



## Application for Works Approval

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

---

<b>Works Approval Number</b>	W6568/2021/1
<b>Applicant</b>	Northern Star Resources (Carosue Dam) Pty Ltd
<b>ACN</b>	116649122
<b>File number</b>	DER2021/000351
<b>Premises</b>	Carosue Dam Minesite Within the mining tenements M31/295, M31/220 and M28/269 Menzies WA 6436  As defined by the premises maps attached to the issued works approval
<b>Date of report</b>	14 October 2021
<b>Decision</b>	Works approval granted

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

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

## Table of Contents

<b>1. Decision summary</b>	<b>1</b>
<b>2. Scope of assessment</b>	<b>1</b>
2.1 Regulatory framework	1
2.2 Application summary and overview of premises	1
2.3 Proposed Works	1
2.3.1 Construction of Cell 1 and 2 Stage 8 embankment raise	2
2.3.2 Operation of the TSF Cell 1& 2 Stage 8	2
<b>3. Risk assessment</b>	<b>3</b>
3.1 Source-pathways and receptors	3
3.1.1 Emissions and controls	3
3.1.2 Receptors	5
3.2 Modelling and monitoring data	8
3.2.1 Tailings Characteristics	8
3.2.2 Groundwater Standing levels and Quality	8
3.2.3 Seepage impacts to Groundwater and Vegetation	9
3.3 Risk ratings	11
<b>4. Consultation</b>	<b>14</b>
<b>5. Conclusion</b>	<b>14</b>
<b>References</b>	<b>15</b>
<b>Appendix 1: Summary of applicant’s comments on risk assessment and draft conditions (if required)</b>	<b>16</b>
<b>Appendix 2: Application validation summary</b>	<b>17</b>
Table 1: Proposed applicant controls	3
Table 2: Sensitive human and environmental receptors and distance from prescribed activity	6
Table 3: Carosue Dam tailings properties	8
Table 4: Risk assessment of potential emissions and discharges from the premises during construction and operation	11
Table 5: Consultation	14
Figure 1: Embankment raise section - TSF Cells 1 & 2 Stage 8 – Carosue Dam Project	1
Figure 2: Location of the Cell 1 and 2 Tailings Storage Facility in relation to other infrastructure at Carosue Dam	1
Figure 3: Distance to sensitive receptors	7
Figure 4: Location of groundwater monitoring bores and piezometers at the Carosue Dam Paddock TSF	10

# 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 W6568/2021/1 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 10 June 2021, Northern Star Resources (Carosue Dam) Pty Ltd (the applicant) submitted an application for a works approval to the department under section 54 of the *Environmental Protection Act 1986* (EP Act).

Carosue Dam Minesite (the Premises) is a gold mine, producing a gold ore concentrate, from which tailings (ore processing waste) is disposed to Tailings Storage Facilities (TSFs). The application is to undertake construction works relating to an upstream embankment raise to Cell 1 and 2 of the existing Paddock TSF from 378.0mRL to the Stage 8 design height of 381.0mRL (3.0m total). The premises is approximately 120 km north-east of Kalgoorlie within mining tenement M31/220, M31/295 and M28/269.

The premises relates to the categories 5, 6, 52, 63, 64, 73, and 85. This project includes works related to changes to the TSF (Cell 1 and 2) associated with Category 5 and assessed design capacity under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) which are defined in works approval W6568/2021/1. 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 W6568/2021/1.

### 2.3 Proposed Works

Carosue Dam has an above ground paddock style TSF and an in-pit TSF at Luvironza Pit. The Luvironza in-pit TSF is not active. The processing plant and the TSF (Cell 1 and 2) were constructed in 2000 and subsequently started operation under licence L7465/1999/1. TSF Cell 1 and 2 were designed as a paddock type facility with partial basin underdrainage and a central pump out decant system. The facility was designed to be raised in stages over the mine life using upstream embankment construction techniques. Originally the Cell 1 and Cell 2 were designed to have the final height of 375.5m, however the current approval obtained from DMIRS in 2013 (Reg ID 39084) permits a final height of 382.2mRL. In 2014, Cell 3 Stage 1 was constructed to provide additional capacity for tailings disposal.

The Stage 7 embankment raise of Cell 1 and 2 was carried out in July to October 2019, and the Carosue Dam Paste plant was commissioned and continued deposition into Cell 1 and 2 at a reduced rate of 2.2 Mtpa. The processing plant has been upgraded to 4 Mtpa and was commissioned in November 2020. Currently, TSF Cell 3 Stage 3 raise is facilitating discharge and has the capacity for approximately eight months (until February 2022). Thus, the applicant is now proposing an upstream embankment raise (second last raise) to Cell 1 and 2 of the existing Paddock TSF from RL378.0m to RL381.0mRL.

Figure 1 shows a cross section drawing of the embankment raises of the Cell 1 and 2 TSF (including Stage 8) and Figure 2 shows the location of the Cell 1 and 2 TSF in relation to other infrastructure at the Premises.

