mixed with diluted reverse osmosis (RO) brine water generated from the reverse osmosis plant under licence L4328/1989/10. The works approval holder has advised that the average construction water demand is approximately 80 m^3/hour and the input of seepage recovery water into the turkeys nest is approximately 80 m^3/hour with a maximum input of 108 m^3/hour. The works approval holder proposed that the average percentage mix of seepage recovery water and RO Brine is 50/50. The works approval has however acknowledged that the actual composition will vary depending on other waters demands at the project ie other mining dust suppression, plant usage and rainfall.

Once the TSFs are commissioned seepage recovery water will be re-directed to either Constellation B decant storage pit (as discussed in section 2.3) or directly to the processing plant.

2.4.1 Pre-conditioning materials

Water demand for the embankment construction for Anson TSF and Dragon TSF (Figure 1) is approximately 1.9 ML/day during. Approximately 90% of the 1.9 ML/day water will be used to condition the construction materials prior to transportation to the embankments. Material will be conditioned to achieve an optimal moisture content to assist achieving the required compaction density of the TSF embankments. The works approval holder has advised that there is no to little expected runoff or seepage to occur during the material conditioning due to the requirement to achieve target moisture requirements and the need to avoid saturation of the material.

Pre-conditioning of the material will only occur within the Atlas NAF stockpile (borrow area) as presented in Figure 2 and Figure 7. Figure 7 presents the most recent available aerial photograph showing the location of the borrow area.

[1] At the time of this amendment report the Turkeys Nest is yet to be constructed and is already authorised under works approval W6734/2022/1.

Figure 7: Atlas NAF stockpile, 3 February 2024 (Google Earth 2025)

2.4.2 Maintaining moisture content of embankment

The works approval holder has advised that there is a requirement to maintain the target moisture content of completed embankment lifts during construction to prevent drying and cracking of the compacted materials. As previously discussed, the expected timeframe for the construction of the embankment is approximately 12 months. Once the embankments are completed that there will no longer be a requirement to discharge seepage recovery water mixed with RO brine water to maintain appropriate moisture content on the TSF.

Due to the nature and location of the emission (outside the Atlas NAF borrow) discharge of seepage recovery water to maintain moisture content has been incorporated into the risk assessment (section 3) for the proposed use of seepage recovery water for dust suppression on haul roads (discussed in section 2.5).

2.5 Seepage recovery water for dust suppression on haul roads

2.5.1 Dust suppression

Approximately 10% of the total water required for the overall embankment construction requirements (approximately 1.9 ML/day) will be used for dust suppression on the haul roads which equates to approximately 190,000 kL per day. The proposed duration for seepage recovery water mixed with RO brine (~50/50 mix) for use as dust suppression is approximately 12 months and will cease when the embankments have been constructed. The works approval holder has advised the department that the majority of the haul roads required for dust suppression using the seepage recovery water will be located within the Atlas TSF catchment.

The applicant manages dust suppression under licence L4328/1989/10 condition 3 and works approval W6734/2022/1 condition 20. L4328/1989/10 allows the use of no more than 1.5 GL/year of RO brine for dust suppression. W6734/2022/1 allows diluted RO brine water to be

used for dust suppression purposes within the Atlas TSF footprint for the duration of the works approval.

Recent (sampled on 3 March 2025) RO brine water monitoring results report lithium concentrations at 0.2 mg/L and a total dissolved solids (TDS) concentration of 2,300 mg/L. It's noted the average lithium concentration within the seepage recovery bore water is 2.9 mg/L and TDS has been reported between 990 to 2,400 mg/L.

2.6 Extension of works approval duration

As mentioned in section 2.4 of this amendment report the construction of the embankments is expected to take approximately 12 months. As a result, there is a potential for this works approval to expire prior to the completion of the works. The applicant has requested for the end date of the works approval be extended from 9 May 2026 to 9 May 2027.

The department considered the proposed new end date of the works approval and has amended the expiry date to 9 May 2027.

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 operation which have been considered in this Amendment Report are detailed in Table 2 below. Table 2 also details the proposed control measures the works approval Holder has proposed to assist in controlling these emissions, where necessary.

