Decision Report

Application for Works Approval

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

Works Approval Number	W6601/2021/1
Applicant	Northern Star (Thunderbox) Pty Ltd
ACN	107 154 727
File number	DER2021/000505
Premises	North Eastern Goldfields Operations Mining tenements: M36/512, M36/582, M36/585
Date of report	3 May 2022
Decision	Works approval granted

Digitally signed by Samara Rogers
Date: 2022.05.03 15:44:15 +08'00'

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

Table of Contents

1. Decision summary 1

2. Scope of assessment 1

2.1 Regulatory framework 1

2.2 Application summary and overview of premises 1

3. Risk assessment 3

3.1 Source-pathways and receptors 3

3.1.1 Emissions and controls 3

3.1.2 Receptors 8

3.2 Risk ratings 12

3.3 Detailed risk assessment for tailings dust from dry tailings cells during construction and operation of the TSF 17

3.3.1 Ambient dust emissions 17

3.3.2 Ambient dust management 18

3.3.3 Risk assessment 19

4. Consultation 20

5. Conclusion 20

References 21

Appendix 1: Summary of applicant's comments on risk assessment and draft conditions 22

Appendix 2: Application validation summary 23

Table 1: Proposed applicant controls 3

Table 2: Sensitive human and environmental receptors and distance from prescribed activity 9

Table 3: Risk assessment of potential emissions and discharges from the premises during construction, commissioning and operation 13

Table 4: Consultation 20

Figure 1: Embankment sections and details 2

Figure 2: Extended TSF diversion infrastructure 8

Figure 3: Schematic section through toe drain, berm and diversion channels 8

Figure 4: Modelled particle tracks at the end of 10 years of discharge to Cells C and D 10

Figure 5: Distance to sensitive receptors 11

Figure 6: Contaminated site area of classifications 17

1. Decision summary

This decision report documents the assessment of potential risks to the environment and public health from emissions and discharges during the construction and operation of the premises. As a result of this assessment, works approval W6601/2021/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

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

2.2 Application summary and overview of premises

On 30 August 2021, the applicant submitted an application for a works approval to the department under section 54 of the *Environmental Protection Act 1986* (EP Act).

The application is to undertake construction works relating to tailings storage facility (TSF) cells C and D at the premises. The premises is approximately 44 km north-west of Leinster.

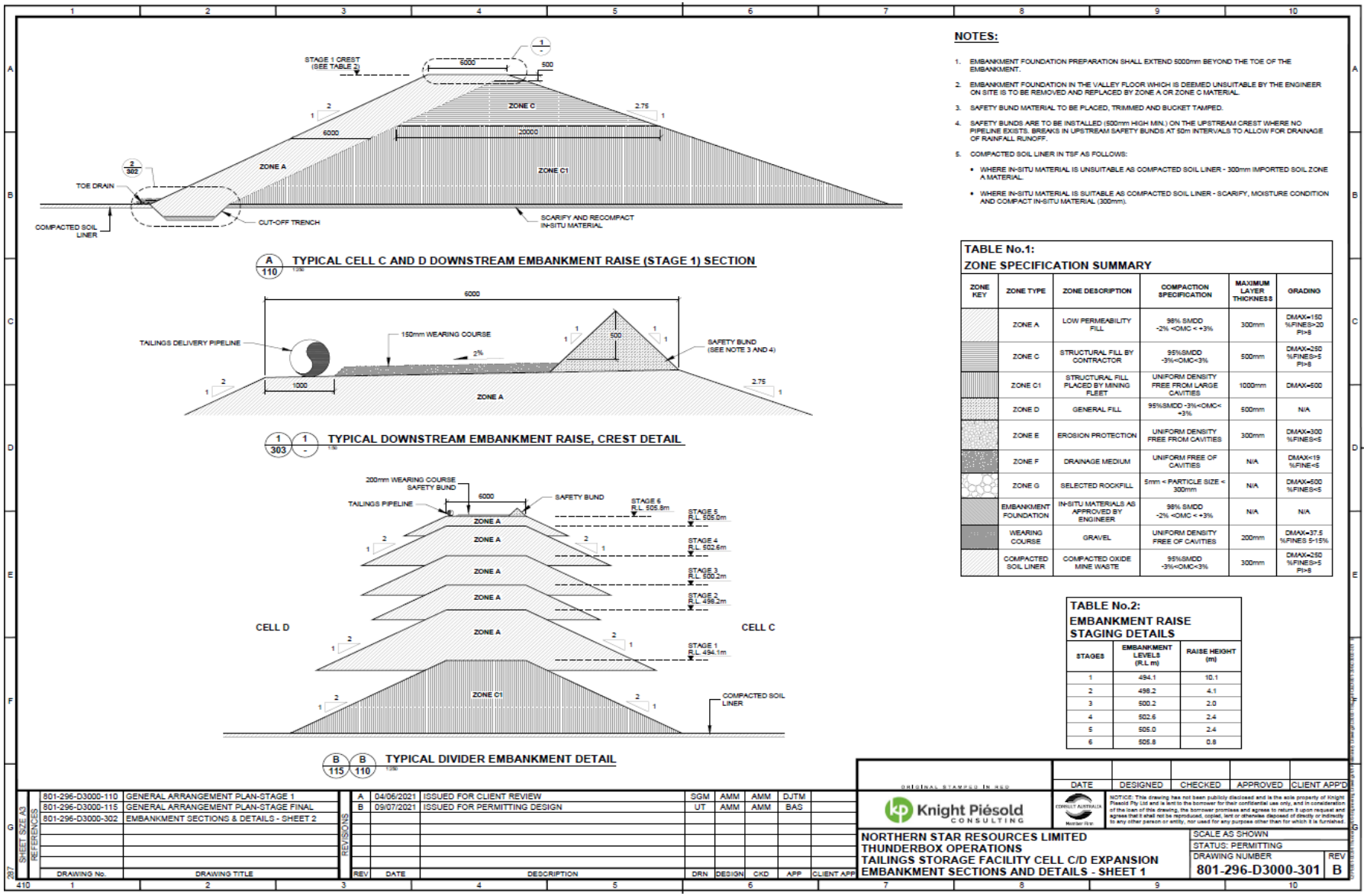
The premises relates to the category 5 and assessed design capacity under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) which are defined in works approval W6601/2021/1. The infrastructure and equipment relating to the premises category and any associated activities which the department has considered in line with *Guideline: Risk Assessments* (DWER 2020) are outlined in works approval W6601/2021/1.

The applicant is expanding the Thunderbox Mill and power station under works approval W6532/2021/1, granted 2 July 2021, to increase the production capacity of the premises to 7,000,000 tonnes per annum. The increased throughput requires increased tailings storage capacity. The new TSF cells will add a further 37.7 Mt of tailings storage to the current TSF storage capacity in cells A and B.