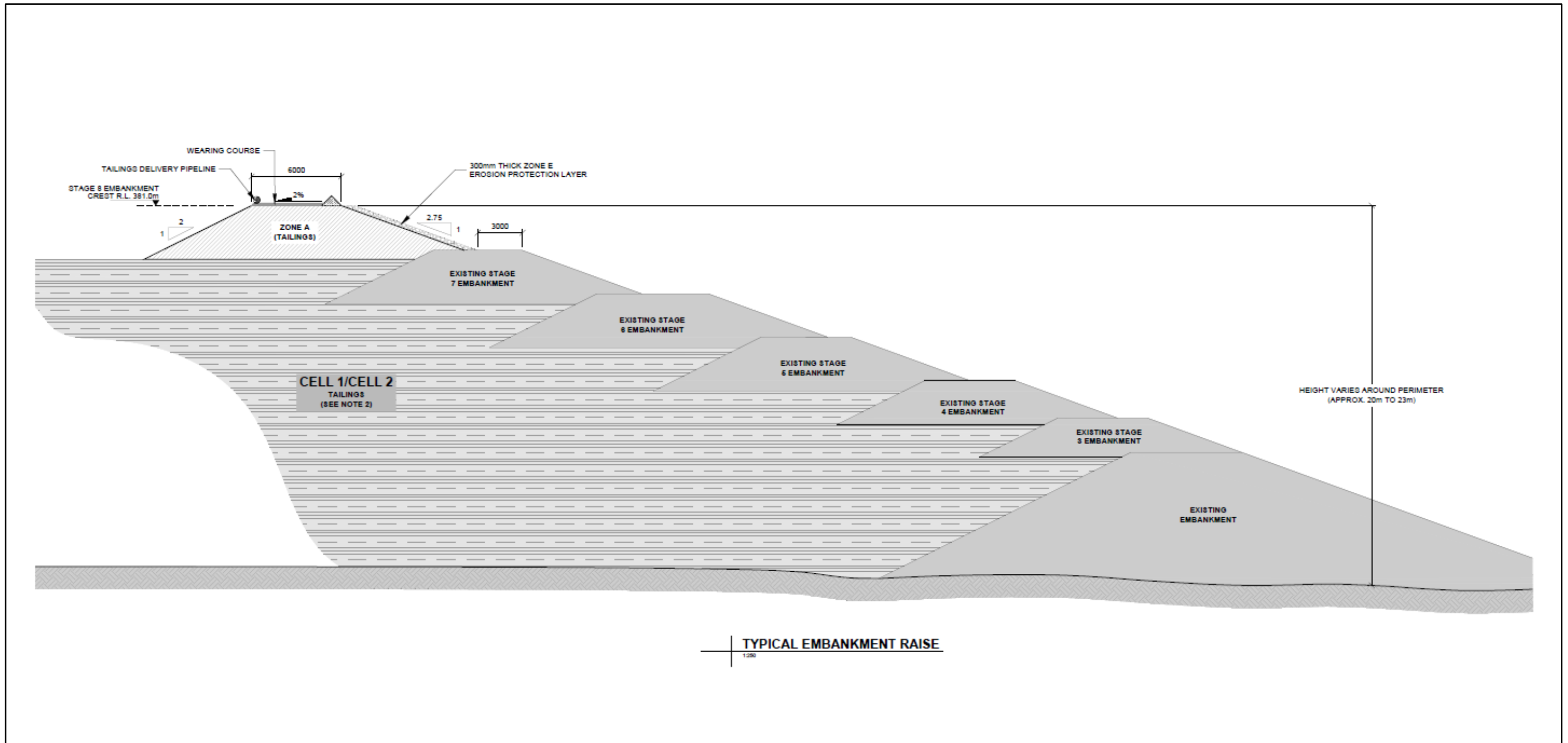
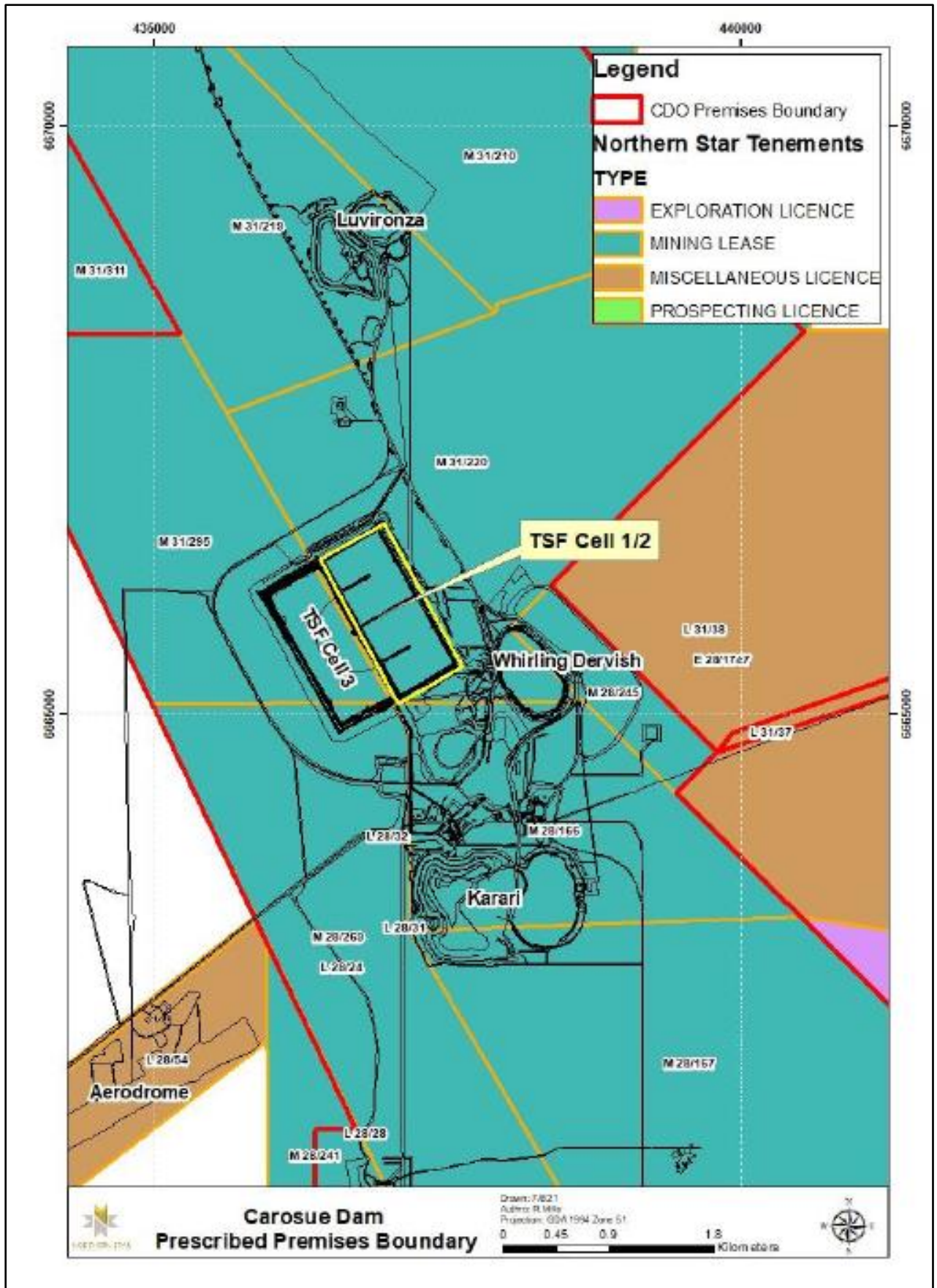