Table 2: Works approval holder controls

Emission	Sources	Potential pathways	Proposed controls
Seepage recovery water	Use of seepage recovery water from TSF seepage recovery bores to condition material at Atlas NAF Stockpile (borrow area) for the construction of Anson and Dragon TSF embankments for construction purposes.	Flooding and/or overland run off from Atlas NAF stockpile (borrow area) followed by seepage/infiltration through the soil profile.	• Short term operations (approximately 12 months); • Avoidance of oversaturating embankment materials preventing runoff; • Seepage recovery water stored in already approved turkeys nest which will be HDPE lined minimizing seepage; and • Estimated approximately 1,710,000 kL per day for material conditioning and embankment moisture maintenance.
	Use of seepage recovery water from TSF seepage recovery bores for use as dust suppression on haul roads during	Flooding and/or overland run off from haul roads or constructed TSF embankment lifts followed by	• Short term operations (approximately 12 months); • Most haul roads located within internally draining catchments of the Atlas TSF; and

Emission	Sources	Potential pathways	Proposed controls
	TSF embankment construction and To maintain moisture content on completed embankment lifts.	seepage/infiltration through the soil profile.	• Estimated approximately 190,000 kL per day kL of water used for dust suppression per day.
Decant and seepage recovery water	Discharge of decant and seepage recovery water to Constellation B decant storage pit.	Seepage / Infiltration of decant/seepage recovery water through pit walls and base.	• Pre-existing seepage modelling conducted; • Existing seepage recovery bores have a total pumping rate of approximately 60 to 100 kL/d; • Existing operational monitoring and mitigation plan (AQ2 2022b) to monitor and manage seepage from Constellation B including: o Seepage recovery bores operations (condition 18 in W6734/2022/1); o Trigger response actions to manage water levels, water quality and visual seepage observations (not conditioned); and o Groundwater monitoring levels and parameters (condition 21 in W6734/2022/1).
		Overtopping of Constellation B decant storage pit.	• Overflow from Constellation B decant storage pit would be directed to the Dragon A Pit; • Flow meter to measure pumped inputs and outputs; • Existing seepage recovery bores have a total pumping rate of approximately 60 to 100 kL/d; and • Freeboard maintained to manage a minimum of 1:100 year, 72-hr storm event.

3.1.2 Receptors

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

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

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

Environmental receptors	Distance from prescribed activity
Remnant native vegetation	Located approximately: • 30 m southeast of Constellation B; • 60 m southwest and south of the Anson and Dragon proposed embankment; and • 50 m from the NAF stockpile area (borrow area).
Priority Flora	Five priority flora and one potentially undescribed flora has been recorded within the premises: • Euphorbia clementii (P3); • Heliotropium muticum (P3); • Terminalia supranitifolia (P3); • Triodia chichesterensis (P3); • Vigna triodiophila (P3); • Abutilon aff. hanni (potentially undescribed). The closeted identified flora is located approximately: • 380 m south of the Anson embankment; • 100 m southeast of the future dragon embankment; and • 60 m northwest of Constellation B.
Native Fauna and Priority fauna	Fauna survey in 2019 identified *Pseudomys chapmani* (P4) approximately 680 m southeast of the Anson embankment. Historic recordings of endangered and vulnerable mammals have been identified surrounding the Atlas TSF between 2009 to 2012. The closet located approximately 60 m north of the future Anson embankment (recorded in 2009 on Geocortex). Six threatened species have the potential to occur within the area, of which three have been recorded. No Threatened species have been recorded in the vicinity of the Atlas Project area. Native fauna assumed primarily inhabit The Rocky Ridge and Gorge habitat areas located approximately 20 m northwest of the future Anson embankment.
Watercourses/drainage lines and waterbodies	No permanent surface water systems intersect the Atlas TSF, although semi-permanent pools, such as the Wodgina Rock Hole, occur following heavy rainfall events. • Minor non-perennial drainage line/watercourse located approximately 640 m south of the future Anson embankment. • Minor non-perennial drainage line/watercourse located near the future Anson embankment generally drains west direction towards the Yule River located 12 km west. • Minor non-perennial drainage line/watercourse located near the future dragon embankment and Constellation B generally drains east direction towards the Turner River West located 5.3 km east.
Turner River West	Located 5.3 km east of Atlas TSF.
Groundwater	The premises is located within the *Rights in Water and Irrigation Act 1914* (RIWI Act) Proclaimed Pilbara Groundwater and Surface Water Areas. No stock bores are in close proximity. The closest bore (not operated by the Works Approval Holder) that is for camp use is under groundwater licence GWL184329 (Pilgangoora Operations Pty Ltd). This bore is located more than 10 km from the Atlas TSF. Groundwater levels at the Atlas TSF range from 10 m below ground level (mbgl) in areas surrounding the greenstone belt to 55 – 95 mbgl