The construction of the cells C and D will follow the following stages:

Cell C and D Stage	Storage Capacity			Embankment Levels		
	Cell C (Mt)	Cell D (Mt)	Total (Mt)	Cell C (RL m)	Divider (RL m)	Cell D (RL m)
1	6.7	2.8	9.5	494.1	494.1	494.1
2	11.5	7.4	19	498.2	498.2	498.2
3	14	9.9	23.9	500.2	500.2	500.2
4	17	12.7	29.7	502.6	502.6	502.6
5	20	15.7	35.7	505.0	505.0	505.0
6	21	16.7	37.7	505.8	505.8	505.8

The initial two stages of embankment will be raised using downstream construction technique with Run of Mine (ROM) waste from the current pit cutback and upstream construction technique using tailings in subsequent stages. The divider embankment will be raised centrally with ROM waste from the current pit cutback until Stage 2 after which the divider will be raised with compacted dry tailings sourced from the exposed tailings beach. The embankments against the Eastern Waste Dump (of the existing Cell A and Cell B) will be raised using downstream technique with ROM in Stage 1 and compacted dry tailings from Stage 2 onwards. Refer Figure 1.



NOTES:

1. EMBANKMENT FOUNDATION PREPARATION SHALL EXTEND 5000mm BEYOND THE TOE OF THE EMBANKMENT.
2. EMBANKMENT FOUNDATION IN THE VALLEY FLOOR WHICH IS DEEMED UNSUITABLE BY THE ENGINEER ON SITE IS TO BE REMOVED AND REPLACED BY ZONE A OR ZONE C MATERIAL.
3. SAFETY BUND MATERIAL TO BE PLACED, TRIMMED AND BUCKET TAMPED.
4. SAFETY BUNDS ARE TO BE INSTALLED (500mm HIGH MIN.) ON THE UPSTREAM CREST WHERE NO PIPELINE EXISTS. BREAKS IN UPSTREAM SAFETY BUNDS AT 50m INTERVALS TO ALLOW FOR DRAINAGE OF RAINFALL RUNOFF.
5. COMPACTED SOIL LINER IN TSF AS FOLLOWS:
   - WHERE IN-SITU MATERIAL IS UNSUITABLE AS COMPACTED SOIL LINER - 300mm IMPORTED SOIL ZONE A MATERIAL.
   - WHERE IN-SITU MATERIAL IS SUITABLE AS COMPACTED SOIL LINER - SCARIFY, MOISTURE CONDITION AND COMPACT IN-SITU MATERIAL (300mm).

TABLE No.1:
ZONE SPECIFICATION SUMMARY

ZONE KEY	ZONE TYPE	ZONE DESCRIPTION	COMPACTION SPECIFICATION	MAXIMUM LAYER THICKNESS	GRADING
	ZONE A	LOW PERMEABILITY FILL	98% SMDD -2% <OMC < +3%	300mm	DMAX=150 %FINES>20 PI>8
	ZONE C	STRUCTURAL FILL BY CONTRACTOR	95%SMDD -3%<OMC<3%	500mm	DMAX=250 %FINES>5 PI>8
	ZONE C1	STRUCTURAL FILL PLACED BY MINING FLEET	UNIFORM DENSITY FREE FROM LARGE CAVITIES	1000mm	DMAX=600
	ZONE D	GENERAL FILL	95%SMDD -3%<OMC< +3%	500mm	N/A
	ZONE E	EROSION PROTECTION	UNIFORM DENSITY FREE FROM CAVITIES	300mm	DMAX=300 %FINES<5
	ZONE F	DRAINAGE MEDIUM	UNIFORM FREE OF CAVITIES	N/A	DMAX<19 %FINE<5
	ZONE G	SELECTED ROCKFILL	5mm < PARTICLE SIZE < 300mm	N/A	DMAX=600 %FINES<5
	EMBANKMENT FOUNDATION	IN-SITU MATERIALS AS APPROVED BY ENGINEER	98% SMDD -2% <OMC < +3%	N/A	N/A
	WEARING COURSE	GRAVEL	UNIFORM DENSITY FREE OF CAVITIES	200mm	DMAX=37.5 %FINES 5-15%
	COMPACTED SOIL LINER	COMPACTED OXIDE MINE WASTE	95%SMDD -3%<OMC<3%	300mm	DMAX=250 %FINES>5 PI>8

TABLE No.2:
EMBANKMENT RAISE STAGING DETAILS

STAGES	EMBANKMENT LEVELS (R.L m)	RAISE HEIGHT (m)
1	494.1	10.1
2	498.2	4.1
3	500.2	2.0
4	502.6	2.4
5	505.0	2.4
6	505.8	0.8

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-296-D3000-110	GENERAL ARRANGEMENT PLAN-STAGE 1
801-296-D3000-115	GENERAL ARRANGEMENT PLAN-STAGE FINAL
801-296-D3000-302	EMBANKMENT SECTIONS & DETAILS - SHEET 2

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/06/2021	ISSUED FOR CLIENT REVIEW	SGM	AMM	AMM	DJTM	
B	09/07/2021	ISSUED FOR PERMITTING DESIGN	UT	AMM	AMM	BAS	

ORIGINAL STAMPED IN A3

	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

Knight Piésold CONSULTING

CONSULT AUSTRALIA Member Firm

NOTICE: This drawing has not been publicly disclosed and is the sole property of Knight Piésold Pty Ltd and is lent to the borrower for their confidential use only, and in consideration of the loan of this drawing, the borrower promises and agrees to return it upon request and agrees that it shall not be reproduced, copied, lent or otherwise disposed of directly or indirectly to any other person or entity, nor used for any purpose other than for which it is furnished.

NORTHERN STAR RESOURCES LIMITED
THUNDERBOX OPERATIONS
TAILINGS STORAGE FACILITY CELL C/D EXPANSION
EMBANKMENT SECTIONS AND DETAILS - SHEET 1

SCALE AS SHOWN
STATUS: PERMITTING
DRAWING NUMBER 801-296-D3000-301
REV B

Figure 1: Embankment sections and details

Works approval: W6601/2021/1

Construction of Stage 1 is expected to commence in May 2022 after which commissioning will be carried out. Commissioning, from pre-commissioning of static infrastructure to tails commissioning and submission of the works approval compliance report, is expected to take 12 to 16 weeks and to be completed in September 2022.

Each cell will then be commissioned concurrently to fill in low points on the cell floors and establish a suitable tailings beach for the ongoing operational phase of the TSF cells. Typical tailings material, as is currently discharged to cells A and B, will be used during the commissioning phase of the cells C and D.

3. Risk assessment

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

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

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises construction and operation which have been considered in this decision report are detailed in Table 1 below. Table 1 also details the control measures the applicant has proposed to assist in controlling these emissions, where necessary.

Table 1: Proposed applicant controls

Emission	Sources	Potential pathways	Proposed controls
Construction			
Dust	Material handling, vehicle movements, earthworks etc.	Air / windborne pathway	• Regular and adequate employment of water spraying on unsurfaced areas to control dust emissions. The need for this control will be assessed continually, based upon on-site observations, weather conditions and the potential for dust emission across the site. In particular, dry conditions with high wind speeds would be a cause for action. • Progressive restoration and establishment of vegetative cover on the site as soon as possible following construction. • The Contractor and Superintendent shall make random audits of dust emissions, and the Superintendent shall have the authority to stop work if, in their opinion, dust emissions are excessive or have the potential to create a safety or environmental problem.