Figure 1: Embankment raise section - TSF Cell 1 and 2 Stage 8 – Carosue Dam Project



**Figure 2: Location of the Cells 1 and 2 Tailings Storage Facility in relation to other infrastructure at Carosue Dam**

### 2.3.1 Construction of Cell 1 and 2 Stage 8 embankment raise

The works required to complete the embankment raise are summarised below:

- Disassemble and move tailings delivery and distribution lines;
- Prepare the existing Cell 1 and 2 embankment crest by removing the wearing course, scarifying, wetting and re-compacting the Zone A fill;
- Raise the TSF embankment to design levels and grades, including erosion protection, wearing course and safety bunds;
- Raise existing decant area, decant tower and underdrainage tower;
- Replace erosion protection material to embankment faces as required;
- Reinststate tailings delivery and distribution lines and spigot droppers; and
- Install new monitoring infrastructure (settlement pins).

The embankments will be constructed in continuous layers by placing fill material with a pre-checked compaction thickness to ensure that each layer achieves the design specifications. Prior to place any fill material, the surface of each layer will be closely inspected to ensure that the surface of the layer has the correct moisture content to bind with the next layer according to design specifications. Embankment foundation will be constructed to a maximum layer thickness of 300mm with scarified in-situ fill and will be recompacted to the design specifications. Embankment tailings and embankment Zone A (300mm each) will be constructed using low permeable fill with a compaction of 98% of standard maximum dry density. Erosion protection layer (Zone E) to be constructed to a 300mm thickness with cavity free uniform density.

The existing Stage 7 decant tower is located in the centre of the two cells on the western divider wall and comprises the following components:

- An access causeway constructed of Zone D material;
- A decant tower, consisting of an 1,800 mm diameter slotted concrete pipe surrounded by clean waste rock (Zone G);
- A submersible pump and pipework; and
- A hoist and pulley to raise and lower the pump

This decant tower is required to be raised as a part of Stage 8 and will continue operation for the rest of the life of the facility. The underdrainage tower will also be raised as a part of this project and the existing underdrainage system will be operated as they are.

All pipelines will be double skinned PE100 and will be constructed and installed in accordance with Australian Standard (AS) 4130 and AS 413, and the Plastics Industry Pipe Association of Australia Limited (PIPA) Guideline POP003. The applicant claims the existing Stage 6 and 7 Piezometers are considered to be sufficient for the monitoring requirements of the containment facility. However, additional monitoring infrastructure (settlement pins) will also be installed to ensure safe operation of the facility.

### 2.3.2 Operation of the TSF Cell 1 and 2 Stage 8

Once the construction of the Stage 8 raise of Cells 1 and 2 is complete, the tailings will be deposited from the northern, eastern, and southern embankments towards the centre of the basin. The decant tower is located in the middle of the western embankment divider wall. Therefore, the proposed tailings deposition method will maintain the pond centrally around the decant tower. Formation of the beach and the location of the supernatant pond will be operated manually by the use of spigot clamps. A submersible pump will be located in the decant and underdrainage towers to continually recover supernatant water and return it back to the processing plant. Cell 1 and 2 Stage 8 will be operated as a standalone facility and have the storage capacity of 2.6Mt of dry tailings.

The Applicant will be authorised to undertake time limited operations for tailings to be deposited into TSF Cell 1 and 2 Stage 8 provided that relevant requirements of this works approval (W6568/2021/1) are met. Ongoing operation of TSF Cell 1 and 2 stage 8 will require licence L7465/1999/8 to be amended.

### 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
<b>Construction</b>			
Dust	Construction works of TSF Cell 1 and 2 Stage 8 embankment lift	Air / windborne dispersion	<ul style="list-style-type: none"> <li>Material stockpiles will be watered down during handling</li> <li>If local wind speeds are conducive to elevated dusting, construction works will be terminated until conditions improve</li> <li>Dust suppression to be carried out using water carts via a roof mounted cannon to the Cell 1/2 embankment during the compaction phase</li> <li>If the prevailing wind direction poses a risk of overspray emitting beyond the facility perimeter watercart operations will be terminated until that risk</li> <li>Wetting down of roads/access tracks will be undertaken with dribble bars</li> <li>Saline water will be used to minimise dust where required. Windrows will be constructed along roads and hardstand areas to prevent saline water from draining into the surrounding environment</li> </ul>
Noise			<ul style="list-style-type: none"> <li>No control proposed. Human receptors are not considered to be impacted</li> </ul>