Environmental receptors	Distance from prescribed activity
	within the greenstone belt located on the high ridges (below the base of the Atlas pits where base elevations range from 40 to 80 mbgl). Groundwater quality: Generally alkaline (pH 7.4 to 8.4), fresh to brackish salinity (510 to 3,200 mg/L total dissolved solids) and very hard (406 to 1,600 mg CaCO3/L). Low environmentally significant metals and metalloids including arsenic, cadmium, cobalt, lead, mercury, selenium and thallium were detected. Variable in lithium content, ranging from 0.08 mg/L (groundwater in non-lithium bearing ultramafic rocks) to 9.5 mg/L (groundwater associated with pegmatite dykes).
Cultural receptors	**Distance from prescribed activity**
Aboriginal heritage sites	ID Number: 22037 – WodE#1 Mabarn Caves (lodged) – Located approximately 180 m northeast of Constellation B In-pit TSF and approximately 220 m north of the Dragon embankment; and ID Number: 28890 – W-08-03 (lodged) – Located approximately 450 m north of future Anson embankment.

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020a) for those emission sources which are proposed to change 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 works approval holder 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 works approval holder'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 works approval 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 works approval W6734/2022/1 that accompanies this amendment report authorises construction and time-limited operations. The conditions in the revised works approval have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

A licence 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 Amendment Report, however licence conditions will not be finalised until the department assesses the licence application.