Emission	Sources	Potential pathways	Proposed controls
Noise			There are no specific noise controls proposed
Earth/rock	Earthworks to construct the TSF cells	Obstruction of surface water	Surface water drainage management: • A diversion drain, bund and silt traps have been designed to ensure surface water is diverted before reporting to the TSF and natural surface water flow is not impeded. • This diversion drain is an extension of the current diversion drain along the northern edge of the current TSF cells.
Commissioning and Operation			
Tailings	Leaks and spills from pipeline	Direct contact with ground and vegetation. Ground contamination causing contamination of stormwater.	All pipelines will be: • High-density polyethylene (HDPE) PE100 and will be constructed and installed in accordance with AS/NZS 4130:2018, *Polyethylene (PE) pipes for pressure applications* (AS4130), and the Plastics Industry Pipe Association of Australia Limited (PIPA) Guideline POP003, *Butt Fusion Jointing of PE Pipes and Fittings - Recommended Parameters* (POP003). • Stored in V-drains sufficient to contain spillages between routine inspections. • Fitted with telemetry (the Citect processing plant control system) which monitors pressure in pipelines and water levels in tanks and dams. Upon an immediate drop in pressure within a pipeline or a dam reaching capacity, mill control operators are alarmed. • Inspected twice daily as per DWER licence L7185/2001/11 condition 1.3.5. The commissioning of the TSF and associated pipelines to ensure they are constructed to specification is as follows: • **Precommissioning**: Comprising static checks on unpowered equipment; • **Energisation**: the new equipment will be energised to ensure all systems are working; and • **Tails commissioning**: Comprising test operation of equipment with tailings. Surface water drainage management: • A diversion drain, bund and silt traps have been designed to ensure surface water is diverted before reporting to the

Emission	Sources	Potential pathways	Proposed controls
			TSF and natural surface water flow is not impeded.
	Overtopping of facility	Direct contact with ground and vegetation. Ground contamination causing contamination of stormwater.	Cells D and C have been designed with a minimum top of embankment freeboard of 500mm to prevent overtopping by tailings or significant (1-100 year) rainfall event. The TSF will be inspected at least twice per twelve (12) hour shift during operation.
	Dust from dry tailings	Air / windborne pathway.	Daily inspections include general assessment of dust emissions.
Leachate	Seepage through base of TSF.	Groundwater contamination Groundwater mounding	The seepage control and underdrainage collection systems for Cells C and D will consist of the components as listed below: i. Low permeability basin liner. A low permeability compacted soil liner is to be constructed across the entire expanded TSF basin. Laboratory testing on the basin material indicated that a permeability in the range of 6×10^{-7} m/s would typically be achievable. Areas of unsuitable material will be removed and replaced with low permeability material. The ferricrete / laterite hardpan underlying the facility will assist in providing adequate seepage control for the facility. ii. Basin underdrainage collection system; iii. Underdrainage collection tower; and iv. Embankment upstream toe drain. v. Cut-off trench: The cut-off trench will be located beneath the upstream toe of the embankments and will be cut to a depth of approximately 0.5 – 1 m. The cut-off trench will be constructed continuously along the upstream toe of the external embankment and the embankment section against the waste dump to the full deposition elevation to limit potential seepage at any level. An external toe drain to collect seepage through the toe of the TSF wall and runoff from the downstream surface of the TSF wall will be positioned at the base of the wall and separated from the runoff diversion channel by a berm. This toe drain will also capture potential horizontal flow from the base of the

Emission	Sources	Potential pathways	Proposed controls
			TSF. If sufficient water is present in toe drains or sumps a pump shall be installed to pump the water back onto the surface of the TSF where it can be re-used within the return water system from the TSF. Potentially a greater than 1 in 10-year rainfall event may overflow the drain due to the low fall of along the drain alignment making flow along the drain slow. To prevent this overflow sediment traps/overflow structures are to be included allowing to increase containment capacity in the drain. Outlets from the sediment traps report to a channel with the same dimensions as the toe drains prior to terminating at a rock apron lined with graded rock to minimise erosion. It is anticipated that most water will dissipate within the apron, however during significant rainfall events some water may be discharged to the environment. A commissioning period of 12 – 16 weeks for the cells will include the cycling of tailings through spigots such that the low points of the cell are filled and the beach established to provide for the correct placement of the decant pond. It is expected that the majority of water during this period of time will report to the underdrainage system rather than the decant tower. The water study for Cells Cand D advised that: • Groundwater modelling shows that seven (7) interception wells around the periphery of the TSF would be an effective solution to mitigate water table mounding and contain leakage at a small distance from the TSF, without affecting the regional groundwater regime, both in terms of quality and quantity. • The proposed trigger for the installation of the recovery bores is a standing water level (SWL) of 6 metres below ground level (mbgl). This is the trigger level currently in place in the licence L7815/2001/11 for TSF monitoring bores.
Decant return water	Leaks and spills from pipeline	Direct contact with ground and vegetation. Ground contamination	All pipelines will be • HDPE PE100 and will be constructed and installed in accordance with AS4130, and POP003.

Emission	Sources	Potential pathways	Proposed controls
		causing contamination of stormwater.	• Stored in V-drains sufficient to contain spillages between routine inspections. • Fitted with telemetry (the Citect processing plant control system) which monitors pressure in pipelines and water levels in tanks and dams. Upon an immediate drop in pressure within a pipeline or a dam reaching capacity, mill control operators are alarmed. • Inspected twice daily as per DWER licence L7185/2001/11 condition 1.3.5. The commission of the TSF and associated pipelines to ensure they are constructed to specification is as follows: • **Precommissioning**: Comprising static checks on unpowered equipment; • **Energisation**: the new equipment will be energised to ensure all systems are working; and • **Tails commissioning**: Comprising test operation of equipment with tailings. Surface water drainage management: • A diversion drain, bund and silt traps have been designed to ensure surface water is diverted before reporting to the TSF and natural surface water flow is not impeded.
	Overtopping of process water dam	Direct contact with ground and vegetation. Ground contamination causing contamination of stormwater	A 300mm freeboard is required under licence condition 1.3.3(b).