Emission	Sources	Potential pathways	Proposed controls
			during construction or operations due to the greater separation distance.
<b>Operation</b>			
Dust (dry tailings)	Operation of TSF Cell 1 and 2 Stage 8 design height of 381.0 m RL	Air / windborne dispersion	<ul style="list-style-type: none"> <li>Saline water will be used to minimise dust where required</li> </ul>
Tailings with cyanide and elevated metals and metalloids	Operation of TSF Cell 1 and 2 Stage 8 design height of 381.0 m RL	TSF embankment failure	<ul style="list-style-type: none"> <li>Monitoring of groundwater at existing downstream monitoring bores to be carried out at the operating licence condition frequency</li> <li>Piezometers will continue to be monitored monthly to assess embankment stability</li> <li>New crest settlement survey pins will be installed prior to operation to track movement of the embankment during deposition</li> <li>Dam break safety bund has constructed between the Whirling Dervish Pit (and operational underground mine) and TSF Cell 1</li> <li>Emergency action plan has been developed</li> </ul>
	Deposition of tailings into Cell 1 and 2	Tailings seepage through base and embankments of the Cell 1 and 2 Stage 8 into soil and groundwater	<ul style="list-style-type: none"> <li>Groundwater levels will be monitored on and around the TSF.</li> <li>In the event of groundwater levels rise above 6m below ground level (bgl) in surrounding monitoring bores, the works approval holder will activate a groundwater recovery programme</li> <li>Piezometers are monitored monthly to assess potential water movement through the walls</li> <li>Vegetation monitoring to be carried out using the Flora monitoring transects to identify any impacts due to seepage</li> <li>Underdrainage system drain by gravity to a collection tower. Decant water is collected from the TSF via a decant tower located within the central part of the basin. Water recovered from the underdrainage and decant systems is pumped back to the plant for re-use in the process circuit.</li> </ul>



Emission	Sources	Potential pathways	Proposed controls
		Direct discharge to land via tailings overtopping from Cell 1 and 2 Stage 8	<ul style="list-style-type: none"> <li>Cell 1 and 2 Stage 8 has been designed with a minimum top of embankment freeboard of 300mm to prevent overtopping by tailings or significant (1-100 year) rainfall event.</li> <li>The TSF will be inspected at least twice per twelve (12) hour shift during operation, which exceeds the frequency stipulated within operational licence conditions</li> <li>Processing to be ceased as per the current Carosue Dam TSF Operating Manual in the event that the minimum freeboard is not reached</li> </ul>
Decant water or underdrainage tailings with cyanide and elevated metals and metalloids	Transferring decant and underdrainage tailings through pipelines between TSF and processing plant	Discharge of decant water/tailings from pipeline rupture or leak	<ul style="list-style-type: none"> <li>Pipelines will be double skinned PE100 and constructed and installed to Australian Standards AS4130 and AS413 and Plastics Industry Pipe Association of Australia Limited (PIPA) Guideline POP003</li> <li>Transfer pipelines are connected to the Citect processing plant control system which monitors pressure in pipelines. In the event of an immediate drop in pressure within a pipeline, an alarm will be activated to notify mill control operators. The plant will be shut down immediately and to stop the flow.</li> <li>Pipelines to be inspected twice daily as per the operating licence conditions</li> <li>Pipelines to be stored in V-drains sufficient to contain spillages between routine inspections.</li> </ul>

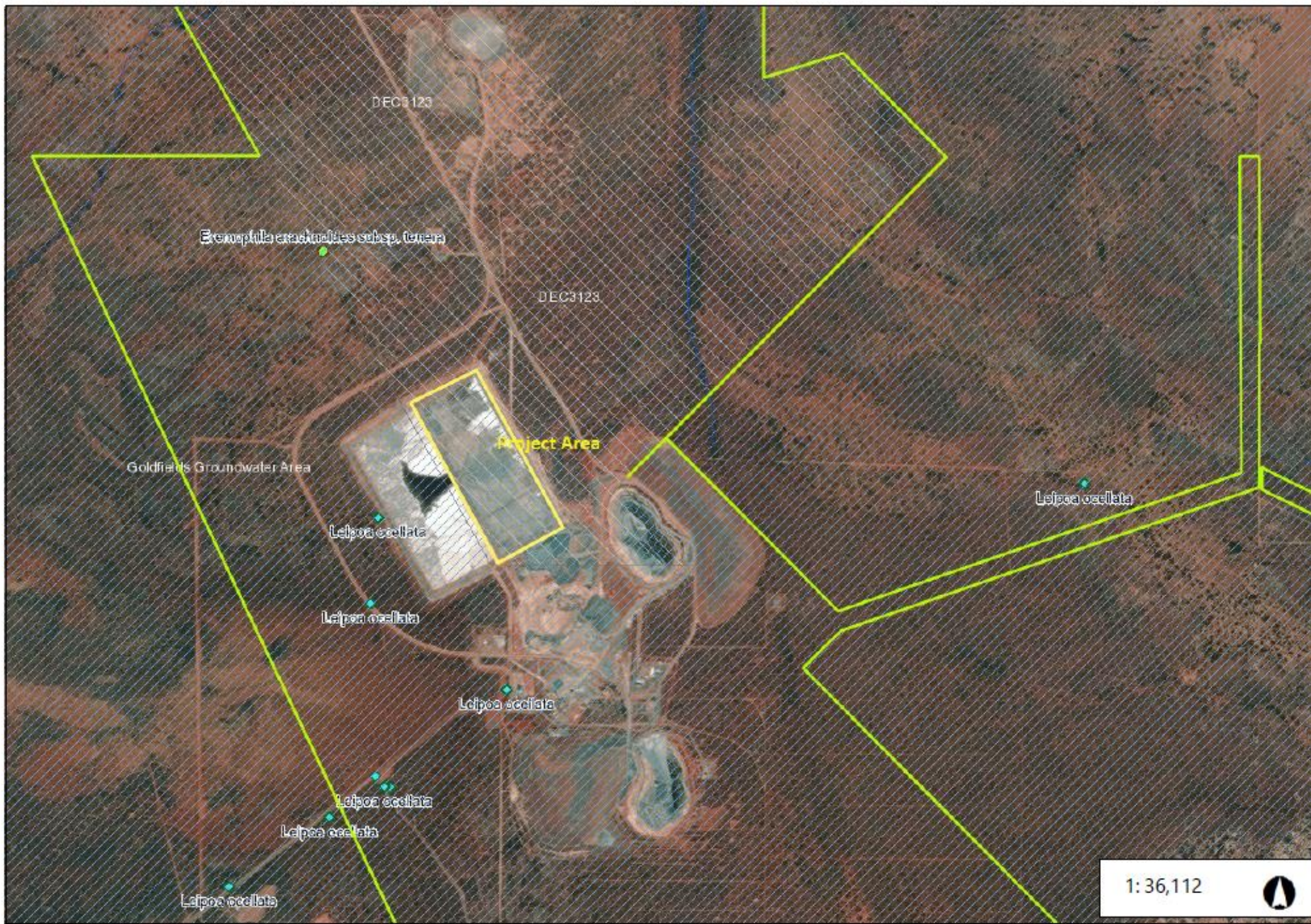
### 3.1.2 Receptors

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 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**