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

Risk Event					Risk rating[1] C = consequence L = likelihood	Works approval holder's controls sufficient?	Conditions[2] of works approval	Comments / justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Works Approval Holder's controls**				
Construction								
Use of seepage recovery water from TSF seepage recovery bores mixed and diluted with RO Brine to condition material for the construction of Anson and Dragon TSF embankments for construction purposes.	TSF seepage recovery water mixed with RO Brine	**Pathway:** Flooding and/or overland run off from Atlas NAF stockpile (borrow area) followed by seepage/infiltration through the soil profile. **Impact:** Sedimentation of water drainage lines, degradation and/or contamination of environmental values.	Priority Flora Native vegetation Groundwater	Refer to Section 3.1	C = Moderate L = Unlikely **Medium Risk**	N	**Condition 4 – Authorises the use of seepage recovery water mixed with RO brine water.** **Condition 5 – Activities using seepage recovery water to avoid contact with native vegetation and preventing pooling via oversaturation.** **Condition 6 - Requirements to capture and retain all stormwater and sediment generated from rainfall events at seepage recovery water use areas.** **Condition 7 – Requirement to recover all sediment captured under condition 6 and to discharge the sediment to a TSF.** **Condition 8 – Monthly monitoring requirement for Turkeys Nest while using seepage recovery water and RO brine water.**	Recent sampling of seepage recovery bore water indicates an average lithium concentration of 2.9 mg/L, with total dissolved solids (TDS) ranging from 990 to 2,400 mg/L. This lithium concentration exceeds the recommended limit of 2.5 mg/L for irrigation water under the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. In contrast, reverse osmosis (RO) brine water sampled on 3 March 2025 reported a lithium concentration of 0.2 mg/L and a TDS concentration of 2,300 mg/L. The works approval holder has proposed using a ~50/50 mixture of RO brine and seepage recovery bore water for; Material conditioning within the Atlas NAF stockpile area (borrow area), Moisture control of the TSF embankment during construction and Dust suppression along haul roads. This mixture will be stored in a temporary containment structure (turkey's nest) during the construction phase. It is noted that the construction phase will also overlap with the time limited operational phase as the applicant wishes to complete staged construction. The period of time expected for this mixed water to be utilised is approximately 12 months. High lithium concentrations in water applied to land pose risks to native vegetation, particularly halophytic plant species common in the Wodgina area. These species are known hyperaccumulators (Nkrumah & van der Ent, 2023), capable of absorbing lithium to levels that may be toxic to grazing livestock and wildlife. Although dust suppression water has not previously been assessed for lithium-related impacts at Western Australian mine sites, relevant research from the USA (e.g., Tasker et al., 2018) provides insight into potential environmental pathways. Key concerns include: 1. Salt Accumulation: Evaporation of applied water leads to crystallisation of salts (mainly sodium chloride) in surface regolith. Lithium may co-precipitate or adsorb onto clay minerals. 2. Progressive Sodicity: Repeated applications increase salt mass and sodicity, displacing calcium and magnesium ions on clay exchange sites. 3. Runoff Dynamics: Initial rainfall events mobilise dissolved lithium and salts with low suspended solids due to aggregate stability. 4. Sediment Transport: Continued rainfall reduces porewater salinity, destabilising clay aggregates and increasing suspended sediment loads containing adsorbed lithium. There is a risk that large amounts of lithium-contaminated sediment produced by rainfall events may impact vegetation and soil fauna if released into the environment. However provided all the suspended sediments produced in rainfall events are captured, the risks of runoff from dust-suppression areas causing immediate environmental impacts should be low. Large amounts of lithium-contaminated sediment may however be produced from these areas, and this will need to be managed after the proposed construction activities have been completed to minimise the risk of long-term environmental impacts To manage these risks, the department has amended the works approval to authorise the use of the water mixture only during the construction phase of the Combined Anson TSF embankment and the Combined Dragon TSF embankment. Use of this water for dust suppression and material conditioning must cease upon completion of embankment construction. The department considers the implementation of measures that will capture all stormwater runoff and recovering all sediment captured from areas where seepage recovery water is used for dust suppression/construction is necessary and conditions have been added to the licence to reflect this. Captured sediment is to be disposed of by discharging to TSF at the end of the construction phase
Use of seepage recovery water from TSF seepage recovery bores mixed and diluted with RO Brine for use as dust suppression on haul roads during TSF embankment construction and To maintain moisture content on completed embankment lifts.		**Pathway:** Flooding and/or overland run off from haul roads or constructed TSF embankment lifts followed by seepage/infiltration through the soil profile. **Impact:** Sedimentation of water drainage lines, degradation and/or contamination of environmental values.	Priority Flora Native vegetation Heritage sites Fauna	Refer to Section 3.1		N	**Condition 4 – Authorises the use of seepage recovery water mixed with RO brine water** **Condition 5 – Activities using seepage recovery water to avoid contact with native vegetation and preventing pooling via oversaturation.** **Condition 6 – Requirements to capture and retain all stormwater and sediment generated from rainfall events at seepage recovery water use areas.** **Condition 7 – Requirement to recover all sediment captured under condition 6 and to discharge the sediment to a TSF.** **Condition 8 – Monthly monitoring requirement for Turkeys Nest while using seepage recovery water and RO brine water.**	
Operation (including time-limited-operations operations)								
Discharge of decant and seepage recovery water to	Decant and seepage	**Pathway:** Seepage / Infiltration of decant/seepage	Native vegetation Priority Flora	Refer to	C = Moderate	Y	Condition 3: Seepage recovery	The seepage model originally used to assess seepage from the Atlas TSF adopted the "worst-case" scenario. The model assumes that the TSF would be full of water (decant) at