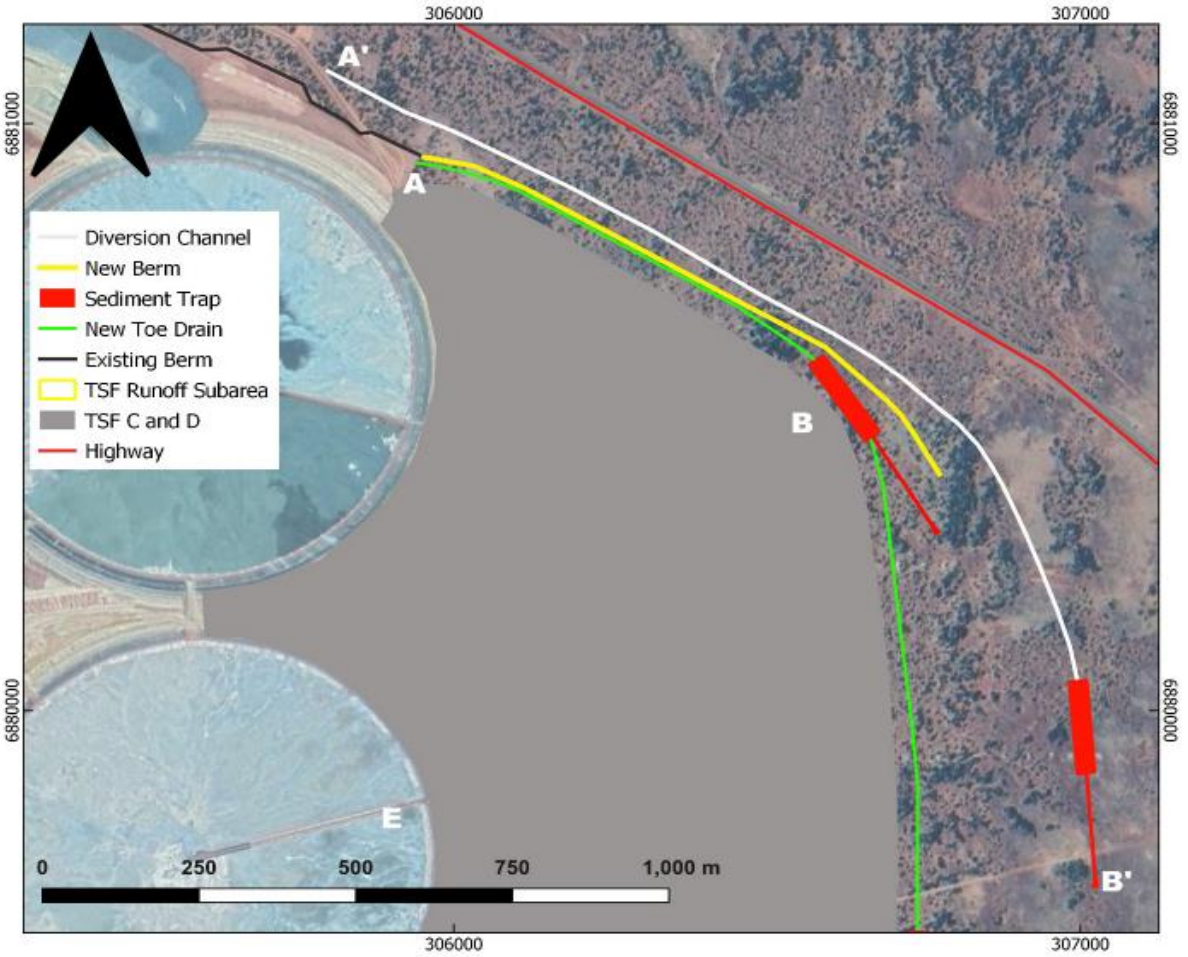


Figure 2: Extended TSF diversion infrastructure

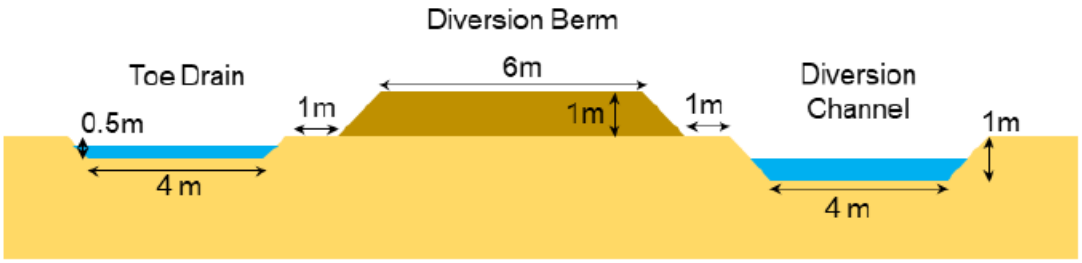


Figure 3: Schematic section through toe drain, berm and diversion channels

3.1.2 Receptors

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

Table 2 and Figure 55 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental Siting* (DWER 2020)).

Table 2: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	Distance from activity / prescribed premises
Weebo Station Homestead	20 km north west of the TSF Cells C and D. Given the significant distance to this receptor, the Delegated Officer considers that a Risk Event is not foreseeable and therefore this receptor is not considered further.
Goldfields Highway	Within 300m of construction.
Environmental receptors	**Distance from activity / prescribed premises**
Surface water	Minor surface water drainage lines exist to the west of the Thunderbox mill operations area. The flow is to the south toward the TSF. This will need to be diverted around the northern boundary of the new TSF cells via a diversion channel to prevent inundation of the nearby Goldfields Highway. The catchment above the diversion, the Northwestern Subcatchment, has a surface area of 420 ha. No major surface water features located within 5km of the Thunderbox mill operations area.
Flora P4 species *Calytrix uncinata*	1km west of the Thunderbox mill
Groundwater	Groundwater level contours indicate that regional groundwater flow occurs from the north east to the south west. This is reflected in current seepage from TSF cells A and B travelling to the west toward the open pits. However, continuing to use cells A and B results in groundwater mounding causing a barrier to the seepage from cells C and D flowing in the same direction. The modelled flow from cells C and D is shown in Figure 4 below assuming no seepage recovery from bores. Groundwater quality has been provided as measured at the monitoring bores for the current TSF. The water is fresh (TDS 290 – 750 mg/L) and the pH neutral to slightly alkaline (7.1 – 8.0). Groundwater quality around the TSF is of stock quality, however, the closest active pastoral bore is located approximately 7km to the south of the TSF.