<b>Human receptors</b>	<b>Distance from prescribed activity</b>
Town of Kalgoorlie-boulder	approximately 120 km south-west of the Premises
Pinjin Station	37km to the west from the Premises
<b>Environmental receptors</b>	<b>Distance from prescribed activity</b>
Lake Rebecca – Salt Lake	8km north-east of the TSF
Threatened/Priority Flora	One priority flora species, <i>Eremophila arachnoides</i> subsp. Tenera (priority 1), recorded within the Premises
Threatened/Priority Fauna	Malleefowl are active on the Premises. No impacts are expected to the local Malleefowl population in relation to the TSF Cell 1 / 2 Stage 8 raise as no new clearing is required and TSF operations have been conducted for >10 years with no negative impacts observed
Surface Water Lines – Ephemeral creek (Hydrography WA 250K)	Approximately 1.5 km West to the TSF
Contaminated sites	Awaiting classification
Groundwater Area – RIWI Act 1914 proclaimed area	Goldfields Groundwater Area The groundwater level prior to construction and operation of the TSF was approximately 22.5m bgl. It has been locally modified by the TSF operations and dewatering and mining of the Whirling Dervish open pit.



2.6 0 1.30 2.6 Kilometers

WGS\_1984\_Web\_Mercator\_Auxiliary\_Sphere  
© Government of Western Australia, Department of Water and Environmental Regulation.

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION



### Legend

- Instruments - Licence
  - 23. Hydrography WA 250K - Surface Water Lines (GA 2015)
    - Watercourse
    - Water Pipeline
    - Canal Line
    - Connector
    - DEMConnector
- 32. Contaminated Sites - Reported Sites
  - Awaiting Classification
  - Contaminated - Remediation Required
  - Contaminated - Restricted Use
  - Decontaminated
  - Not Contaminated - Unrestricted use
  - Possibly Contaminated - Investigation Required
  - Remediated for Restricted Use
  - Report Not Substantiated
- RIWI Act 1914 - Groundwater Areas
- 20. Flora - WAHerb
- ◆ 21 Threatened

### Notes

TSF Cell 1 & 2 Stage 8 raise

Author:  
Recipient:

Figure 3: Distance to sensitive receptors

## 3.2 Modelling and monitoring data

### 3.2.1 Tailings Characteristics

The Applicant expects that the chemical composition of the tailings and return water in the Stage 8 raise will be similar to that of the current operation. Tailings will comprise of ore from a number of project areas including Whirling Dervish, Karari Underground, Deep South Underground, Million Dollar open pit, Maingays and potentially other satellite Projects. Tailings will be discharged as approximately 60% solids slurry with a specific gravity of approximately 1.75. Key tailings composition characteristics are summarised in Table 3 below.

**Table 3: Carosue Dam tailings properties**

Source	Parameter	Value
Process Water	Conductivity	215,000 $\mu$ S/cm
	pH	7.20 - 8.30
Tailings Slurry	pH	8.4 – 8.6
	WAD CN	60 – 70 mg/L
Supernatant	pH	7.5
	WAD CN	10 mg/L

Based on the geochemical tests performed using ore and waste recovered from the operation, it is expected that acid generation potential, associated mobilization and leaching of heavy metals from the tailings will be minimal. Therefore, all tailings have been classified as Non-acid forming.

Recent testing (ALS Metallurgy, 2021) of wastes depicted that the concentrations of heavy metal such as Arsenic (As), Cobalt (Co), Copper (Cu), Nickel (Ni) and Zinc (Zn) levels are well below the Ecological Investigation Levels (EIL) (2010) for commercial/industrial premises. Barium (Ba) was identified as the only element, which was detected above the EIL levels. However, bioavailability testing carried out by Aquaterra in 2010 has indicated that Ba is not available for leaching and is inert. These tests also demonstrated that As, B, Cd, Mo, Se and U have some degree of mobility (>1%). However, low levels of these elements in the tailing materials will limit the concentrations of leaching in solution. Selenium (Se) identified as the only element that exceeded the corresponding non-potable groundwater use guidelines, but with a slight amount. Aquaterra (2010) concluded that the bioavailability of the majority of elements is also low, and together with their low solids content, the quality of any water from the pit entering the surrounding aquifer, is unlikely to be of any environmental concern.

Further geochemical characterization undertaken in 2014 by consultants, Knight Piesold, reassured that the tailings sample, which was tested at a NATA accredited Laboratory, can be classified as Non-Acid Forming. Also, that test concluded that the tailings sample had a moderate number of elemental enrichments, with arsenic, chloride and sulphur found to be highly enriched with bismuth, molybdenum and selenium also found to be significantly enriched.

### 3.2.2 Groundwater Standing levels and Quality

Groundwater around the project area is considered hypersaline. The static water table was about 20m below ground level (bgl) prior to the construction of the existing TSF. Underlying groundwater at the Carosue Dam TSF area has recorded a TDS of between 40,000 and 170,000mg/L. The main use of this groundwater is for mining purposes. The nearest stock watering point is Relief Hill Well located 5.5km to the east of the TSF and is currently not in use.