Risk Event					Risk rating[1] C = consequence L = likelihood	Works approval holder's controls sufficient?	Conditions[2] of works approval	Comments / justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Works Approval Holder's controls**				
Constellation B decant storage pit.	recovery water	recovery water through pit walls and base. **Impact:** Potential groundwater mounding resulting in impacts to vegetation and/or surface expression and contamination of groundwater.	Groundwater	Section 3.1	L = Possible **Medium Risk**		bore construction requirements. Condition 19: Seepage recovery bore operational requirements. Condition 20: Authorised discharge location for decant and seepage recovery water.	the start of the operation. It's also advised that seepage from the Constellation B decant storage pit would be constrained to the immediate mine area with no surface water expression of groundwater/seepage over the life of mine. The department has undertaken a technical review of the proposal and has concluded: • Based on publicly available geological information, the department does not consider seepage from Constellation B decant storage pit will cause regional environmental impacts due to the generally low hydraulic conductivity of the pit rock walls; • It is expected that seepage will most likely take place from fracture zones in these rocks which could emerge in localised areas at the ground surface in low-lying areas near the mine void; o As a result, there could be localised impacts on vegetation in this void that would need to be managed with the construction of additional seepage recovery bores; o The extent of potential impacts would depend on elevation of the water surface in the mine void, distribution and density of fracture zones in bedrock and on the extent of block-faulting in the area has occurred. • The department does not consider the storage of decant and seepage recovery water within the mine void to significantly change the level of risk that would be associated within the management of wastewater from these sources. The department has granted the proposed use of Constellation B Pit to temporary store decant and seepage recovery water within the pit. The department has not included any additional regulatory controls and considers the works approval holders proposed controls and current works approval conditions suitable to manage this risk event.
		Pathway: Overtopping of Constellation B decant storage pit. **Impact:** Overflow of water impacting or contaminating nearby receptors.	Waterlines Groundwater Native vegetation Priority Flora Fauna	Refer to Section 3.1	C = Moderate L = Unlikely **Medium Risk**	Y	Condition 19: Constellation B decant storage pit freeboard and inspection requirements. Condition 20: Authorised discharge location for decant and seepage recovery water.	Applicant proposed controls (freeboard requirement) is adequate to manage this risk event. No additional regulatory controls required.
		Pathway: Overland runoff caused by spills/leaks of pipeline. **Impact**: Reduced soil and surface water quality and impacting health of surrounding vegetation.	Land/soils Native vegetation Heritage sites	Refer to Section 3.1	C = Minor L = Unlikely **Medium Risk**	Y	Condition 19: Requires the pipelines to be maintained to include a telemetry system, bunding, scour pits and to be inspected daily.	Existing conditions adequately mange this risk event. No additional regulatory controls required.

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

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

4. Consultation

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

Table 5: Consultation

Consultation method	Comments received	Department response
Department of Mines, Petroleum and Exploration (DMPE) advised of proposal on 8 April 2025.	DMPE replied on 5 May 2025 stating/advising that: • In 2014 DMPE approved a mining proposal for in-pit waste rock disposal within Constellation Stage 1. Within the mining proposal it was described that geochemical analysis of the Constellation waste rock has identified elevated baseline levels of Arsenic and Boron that may be mobilised if saturated. It was described in the mining proposal that there was a management plan to ensure the waste rock was encapsulated within the Constellation pit using inert waste material to ensure isolation from the seasonal wetting front and the groundwater table. • DMPE has noted that application has mentioned that the material used for the embankment construction is NAF and therefore reduces risk of acid mine drainage (AMD) occurring from wetting. • DMPE has mentioned that a revised mining proposal is required to alter the approved use of Constellation B decant storage pit from a TSF to store decant and seepage recover water. • DMPE provided the following recommendations: 1. An external review occurs periodically to review the results from the recovery bores and a copy is forwarded to DMPE; 2. The engineer on records submits the TSF operating manual annually, noting changes to the facility; 3. Seek clarity about any backfilled waste rock which maybe saturated as a result of this proposal; and	Comments have been noted and considered in this risk assessment. The department informed the works approval holder of the previous mining proposal statements and provided the works approval holder an opportunity to provide a comment. The works approval holder responded to the department and stated that the "approval to backfill Constellation B areas was never implemented, with backfill instead distributed between Anson and Main Dump areas. Mining Proposal Reg ID 39838 approved the deposition of Constellation Pit waste rock within Anson open pit stages 7 and 9, with the mitigation and controls that the waste rock would be encapsulated within the Anson Pit using inert waste material to ensure isolation from the seasonal wetting front and groundwater table. As no backfilling has occurred within Constellation B, the risk pathway of inundating and/or saturation of the backfilled waste rock is not applicable."

Consultation method	Comments received	Department response
	4. Confirmation should be provided once the recovered groundwater from the Atlas TSF recovery bores is redirected to the Processing Plant as per current approval (estimated 12 months).	
Kariyarra Aboriginal Corporation advised of proposal on 8 April 2025.	Response from Kariyarra Aboriginal Corporation replied on 29 April 2025 and requested the department to include additional e-mail addresses for future correspondence. No further comments have been received.	The department has noted the request and has updated the contact information for this works approval for the Kariyarra Aboriginal Corporation.
Works approval holder was provided with draft amendments on 14 July 2025 and 5 Augst 2025.	Response from the works approval holder was received on 21 July 2025 and 8 August 2025. Refer to Appendix 1.	Refer to Appendix 1.