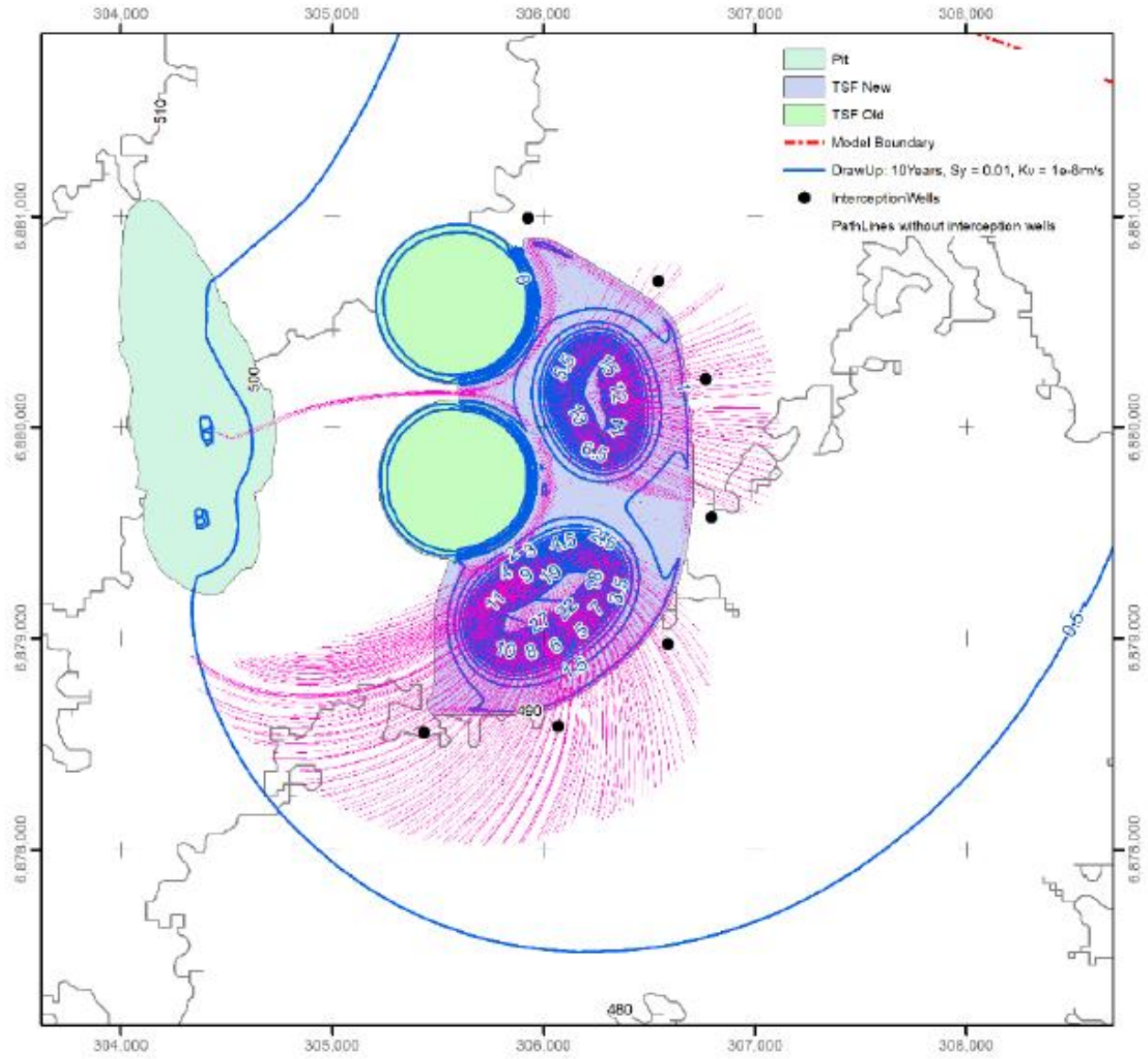


Figure 4: Modelled particle tracks at the end of 10 years of discharge to Cells C and D

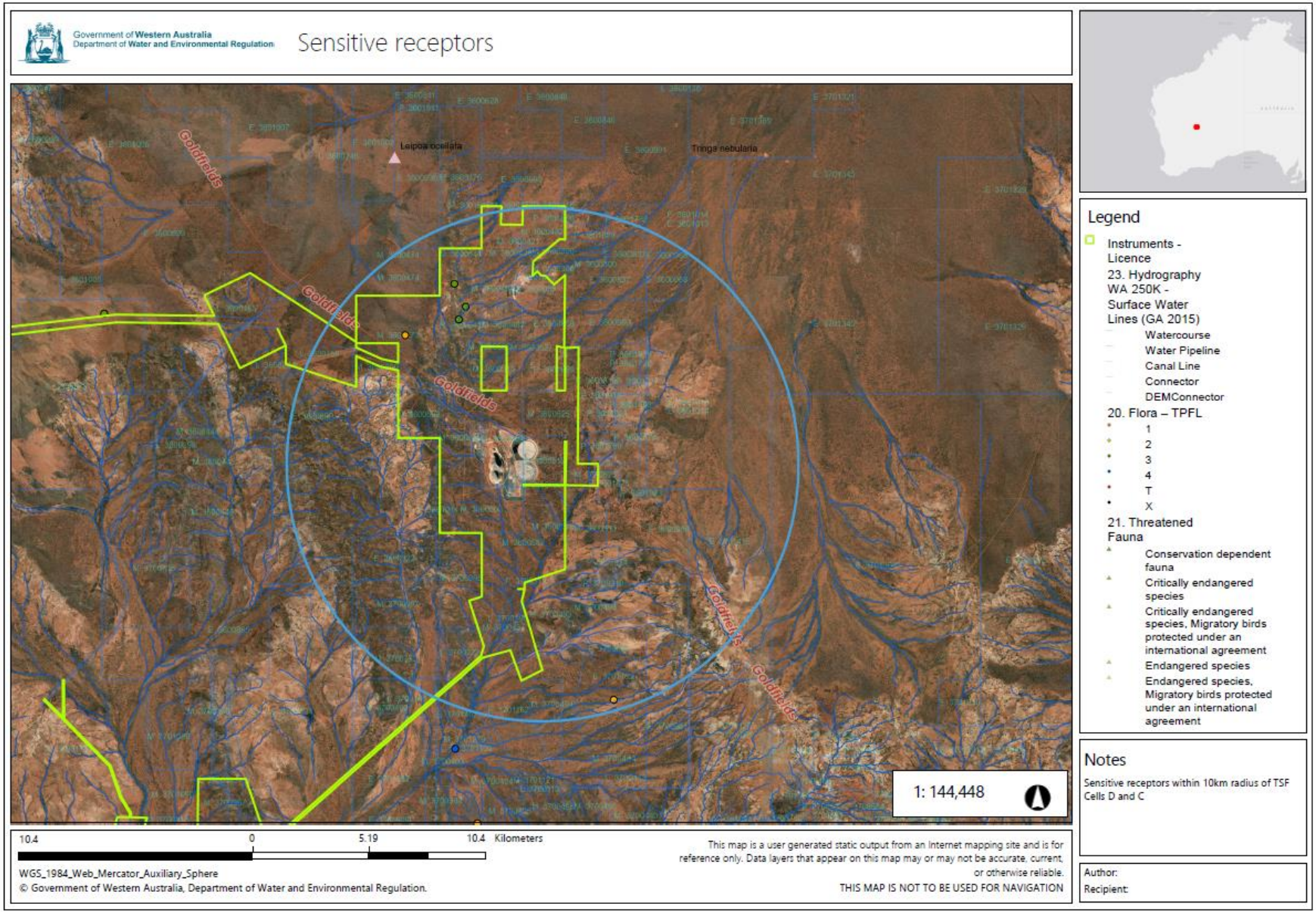


Figure 5: Distance to sensitive receptors

Works approval: W6601/2021/1

3.2 Risk ratings

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

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

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 3.

Works approval W6601/2021/1 that accompanies this decision report authorises construction and time-limited operations. The conditions in the issued works approval, as outlined in Table 3 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 decision report, however licence conditions will not be finalised until the department assesses the licence application.