Current groundwater standing water levels around the TSF range between 8.54mbgl (MB5D) and 23.11mbgl (MB8D) (Figure 4). In contrast, dewatering at Whirling Dervish has created a groundwater sink with water levels in the Southeast corner (MB1D) falling 26m (Figure 4). Therefore, it is evident that the groundwater in the TSF area has been modified by the construction and operation of the existing TSF as well as dewatering and mining of the Whirling Dervish open pit. Thus, the water levels around the existing TSF vary depending on which cell is in operation (Northern Star Pty Ltd, 2021).

pH of the deep bores surrounding the TSF ranges widely from acidic at MB6, MB7 and MB8 (approximately 3.5 – 4.8) to near-neutral at MB5 and MB9 (approximately 6 - 7.9). A previous investigation conducted in 2012 (Pennington Scott, 2012) concluded that the low pH in TSF monitoring bores is caused by a ferrolysis reaction, influenced by local groundwater abstraction which has created oxidising conditions.

Metals and WAD cyanide concentrations in groundwater around the TSF have been monitored since 2000. WAD cyanide concentrations in the monitoring bores have been recorded at less than 0.2mg/L, which is below the operating licence limit (L7465/1999/8) of 0.5mg/L (Northern Star Pty Ltd, 2021).

### 3.2.3 Seepage impacts to Groundwater and Vegetation

Seepage analysis modelling conducted in 2012, indicated that although there appears to be significant groundwater mounding around the TSF, the actual volumes of TSF seepage may be very low due to the low permeability of the upper horizon clay layer. It was estimated that, during the initial phases seepage rate through its base would have been up to 8L/s, whereas the current rate of seepage has been estimated at around 3.5L/s (Northern Star Pty Ltd, 2021). The TSF seepage rate has been steadily declining since the start of mining as the ground water mound has developed (Northern Star Pty Ltd, 2021).

Embankment piezometers and surrounding monitoring bores results have confirmed that there is no embankment seepage during the previous and/or current lifts on Cell 1 and 2. However, three embankment piezometers on Cell 2 (PZ04, PZ05 and PZ06) have intermittently recorded evidence of lateral movement of water within the eastern embankment wall, however the volume of seepage is extremely minor and is showing no external surface expression on the outer embankment of the cell (Northern Star Pty Ltd, 2021).

Detecting WAD cyanide in groundwater monitoring bores surrounding the TSF indicates the presence of tailings seepage. Given the fact that WAD cyanide concentrations are predominately less than 0.2mg/L, the applicant claims that seepage is not an issue and does not impact to the quality of groundwater.

Another key potential impact from tailings seepage is inundation of the rootzone of surrounding native vegetation by rising groundwater levels. The vegetation surrounding the TSF is not regarded as a ground-water dependent ecosystem, it is shallow-rooted and will not be affected by rises in groundwater (Northern Star Pty Ltd, 2021). Consultants, Knight Pièsold, estimated the root zone is at a depth of 3mbgl, which is above the operating licence standing water limit of 4mbgl.

It is proposed that the health of native vegetation around the TSF will be monitored annually using the existing vegetation monitoring transects, which were established in March 2009 (prior to the recommencement of tailings deposition). The applicant has pointed out that based on their annual monitoring results, slight changes in species diversity or abundance has appeared since monitoring began.

The applicant also proposes to continue to monitor groundwater levels and chemistry to comply with the operating licence frequency and other conditions. If groundwater levels in monitoring bores reach 6mbgl, monitoring will be carried out monthly. In the event of a rise in SWL above 4mbgl or a decline in water quality, a groundwater recovery system will be designed and implemented.



### 3.3 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 4.

Works approval W6568/2021/1 that accompanies this decision report authorises construction and time-limited operations. The conditions in the issued works approval, as outlined in Table 4 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

A licence amendment is required following the time-limited operational phase authorised under the works approval to authorise emissions associated with the ongoing operation of the premises i.e. deposition into TSF Cell 1 and 2 Stage 8. 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 4: Risk assessment of potential emissions and discharges from the premises during construction and operation**

Risk events					Risk rating <sup>1</sup>	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls	C = consequence L = likelihood			
<b>Construction</b>								
<b>Category 5:</b> Construction works of TSF cell 1 and 2 stage 8 embankment lift	Dust	Air / windborne dispersion causing impacts to the vegetation health	Native vegetation adjacent to TSF Cell 1 and 2	Refer to Section 3.1	C = Minor L = Rare <b>Low Risk</b>	Y	N/A	N/A
	Noise	Air / windborne pathway causing impacts to health and amenity	Carosue Dam Operations is located 120 km north-east of Kalgoorlie. The Pinjin station is the nearest residential dwelling, located approximately 37 km to the west from the premises.  Greater distance to the above sensitive receptors is sufficient to avoid any potential impacts from the operation.	Refer to Section 3.1	No pathway to receptor. Further risk assessment not needed.	N/A	N/A	N/A
<b>Operation (including time-limited-operations operations)</b>								
<b>Category 5:</b> Operation of TSF Cell 1 and 2 Stage 8 design height of 381.0 m RL Activity: deposition of tailings	Dust (dry tailings)	Air / windborne pathway causing impacts to vegetation health	Native vegetation adjacent to TSF Cell 1 and 2	Refer to Section 3.1	C = Minor L = Rare <b>Low Risk</b>	Y	N/A	N/A