5. Conclusion

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

5.1 Summary of amendments

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

Table 6: Summary of works approval amendments

Condition no.	Proposed amendments
Front page	Added DWER internal number “INS-0002602”.
	Extended works approval end date from 9/05/2026 to 9/05/2027.
Works approval history	Included summary of changes of this works approval amendment.
1 (table 1)	Amended condition to include construction and placement requirements for the discharge point of Constellation B decant storage pit to be constructed.
	Amended table to split Combined Anson TSF, Combined Dragon TSF and Constellation B In-pit TSF into separate items to allow a staged construction and the submission of separate Environmental Compliance Reports. No conditions or infrastructure requirements are changed and added a note below the table to reference that the three TSFs comprise of the Atlas TSF.
4 (new condition	Added new condition to allow mixing of seepage recover water and diluted RO brine within the Turkeys Nest and utilised as for the purpose of dust suppression along haul roads within the Atlas TSF catchment, maintaining moisture content during embankment lifts and conditioning of material at the Atlas NAF Stockpile.

Condition no.	Proposed amendments
5 (new condition)	Added requirement that water used for dust suppression does not come into contact with native vegetation or cause pooling.
6 (new condition)	New condition to require works approval holder to capture and retain all stormwater runoff in areas where dust suppression water has been applied.
7 (new condition)	New condition to require the works approval holder to recover all sediment captured in areas where dust suppression water has been applied.
8 (new condition)	Included monthly monitoring for the Turkeys Nest during the construction of the Combined Anson TSF and Combined Dragon TSF embankments.
10	Included requirement for the works approval holder to audit their compliance for the construction of groundwater monitoring bores and seepage recovery bores.
11	Included requirement for the works approval holder to submit an Environmental Compliance Report on the construction of groundwater monitoring bores and seepage recovery bores.
	Included a requirement for the Environmental Compliance Report to include monitoring conducted within the turkeys nest.
14 (table 6)	Added a requirement for Constellation B decant storage pit to undergo commissioning activities.
	Changed reference to TSF to “item” within the table.
16	Added a requirement for the Environmental Commissioining Report to include the volume of decant/seepage recover water discharged to Constellation B decant storage pit.
19 (table 7)	Added a requirement for Constellation B decant storage pit to be sufficiently dewatered prior to the beneficiation plant prior to tailings deposition in Constellation B In-Pit TSF.
	Amended Constellation B decant storage pit to be able to receive recovered seepage.
	Added Constellation B decant storage pit minimum freeboard requirements, a daily visual inspection requirements and a restriction to prevent decant and seepage recovery water discharge once tailings discharge has occurred.
	Amended table to split Combined Anson TSF, Combined Dragon TSF and Constellation B In-pit TSF to allow a staged time limited operations of the pits. No conditions or infrastructure requirements are changed and added a note below the table to reference that the three TSFs comprise of the Atlas TSF.
20 (table 8)	Added wording to condition that the authorised discharge points are online discharged to during time limited operations.
	Added Constellation B decant storage pit as an authorised discharge point for decant and seepage recovery water.
	Added a note below the table to stop decant and seepage recovery discharge into Constellation B decant storage pit once tailings deposition within Constellation B In-Pit TSF has occurred.
Schedule 1	Added Figure 11 detailing location of the Atlas NAF stockpile borrow location.