Table 3: Risk assessment of potential emissions and discharges from the premises during construction, commissioning and operation

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emissions**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Construction								
Clearing of ground Movement of vehicles Construction of TSF Cell	Dust	Air/windborne pathway causing impacts to health and amenity	Traffic along Goldfields Hwy – amenity/safety. Vegetation	Refer to Section 3.1	C = Severe L = Rare **High Risk**	Y	**Conditions 4 and 5: Dust suppression and visible dust prevention.** **Condition 4 is based upon Condition 2.3.1 of licence L7815/2001/11.** **Condition 5 is a standard dust condition for premises where dust from activities has potential to cause impact beyond the premises boundary**	The construction of the TSF in such proximity to the Goldfields Highway creates a risk of visibility impairment to traffic on the highway. The controls proposed by the works approval holder are sufficient, but the risk rating justifies the addition of the standard condition relating to visible dust not crossing the border. Condition 2.3.1 of the licence L7815/2001/11 also requires that prior and during any disturbance to the 'TSF affected area' the area is continually wetted using water sprays, dribble bars or other suitable methods to ensure there is no visible windblown dust. Refer to Section 3.3
Commissioning								
Commissioning of TSF – establishing of the tailings beaches in TSF Cells C and D	Tailings	Direct contact with ground and vegetation due to leaks and spills from pipeline	Surface water Soil Vegetation	Refer to Section 3.1	C = Moderate L = Possible **Medium Risk**	Y	No conditions are proposed for the commissioning of the TSF cells.	The commissioning plan provides both a **tailings commissioning** of the infrastructure, prior to the submission of the compliance report, where the pipes are tested using tailings to ensure the integrity of the infrastructure and a period of **commissioning of the TSF cells** to ensure the placement of tailings is such that a beach of tailings is established to create a decant pond around the decant tower. The following commissioning/testing of infrastructure, prior to submission of the compliance report required by condition 6, is to be carried out by the works approval holder: - **Precommissioning**: Comprising static checks on unpowered equipment to confirm that the infrastructure has been built according
	Leachate/seepage	Groundwater contamination Groundwater mounding	Groundwater vegetation	Refer to Section 3.1	C = Moderate L = Possible **Medium Risk**	Y		

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emissions**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
								to specification; - **Energisation**: the new equipment will be energised to ensure all systems are working; - **Tails commissioning**: Comprising testing operation of equipment with tailings. - **Compliance report**: Submission of compliance report to demonstrate compliance in accordance with the Works Approval. The commissioning period of the TSF cells after submitting the report does not differ in discharge (tailings) or the position of the discharge (TSF cells Cand D), to the full operational stages of the TSF. The emission controls for the management of the TSF cells commissioning will be the same controls as required for normal operation of the TSF. This commissioning period may be carried out under the time limited operations period provided under conditions 9 – 14. This will allow for sufficient flexibility of the discharge during commissioning of the TSF cells.
Operation (including time-limited-operations operations)								
Discharge of tailings to TSF Cells C and D	Tailings	Direct contact with ground and vegetation due to leaks and spills from pipeline.	Surface water Soil	Refer to Section 3.1	C = Moderate L = Unlikely **Medium Risk**	Y	Condition 1 Standard condition requiring the construction of pipelines to size and standard required.	N/A

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emissions**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
		Dry tailings dusting.	Surface water Soil Fauna and flora Human receptors on highway and pastoral property	Refer to Section 3.1	C = Moderate L = Unlikely **Medium Risk**	Y	**Condition 12** **Requires specific dust management actions when disturbing any TSF components including the 'TSF affected area' as denoted by Figure 6 in Schedule 1 of the works approval.** **This condition is modelled on condition 2.3.1 of licence L7815/2001/11.**	Refer to Section 3.3
	Leachate/seepage	Groundwater mounding	Vegetation	Refer to Section 3.1	C = Moderate L = Unlikely **Medium Risk**	*Y*	Condition 1 Standard condition for construction of the TSF with seepage mitigation infrastructure. Condition 2 Standard condition for construction of monitoring bores. Condition 8 Baseline monitoring of bores installed under Condition 2 prior to deposition of tailings. Condition 13 Monitoring during time limited operations	The standard conditions require the construction of the TSF, pipelines and bores to be constructed with the control measures that have been proposed to manage potential discharges from the facility. The seepage control and underdrainage collection systems will exceed the seepage control measures used for Cells A and B. The inclusion of these systems in Table 1 of the works approval is considered appropriate given the level of risk from this discharge. Base case numerical model simulations suggest that by the time the TSF reaches its full height, the water table beneath the TSF walls may rise by up to 10 m, which would bring it within 5 m of the ground surface (about 480 mAHD). While the mounding effects diminish with distance away from the TSF wall, discernible water table mounding of up to 0.5 m may extend up to several kilometres from the TSF. Particle track modelling shows that groundwater migration from the TSF through the saprolite weathering profile would be slow. So much so that by the end of the 10 year life of mine, seepage from the TSF would have travelled less than a kilometre from the TSF

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Source/Activities	Potential emissions	Potential pathways and impact	Receptors	Applicant controls				
								The monitoring of groundwater impacts is key to future management of seepage. To ensure the monitoring data is collected accurately Condition 2 requires the construction of the monitoring bores to standard. Baseline monitoring before, and monitoring during, the time limited operations will provide the data to assess the level of impact from seepage after the commencement of tailings deposition.

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

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

3.3 Detailed risk assessment for tailings dust from dry tailings cells during construction and operation of the TSF

3.3.1 Ambient dust emissions

Background

There are two aspects of ambient dust emissions due to the construction and operation of the tailings storage facility being considered in this section.

1. The dust may contain elevated levels of arsenic and may cause contamination if it is allowed to spread and settle on the surface of surrounding areas.
2. The TSF is adjacent to the Goldfields Highway, the major public transport route connecting the towns and mining operations within the northern Goldfields Region. It has the potential to impact visibility on the highway if dust is not managed sufficiently.

Contaminated Sites

The current tailings storage facility (cells A and B) and surrounds are registered as a contaminated site with classification: Remediated for restricted use, Figure 6. This is due to earlier dust contamination from the current TSF cells. The soils are contaminated with arsenic and the use of the area is restricted to mining and mineral processing.