Risk events					Risk rating <sup>1</sup>	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls	C = consequence L = likelihood			
into Cell 1 and 2	Tailings with cyanide and elevated metals and metalloids	<p>TSF embankment failure</p> <p>Impacts: Impacts to vegetation growth and health</p> <p>Degradation of soil structure and soil contamination</p> <p>Contamination of groundwater</p>			<p>C = Major</p> <p>L = Unlikely</p> <p><b>Medium Risk</b></p>	Y	<p>Condition 1 – Infrastructure requirements</p> <p><b><u>Condition 2 and 3 – compliance reporting requirements</u></b></p> <p><b><u>Condition 4 and 5 – Time limited operation commencement, duration, and operating requirements</u></b></p>	<p>Infrastructure and installation requirements of monitoring equipment are outlined in Condition 1 of the issued works approval. This monitoring equipment needs to be installed prior to operation to track movement of the embankment during deposition.</p> <p>Reporting and time limited operations commencement conditions have been applied in the issued works approval to ensure that all the required monitoring equipment are in place prior to operation.</p> <p>The Delegated Officer notes the TSF dam stability, safety and construction requirements are regulated by the <i>Mining Act 1978</i>. Mining Proposal is required to authorise construction, operation or closure of the TSF. The <i>Mines Safety and Inspection Act 1994</i> and related Regulations also apply. Therefore, additional regulatory controls are not required under Part V of the <i>Environmental Protection Act 1986</i>.</p> <p>Given that, the applicant's proposed controls are deemed adequate to identify and mitigate any potential risk of embankment failure of TSF Cell 1 and 2.</p>
		<p>Tailings seepage through base and embankments of the Cell 1 and 2 Stage 8 TSF into soil and groundwater</p> <p>Impacts: Mounding of groundwater inundating vegetation rootzones</p> <p>Contamination of groundwater</p>	<p>Surrounding Native vegetation</p> <p>Groundwater</p>	Refer to Section 3.1	<p>C = Moderate</p> <p>L = Possible</p> <p><b>Medium Risk</b></p>	Y	<p>Condition 1 – Infrastructure requirements</p> <p><b><u>Condition 2 and 3 – compliance reporting requirements</u></b></p> <p><b><u>Condition 4 and 5 – Time limited operation commencement, duration, and operating requirements</u></b></p>	<p>The Delegated Officer has determined that the Applicant's proposed controls are adequate to manage any potential impacts from seepage of tailings. Those controls have conditioned within the works approval in accordance with <i>Guidance statement: Risk Assessments</i> (DER 2017).</p> <p>Some additional regulatory requirements apply for reporting and time limited operations commencement and duration. These are standard conditions required for most works approvals authorising construction of TSFs.</p> <p>Additionally, the operating licence conditions relating to the regulation of seepage impacts from TSF Cell 1 and 2 apply. Licence conditions include the requirement to conduct a monthly water balance to estimate seepage losses (existing condition 7), a standing water level limit of 4 mgbl within monitoring bores (existing condition 28), the requirement to design and implement a groundwater recovery plan in the event that standing water levels reach 6.0 mgbl (existing condition 8), requirement for a seepage collection and recovery system (existing condition 5) and other groundwater monitoring conditions to assess changes in groundwater levels and quality.</p> <p>The licence will require an amendment to modify conditions to allow deposition into Stage 8 of TSF Cell 1 and 2.</p>



Risk events					Risk rating <sup>1</sup>	Applicant controls sufficient?	Conditions <sup>2</sup> of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls	C = consequence L = likelihood			
		Direct discharge to land via tailings overtopping from Cell 1 and 2 Stage 8 TSF  Impacts: Causing impacts to vegetation health  Soil contamination	Adjacent terrestrial ecosystem – soils and native vegetation  Potential impacts to groundwater	Refer to Section 3.1	C = Moderate L = Unlikely <b>Medium Risk</b>	Y	Condition 1 – Infrastructure requirements  <b><u>Condition 2 and 3 – compliance reporting requirements</u></b>  <b><u>Condition 4, 5 and 6 – Time limited operation commencement, duration, and operating requirements</u></b>	The Delegated Officer considers that the applicant controls, summarised in section 3.1, are sufficient to mitigate any impacts from overtopping of tailings from TSF Cell 1 and 2. Those controls have conditioned within the works approval in accordance with <i>Guidance statement: Risk Assessments</i> (DER 2017).  Additionally, current conditions in the operating licence L7465/1999/8 include the requirement to maintain a minimum 300mm operational freeboard (existing condition 4); visual inspection of the TSF embankment freeboard every 12 hours (existing condition 6); and the requirement to conduct monthly water balance (existing condition 7).  Thus, conditions in this issued works approval together with the conditions in the current operating licence adequately regulate the risk of cell 1 and 2 overtopping.
<b>Category 5:</b>  Transferring decant and underdrainage tailings through pipelines between TSF and processing plant	Decant water or underdrainage tailings with cyanide and elevated metals and metalloids	Direct discharge of decant water/tailings from pipeline rupture or leak  Impacts: Degradation of soil structure and soil contamination  Impacts to vegetation growth and health	Adjacent terrestrial ecosystem – soils and native vegetation  Potential impacts to groundwater	Refer to Section 3.1	C = Moderate L = Unlikely <b>Medium Risk</b>	Y	Condition 1 – Infrastructure requirements  <b><u>Condition 2 and 3 – compliance reporting requirements</u></b>  <b><u>Condition 4 and 5 – Time limited operation commencement, duration, and operating requirements</u></b>	The premises licence has existing conditions relating to the regulation of spills and leaks from pipelines. These include the requirement that all the pipelines need to be equipped with telemetry, pressure sensors and automatic cut-outs (existing condition 1); requirement to provide sufficient secondary containment to contain any spills (existing condition 1); requirement for pipeline inspection every 12 hours to ensure integrity (existing condition 6).  Therefore, additional regulatory controls are not required other than those requiring reporting and authorising time limited operations commencement and duration. The Delegated Officer considers the applicant controls, which are conditioned in the issued works approval and in the current operating licence are sufficient to mitigate and regulate the risk of spills or leaks from pipelines.

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.

## 4. Consultation

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

**Table 5: Consultation**

Consultation method	Comments received	Department response
Application advertised on the department's website on 23 August 2021	None received	N/A
Local Government Authority advised of proposal on 22 September 2021	None received	N/A
Applicant was provided with draft documents on 06 October 2021	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. Email titled "Northern Star (Carosue Dam) Pty Ltd- TSF Cell 1/2 Stage 8 Works Approval Application" dated 10/06/2021 authored by Roberts Mills, available at DWER records (DWERDT463201).
2. DER 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
3. Department of Water and Environmental Regulation (DWER) 2019, *Guideline: Decision Making*, Joondalup, Western Australia.
4. DWER 2016, *Guideline: Environmental siting*, Joondalup, Western Australia.
5. DWER 2017, *Guideline: Risk assessments*, Joondalup, Western Australia.