References

1. AQ2 2022a, Wodgina Lithium Project In-Pit TSF Seepage Assessment - Atlas Iron Pits. Prepared for MARBL Lithium Operations Pty Ltd, August 2022.
2. AQ2 2022b, Wodgina Lithium Project Atlas Pits TSF Operational Monitoring and Mitigation Report. Prepared for MARBL Lithium Operations Pty Ltd, December 2022.
3. AQ2 2024, Memo for Potential Impacts of Decant Water Storage in Constellation B Pit (Atlas in-Pits TSF Area), 15 November 2024, Doc Number 422J_026a.
4. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
5. Department of Water and Environmental Regulation (DWER) 2020a, *Guideline: Risk Assessments*, Perth, Western Australia.
6. DWER 2020b, *Guideline: Environmental Siting*, Perth, Western Australia.
7. Mineral Resources (MinRes) 2025 Part V works approval amendment application 0 Attachment 3B – supporting documentation, Version 01.
8. Nkrumah, P.N. and van der Ent, A., 2023. Possible accumulation of critical metals in plants that hyperaccumulate their chemical analogues? *Science of the Total Environment*, **878**,162791. The paper is available from the following website: www.wur.nl

    (A) Shakoor, N., Adeel, M., Ahmad, M.A., Zain, M., Waheed, U., Javid, R.A., Haider, F.U., Azeem, I., Zhou, P., Li, Y., Jilani, G., Xu, M., Rinklebe, J. and Rui, Y., 2023. Reimagining safe lithium applications in the living environment and its impacts on human, animal and plant systems. Environmental Science and Ecotechnology, 15, 100252,

    (B) Tasker, T.L., Burgos, W.D., Piotrowski, P., Castillo-Meza, L., Blewett, T.A., Ganow, K.B., Stallworth, A., Delompré, P.L.M., Goss, G.G., Fowler, L.B., Vanden Heuvel, J.P., Dorman, F. and Warner, N.R., 2018. Environmental and human health impacts of spreading oil and gas wastewater on roads. *Environmental Science and Technology*, **52**, 7081-7091.

Appendix 1: Summary of Works Approval Holder's comments on risk assessment and draft conditions

Condition	Summary of Works Approval Holder's comment	Department's response
1 (Table 1, Item 1)	The works approval holder suggested to replace the reference to 'embankments' with a reference to 'pit crest' for Constellation B decant storage pit.	Amended condition 1 item 1 (Constellation B decant storage pit) to reference the pit crest instead of embankments.
6 (Table 6) *(deleted)*	The works approval holder has requested the lithium concentration limit (2.5 mg/L) placed on the Turkeys nest to be removed. The works approval holder has proposed that if the removal of the lithium concentration limit is not removed the works approval holder has proposed a limit of 13 mg/L. The justification for the limit is due to: **1. Applicable guideline criterion:** The works approval holder mentions that the 2.5 mg/L threshold sourced from the ANZG (2000) for irrigation of vegetation is applicable to the use of agricultural irrigation water used over 20 and 100 year time frames. The limit of 2.5 mg/L is therefore not appliable to the proposed use. Water will be used for dust suppression on haul roads that are bunded on either side, temporary construction phase material conditioning and not continued irrigation of edible or grazed plants. The works approval holder states that the distinction is critical, as using an irrigation-based threshold in a dust suppression context is inappropriate and does not reflect credible risk pathways in the borrow areas or TSF construction zones. **2. Other controls adequately address the risk:** The works approval holder has mentioned that conditions specified within draft instrument restrict where water can be used and include requirements for monitoring and detect and prevent overspray or accidental release. The works approval holder considers that conditions 4, 5 and 7 are sufficient to manage the risk, with condition 6 being unnecessary in achieving the desired outcomes.	The Licence Holder is correct in noting that the ANZ irrigation limit for lithium is based on crop irrigation and may be conservative when applied to dust suppression on natural vegetation. However, in the absence of site-specific studies on the tolerance of local vegetation and soil fauna to elevated lithium concentrations, the department must adopt a precautionary approach to protect environmental receptors. This is particularly important in light of recent findings (Shakoor et al., 2023) indicating that soil fauna may be especially sensitive to elevated lithium levels. The intention of the limit was to slow the rate at which lithium accumulates on minerals within the regolith in between rainfall events. Unless all water and sediment from rainfall and runoff events in the dust suppression area will be fully contained, there remains a risk of long-term environmental impacts, despite the temporary nature of the activity. The proposed lithium concentration limit of 13 mg/L is not supported by site-specific scientific evidence and appears to be opportunistic. While some literature suggests that lithium concentrations above the ANZ irrigation criterion may not cause long-term harm to vegetation, this is not conclusive. For instance, Fipps (2003) reported that most crops can tolerate up to 5 mg/L lithium in irrigation water, and Shakoor et al. (2023) noted that some plant species can withstand concentrations above 10 mg/L for short periods. However, the