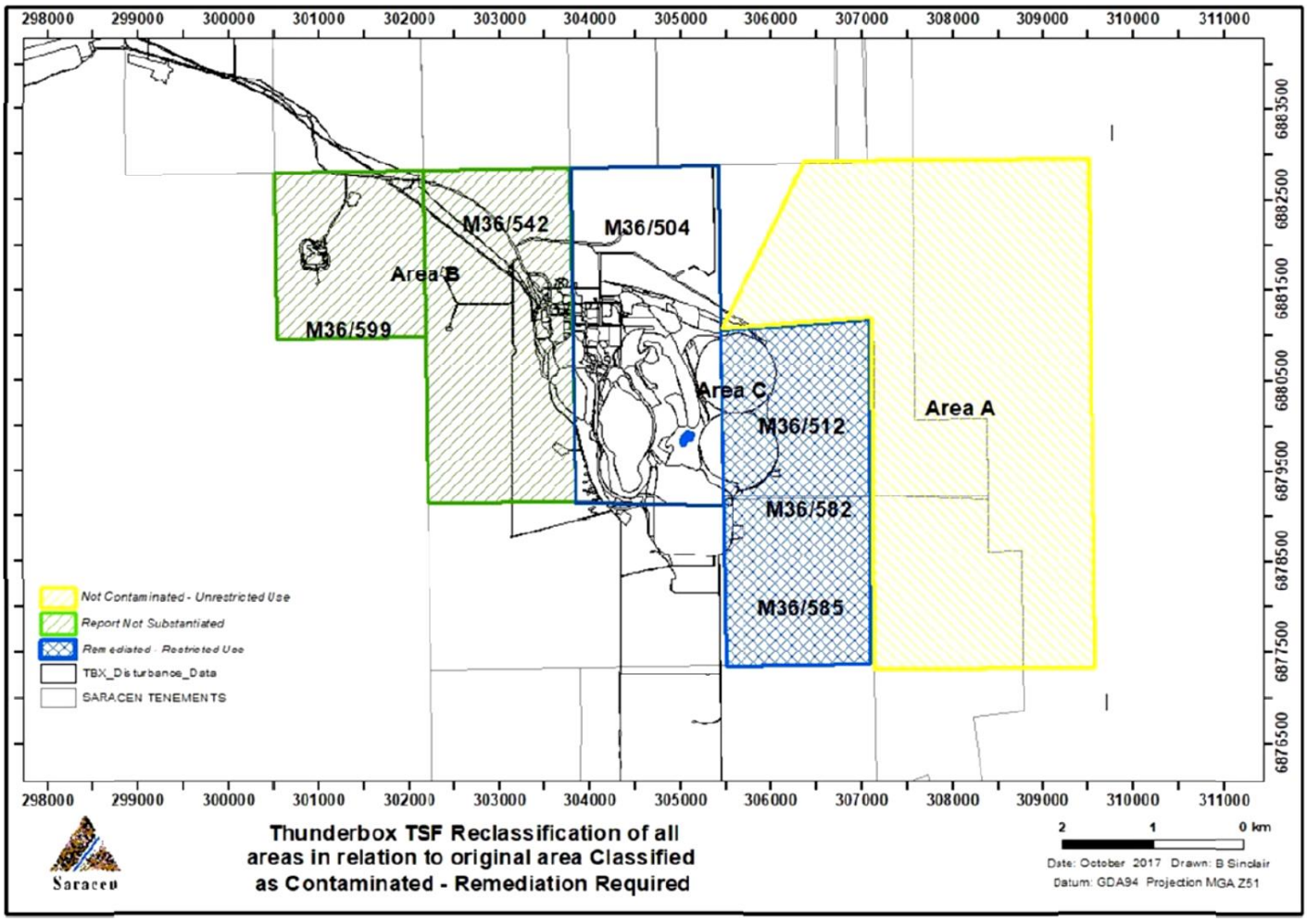


Figure 6: Contaminated site area of classifications

(The area shaded blue = Contaminated - Restricted Use; the yellow shaded area (Area A) = Not Contaminated – Unrestricted use)

The dust emitted from TSF Cells A and B when the cells dried during a period of Care and Maintenance, triggered the investigation of impacts. Soil investigations found that concentrations of arsenic in surface soils exceeded ecological and Health Investigations levels for parks and recreational use as specified in the 'National Environment Protection (Assessment of Site Contamination) Measure 1999' (The NEPM). The identified soil impacts extended beyond the site's southern boundary to the adjacent Mining Tenement M36/582 and pastoral station. Remedial works were confined to cleared areas in the immediate vicinity of TSF.

A study of the impact by the dust was provided to the then Department of Environmental Regulation in 2014 (SKM 2014). A finding from this study was that identified contamination does not pose an unacceptable risk to human health, the environment or environmental values under current land use, provided site-specific management measures are undertaken to minimise exposure of workers, visitors and pastoral livestock to impacted area. Site specific measures are outlined in a Site Management Plan (SMP) dated June 2019 provided to the DWER.

The site classification was changed from 'Contaminated – Remediation required' to 'Remediated – Restricted use' based on the recommendation of the accredited contaminated sites auditor that subject to implementation of the SMP, substances present on the site do not pose an unacceptable risk to human health, the environment or any environmental value, and the site is suitable for its current land use as a mining and processing facility.

Visibility

A risk considered in assessing this works approval W6601/2021/1 that wasn't included in the contaminated site assessments, is the impact on visibility for drivers on the highway resulting in a safety hazard. Although not typically a concern when considering the impacts of mining operations; the impact of dust on road visibility from construction of the North Eastern Goldfields Operation TSF is assessed in this works approval due to the proximity of the construction to the major public highway within the Goldfields. This risk has also not been addressed within the application supporting documentation**.**

3.3.2 Ambient dust management

The receptors of dust that were considered in the SMP produced in June 2019, other than site personnel, are terrestrial fauna, surface water, groundwater and pastoralists/prospectors/visitors in land adjacent to the TSF.

To manage exposure to the contaminated dust to these receptors the following management actions are to be carried out:

- Dust suppression with water carts and other measures (refer Table 1 of this report)
- TSF maintenance program to reduce potential for exposure to dust from TSF
- Ensure that tailings do not accumulate in lower lying areas, including drainage channels and stormwater sumps.
- Minimise the risk of fauna grazing around the area of the TSF or drinking from onsite stormwater drainage sumps at the base of TSF Cells by:
    - (i) Keeping working areas around the TSF including batters, roads and drainage lines free of vegetation to discourage fauna from coming into the working areas of the TSF to graze.
    - (ii) The Pastoralist (Weebo Station) not activating pastoral bores within 6km of the mine site thus discouraging cattle and other fauna that rely on pastoral water sources from grazing in the immediate mine area.
    - (iii) Notifying the pastoralist when cattle are frequently grazing through the affected area request that the cattle be mustered offsite.
    - (iv) Pumping to be conducted on an ad hoc basis when significant water is present in the sumps. The success of pumping as a means of diminishing

an available water source for fauna is monitored through visual observation.

- Groundwater is not to be abstracted (except for monitoring or TSF management purposes in accordance with license conditions) unless specific assessment demonstrates it is chemically suitable for its proposed purpose. This restriction will be included as a memorial on title and should also be included in a revised version of the Groundwater Operating Strategy to ensure it is effectively documented at the mine operational level.
- Flora health monitoring.

In addition to the above control measures, the premises' licence L7815/2001/11 includes a fugitive emissions condition 2.3.1 requiring the use of water sprays prior to and during any disturbance to:

- The surface of the TSF
- The onsite roadways in the immediate vicinity of the TSF
- TSF embankments
- The 'TSF affected area',

The 'TSF affected area' includes the area where the new TSF cells are to be constructed. This area has been recognised as containing deposited dust contaminated with elevated arsenic levels from the dust emissions detailed in this section.

3.3.3 Risk assessment

Contamination

The tailings are not significantly different in quality to those contained in TSF Cells A and B when the contamination of the surrounding environment by dust occurred. The potential then is that a similar contamination could be the result of dusting from the TSF Cells C and D. Given the cells are within the area impacted by previous contamination there is potential that the area of contamination could be extended further in the event of the cells C and D drying and tailings dust being released by wind. The health and environmental impacts are not considered to be greater than those previously assessed by the studies undertaken in assessing the currently contaminated site. **Consequence = moderate.**

The control measures for the management of dust present as both site practice and premises licence conditions make the potential for release of tailings dust significantly reduced. There is still potential for dusting from the new cells however if they dry sufficiently in strong wind conditions. **Likelihood = unlikely.**

Visibility

The position of the construction within approximately 300m of the Goldfields Highway makes the potential for dust being sufficiently thick to affect visibility for drivers possible. Reduction of visibility can be a significant safety hazard for drivers potentially even resulting in a fatal accident. **Consequence = Severe.**

The measures included in the SMP, with the requirements under licence condition 2.3.1, make the potential occurrence of this event very low. **Likelihood = rare**.