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

Condition	Summary of applicant's comment	Department's response
Condition 1 Table 1	<p>The current construction approach for this raise is to utilise tailings won from the beach as the low permeability Zone A material. Based on existing laboratory testing it is unlikely the current proposed value of <math>1 \times 10^{-8}</math> m/s in the draft can be achieved.</p> <p>Therefore, requirement 3 in Table 1 be changed to <i>"upstream raising embankments are to be constructed using a Low Permeability Fill (in the zone A) with a compacted hydraulic conductivity not greater than <math>5 \times 10^{-7}</math> m/s"</i>.</p>	<p>Considering the existing groundwater monitoring program and usage of piezometers, which will identify any potential lateral tailings seepage, the revised permeability rate which can be practically achieved using tailings won from the beach is considered an acceptable. Permeability rate was therefore amended as requested.</p>
	<p>Northern Star would like to request the removal of bullet point three of Table 1 as it is relevant to basin seepage for starter embankment construction only. Bullet point 4 is applicable for embankment construction (lifts) as it covers embankment raising and geotechnical testing requirements.</p>	<p>DWER has not removed this construction requirement, which is in place to ensure that the embankment material has an acceptable low permeability. The level of permeability has been amended a level which is practically achievable as requested by the applicant (refer to above row).</p>
	<p>In reference to Table 1 bullet points five and six, the decant and underdrainage towers are designed to a height of 378 and 379.9m RL AHD respectively.</p>	<p>DWER noted the request and updated the condition accordingly.</p>
Condition 6 Table 2	<p>In reference to Table 2 bullet point one, Northern Star wishes to amend the TSF Cell 1 &amp; 2 (Stage 8) height to 381m RL AHD for time limited operations.</p>	<p>DWER noted the typographical error and updated the condition accordingly.</p>

## Appendix 2: Application validation summary

SECTION 1: APPLICATION SUMMARY (as updated from validation checklist)				
<b>Application type</b>				
Works approval	<input checked="" type="checkbox"/>			
Licence	<input type="checkbox"/>	Relevant works approval number:		None <input type="checkbox"/>
		Has the works approval been complied with?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Has time limited operations under the works approval demonstrated acceptable operations?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>	
		Environmental Compliance Report / Critical Containment Infrastructure Report submitted?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Date Report received:		
Renewal	<input type="checkbox"/>	Current licence number:		
Amendment to works approval	<input type="checkbox"/>	Current works approval number:		
Amendment to licence	<input type="checkbox"/>	Current licence number:		
		Relevant works approval number:	N/A	<input type="checkbox"/>
Registration	<input type="checkbox"/>	Current works approval number:	None	<input type="checkbox"/>
Date application received	10 June 2021			
<b>Applicant and Premises details</b>				
Applicant name/s (full legal name/s)	Northern Star Resources (Carosue Dam) Pty Ltd			
Premises name	Carosue Dam Minesite			
Premises location	M31/220 (436804E 6665742N)			
Local Government Authority	Shire of Menzies			
<b>Application documents</b>				
HPCM file reference number:	DER2021/000351			
Key application documents (additional to application form):	Document titled "Cells 1 & 2 Tailings Storage Facility - Stage 8 Embankment Raise Supporting Information" attached to the application			
<b>Scope of application/assessment</b>				
Summary of proposed activities or changes to existing operations.	<p><i>Works approval</i></p> <p>An upstream embankment raise to Cell 1 and 2 of the existing Paddock Tailings Storage Facility (TSF) from 378.0mRL to the Stage 8 design height of 381.0mRL (32.0m total)</p>			
<b>Category number/s (activities that cause the premises to become prescribed premises)</b>				

<b>Table 1: Prescribed premises categories</b>		
<b>Prescribed premises category and description</b>	<b>Proposed production or design capacity</b>	<b>Proposed changes to the production or design capacity (amendments only)</b>
Category 5: Processing or beneficiation of metallic or non-metallic ore	4 million tonnes per annum	N/A
<b>Legislative context and other approvals</b>		
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 <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referral decision No: Managed under Part V <input type="checkbox"/> Assessed under Part IV <input type="checkbox"/>
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Ministerial statement No: EPA Report No:
Has the proposal been referred and/or assessed under the EPBC Act?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Reference No:
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Certificate of title <input type="checkbox"/> General lease <input type="checkbox"/> Expiry: Mining lease / tenement <input checked="" type="checkbox"/> Expiry: Other evidence <input type="checkbox"/> Expiry:
Has the applicant obtained all relevant planning approvals?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>	Approval: Expiry date: If N/A explain why?
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	CPS No: N/A No clearing is proposed.
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Application reference No: N/A Licence/permit No: N/A No clearing is proposed.
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Application reference No: N/A Licence/permit No: N/A Licence / permit not required.

<p>Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>	<p>Name: Goldfields Groundwater Area  Type: Proclaimed Groundwater Area (RIWI Act 1914)  Has Regulatory Services (Water) been consulted?  Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A <input type="checkbox"/>  Regional office: Goldfields</p>
<p>Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p>Name: N/A  Priority: P1 / P2 / P3 / N/A  Are the proposed activities/ landuse compatible with the PDWSA (refer to <a href="#">WQPN 25</a>)?  Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/></p>
<p>Is the Premises subject to any other Acts or subsidiary regulations (e.g. <i>Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004, State Agreement Act xxx</i>)</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>	<p><i>Mining Act 1972 - Mining proposals  Dangerous Goods Safety Act 2004  RIWI Act 1914</i></p>
<p>Is the Premises within an Environmental Protection Policy (EPP) Area?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p>N/A</p>
<p>Is the Premises subject to any EPP requirements?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p>N/A</p>
<p>Is the Premises a known or suspected contaminated site under the <i>Contaminated Sites Act 2003</i>?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p>N/A</p>