Condition	Summary of Works Approval Holder's comment	Department's response
	3. Works are temporary in nature: The works approval holder has mentioned that the use of the seepage recovery water mixed with RO brine water for dust suppression is explicitly time-bound, being restricted to the construction phase of the works approval (approximately 12 monthly period). The proposed seepage recovery water use is not a continuing source of lithium exposure to surrounding vegetation, especially when considering the final land use. Risk of persistent environmental exposure or long-term lithium build-up from the activity is minimal. **4. Credible risk pathway – bioaccumulation in vegetation:** The works approval holder mentions that the department cites bioaccumulation risk within the amendment report, particularly in halophytes (specifically in their capacity as hyperaccumulator plants). The works approval holder mentions that there is a difference between the quoted literature results (under artificial, hydroponic, laboratory conditions focusing on the floristic potential for phytomining) and real-world exposure through dust suppression in a managed mining environment. The works approval holder mentions that the cited literature (Nkrumah and van der Ent, 2023) does not address the risks relevant to this application (short-term use for seepage recovery water mixed with the RO brine). The data in the cited study indicates the tested species can "tolerate relatively high concentrations of lithium (~50 mM) in solution and have the ability to accumulate high lithium concentrations in their shoots". The works approval holder mentions that the findings are very different to saying these species will hyperaccumulate lithium in tissues, leading to environmental harm under field conditions. It is noted that condition 5 of the draft works approval specifies the prevention of pooling or overspray to native vegetation, mitigating against the potential pathways to receptors. **5. *Proposed alternative lithium discharge limit:*** The works approval holder has mentioned that site-specific data and GoldSim modelling has demonstrated that the mixed water proposed for the Turkeys Nest would exceed the conservative 2.5 mg/L limit for lithium, particularly in the seepage recovery bores. Our operational dataset shows maximum concentrations up to 9.8 mg/L in some bores (REC4), and typical mixtures will likely exceed the ANZG limit, but without risk of ecological harm in the context of the overall project. The works approval holder proposes, that if a limit is to be set, it should instead reflect site-	long-term effects on plant health and soil fauna remain uncertain. Furthermore, lithium accumulation in sediments could lead to bioaccumulation in plant tissues. Nkrumah and van der Ent (2023) found that certain Australian native species can absorb up to 10 g/kg of lithium from hydroponic media within six weeks—levels potentially harmful to grazing animals. Although uptake from soil is likely slower, this pathway could introduce lithium into local food webs. Given these uncertainties, the Department has determined to remove the lithium concentration limit from the licence conditions. Instead, the Licence Holder will be required to implement robust runoff and sediment management measures and disposing of collected material in a tailings storage facility upon completion of construction activities

Condition	Summary of Works Approval Holder's comment	Department's response
	specific conditions by establishing a value between maximum expected in the recovery bores and below the minimum observed in decant water. Ensuring that water sourced from unauthorised sources is able to be identified. Noting the short-term nature of this use and the limited risk of receptor contact, this limit should alternatively achieve the aims of Condition 6. Based on GoldSim modelling of worst-case-scenario conditions, the proposed value for replacement of the 2.5 mg/L limit would be 13 mg/L. This limit would be set in conjunction with condition 5, avoiding pooling and overspray coming into contact with surrounding native vegetation.	
18, Table 8, Item 3 (now condition 19, Table 7)	The works approval holder has requested that recovered seepage water is included within the condition to allow it to be directed to the Turkeys Nest along with pumped back to the plant and/ or discharged to Constellation B decant storage pit during time-limited operations.	It is noted that the works approval holder is planning to undertake staged construction which will result in construction phase overlapping with time limited operation (TLO) phase for some components of infrastructure. It is acknowledged that RO Brine approved for dust suppression is stored within the same turkey's nest which has also been approved to store seepage recovery water/RO bine mixture approved for dust suppression during the construction phase. As it is not possible to separate the two water sources the department has amended condition 19 and 20 to allow the use of seepage water for dust suppression during TLO while construction of infrastructure outline in Table 1 is occurring.
19, Table 9 (now condition 20, Table 8)	The works approval holder has requested that recovered seepage water to be directed to the Turkeys Nest is included within the condition.	