4. Consultation

Table 4 provides a summary of the consultation undertaken by the department.

Table 4: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website on 6/12/2021	None received	N/A
Local Government Authority advised of proposal on 29/11/2021	None received	N/A
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal 29/11/2021	DMIRS replied on 9/12/2021 stating advising that: This works approval application is consistent with a mining proposal approved by DMIRS on 4 November 2021 (Reg. ID: 99935). During the assessment of this mining proposal, a DMIRS Inspector of Mines – Geotechnical, reviewed the application and advised that geotechnical aspects had been sufficiently considered by the proponent.	No response required.
Applicant was provided with draft documents on 06/04/2022	Refer to Appendix 1	Refer to Appendix 1

5. Conclusion

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

References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
3. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
4. Sinclair Knight Merz (SKM) 2014, Thunderbox TSF fugitive dust assessment: Risk assessment, Norilsk Nickel Wildara Pty Ltd, Perth, Western Australia.
5. Saracen Metals Pty Limited (Saracen) 2019, Thunderbox Gold Project tailings storage facility residual arsenic impacts: Site management plan, Saracen Metals Pty Limited, Pert, Western Australia.
6. Department of Water and Environmental Regulation (DWER) 2019, Contaminated Sites Act 2003: Basic summary of records: ID 17929, accessed on 6 October 2021 via the DWER Contaminated Sites online database: https://dow.maps.arcgis.com/apps/webappviewer/index.html?id=c2ecb74291ae4da2ac32c441819c6d47
7. Northern Star Resources Limited (Northern Star) 2021, Thunderbox environmental group site S0222877: Mining proposal [MP 99935], v10, accessed on 9 December 2021 via the Department of Mines, Industry Regulation and Safety (DMIRS) Mines and mineral deposits online database (MINEDEX): GeoDocs (dmirs.wa.gov.au)

Appendix 1: Summary of applicant's comments on risk assessment and draft conditions

Condition	Summary of applicant's comment	Department's response
Decision report Table 1: Proposed applicant controls	Applicant confirmed the dust controls used during construction, TSF freeboard of 500mm and TSF toe drain water management.	Details in table updated.
	Applicant responded to request for details on actions regarding management of dusting from dry tailings cells prior to lifts with: *'During the time between lifts, dusting of the inactive cell is not expected as the material will retain moisture under a salt crust. Water component of the tailings will be hypersaline which will allow the crust to form.'*	The Delegated Officer notes that the period between lifts, when a TSF cell will be required to dry out, is likely to be shorter than a period of Care and Maintenance. However the Works Approval Holder is advised that, as per the risk analysis for ambient dust emissions in Section 3.3 of this report, the tailings produced at the North Eastern Goldfields Operations have historically produced significant amounts of ambient dust when dry. The assumption that salinity forms a crust sufficient to provide dust suppression for an extended period of time has been proven to be incorrect at this premises. This ability of the TSF to generate dust when dry has caused the area surrounding the current TSF to be recorded as a contaminated site with the classification of 'remediated for restricted use'. The risk during the period of limited time operations covered by this works approval is expected to be low so further conditions are not required. The Works Approval Holder is however, advised to consider the dust management of dry tailings during long term operation of the tailings cells when submitting an application to amend the licence.
Condition 11, Table 4	Freeboard is 500mm.	Details in table updated.

Appendix 2: Application validation summary

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)		
Application type		
Works approval	☒	
Date application received		30/08/2021
Applicant and premises details		
Applicant name/s (full legal name/s)		Northern Star (Thunderbox) Pty Ltd
Premises name		North Eastern Goldfields Operations
Premises location		M36/512, M36/582, M36/585
Local Government Authority		Shire of Leonora
Application documents		
HPCM file reference number:		DER2021/000505
Key application documents (additional to application form):		Attachment 1a M36/512, M36/582 and M36/585 Tenement Summary Report Attachment 1b ASIC Relational Extract - Northern Star Resources Ltd Attachment 1c Northern Star Letter of Authority- All Sites Attachment 2a TBO_Project Infrastructure and Works Approval Premises Map Attachment 3a Commissioning Plan Attachment 3c Proposed Clearing Attachment 5 Consultation Register Attachment 8a Tailings Storage Facility C and D Permitting Design Attachment 8b Water studies for TSF Cells C and D Attachment 9 Fee Calculations Attachment 9a Detailed Cost Calculations Works Approval Boundary Spatial Files
Scope of application/assessment		
Summary of proposed activities or changes to existing operations.		**Works approval** Construction of Tailings storage facility cells C and D. No increase of throughput required as a result of this works approval.

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)

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

Table 1: Prescribed premises categories

Prescribed premises category and description	Proposed production or design capacity	Proposed changes to the production or design capacity (amendments only)
Category 5: Processing or beneficiation metallic or non-metallic ore	7,000,000 tonnes per annual period	N/A

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 ☒	Referral decision No: Managed under Part V ☐ Assessed under Part IV ☐
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes ☐ No ☒	Ministerial statement No: EPA Report No:
Has the proposal been referred and/or assessed under the EPBC Act?	Yes ☐ No ☒	Reference No:
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes ☒ No ☐	Mining lease / tenement ☒ Expiry: M36/512 (expires 02/01/2022), M36/585 (expires 18/02/2022) and M36/582 (expires 04/02/2029)
Has the applicant obtained all relevant planning approvals?	Yes ☐ No ☐ N/A ☒	If N/A explain why? Mining tenure
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes ☒ No ☐	CPS No: 6259/4 Granted 23/09/2021 Expiry 19/10/2023
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes ☐ No ☒	Application reference No: N/A Licence/permit No: N/A No clearing is proposed.

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)		
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes ☒ No ☐	Application reference No: Licence/permit No: 158766(7)
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes ☒ No ☐	Name: Goldfields Type: Proclaimed Groundwater Area Has Regulatory Services (Water) been consulted? Yes ☐ No ☒ N/A ☐ Regional office: Goldfields
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes ☐ No ☒	Name: N/A Priority: N/A Are the proposed activities/ landuse compatible with the PDWSA (refer to WQPN 25)? Yes ☐ No ☐ N/A ☒
Is the Premises subject to any other Acts or subsidiary regulations (e.g. *Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004, State Agreement Act xxxx*)	Yes ☒ No ☐	*Mining Act 1978*
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes ☐ No ☒	
Is the Premises subject to any EPP requirements?	Yes ☐ No ☒	
Is the Premises a known or suspected contaminated site under the *Contaminated Sites Act 2003*?	Yes ☒ No ☐	Classification: 17929: remediated for restricted use (RRU) – tenement M36/512 Date of classification: 23/10/2019 Classification: 71567: remediated for restricted use (RRU) – tenement M36/582 Date of classification: 23/10/2019