



## Application for Licence Amendment

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

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<b>Licence Number</b>	L7404/1999/9
<b>Licence Holder</b>	Australian Nickel Investments Pty Ltd
<b>ACN</b>	111 599 323
<b>File Number</b>	DER2015/002781-1
<b>Premises</b>	Cosmos Nickel Operations Goldfields Highway SIR SAMUEL WA 6437  Legal description –  Mining tenements L36/118, L36/159, L36/171, L36/172, M36/127, M36/212, M36/365, M36/371, M36/375, M36/376, M36/377, M36/441, M36/659, and part of M36/180 and M36/349  As defined by the Premises maps attached to the Revised Licence
<b>Date of Report</b>	10 January 2023
<b>Decision</b>	Revised works approval granted

**Lauren Edmands**

**MANAGER, RESOURCE INDUSTRIES**

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

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# 1. Decision summary

Licence L7404/1999/9 is held by Australian Nickel Investments Pty Ltd (Licence Holder) for the Cosmos Nickel Operations (the Premises), located at Goldfields Highway, Sir Samuel in Western Australia.

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the construction and operation of the Premises. As a result of this assessment, Revised Licence L7404/1999/9 has been granted.

## 2. Scope of assessment

### 2.1 Regulatory framework

In completing the assessment documented in this Amendment Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at <https://dwer.wa.gov.au/regulatory-documents>.

### 2.2 Application/Amendment summary

On 13 June 2022, Australian Nickel Investments Pty Ltd (Licence Holder) submitted an application to the department to amend Licence L7404/1999/9 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The application is to undertake construction of an embankment raise on tailings storage facility 1 (TSF1) at the Cosmos Nickel Operations (the premises) in the Goldfields Region of Western Australia. The premises is located in the Shire of Leonora approximately 32km north of Leinster.

The TSF was originally constructed as two cells with the first cells (TSF1) commissioned in April 2000 and the second TSF cell (TSF2) constructed in 2003. Deposition was alternated between the cells. The cells were then raised to an equal elevation of RL 493.5m and amalgamated into a single cell TSF1 in 2009. The Licence Holder ceased discharging tailings in 2012 and the site was placed in care and maintenance. Figure 1 indicates the location of TSF1 within the premises.

The premises is currently undergoing an upgrade and refurbishment of the plant to take the facility out of care and maintenance as assessed under works approval W6605/2021/1 and works are expected to be completed in September 2023. In accordance with W6605/2021/1 tailings from the processing plant will be disposed of to TSF1 during wet commissioning (1-2 months) and time limited operations (6 months).

The licence holder has reassessed the current storage capacity within TSF1 and has determined there is approximately 2 months tailings storage available. The licence holder is proposing to increase the embankment height of TSF1 to allow additional tailings storage capacity to 2025.

#### **Embankment raise proposed:**

The licence holder has commissioned Golder Associates Pty Ltd to prepare a TSF design report (Golder, 2022) for construction of two 1.5m upstream raises for TSF1 to elevations RL 495 M and RL 496.5m (17.5m height). The Licence Holder is proposing that construction of the upstream raises will occur in parallel with the ongoing tailings depositions. The raises will assist in managing life of mine deposition requirements until 2025, when the licence holder plans to apply for approval to construct TSF3, a new facility abutting TSF1.

The estimated life of total mine (LoM) tailings production for the project from 2022 to 2033 is 1.86 Mt of tailings (requiring storage in TSF), with production to commence in Q4 2022. This

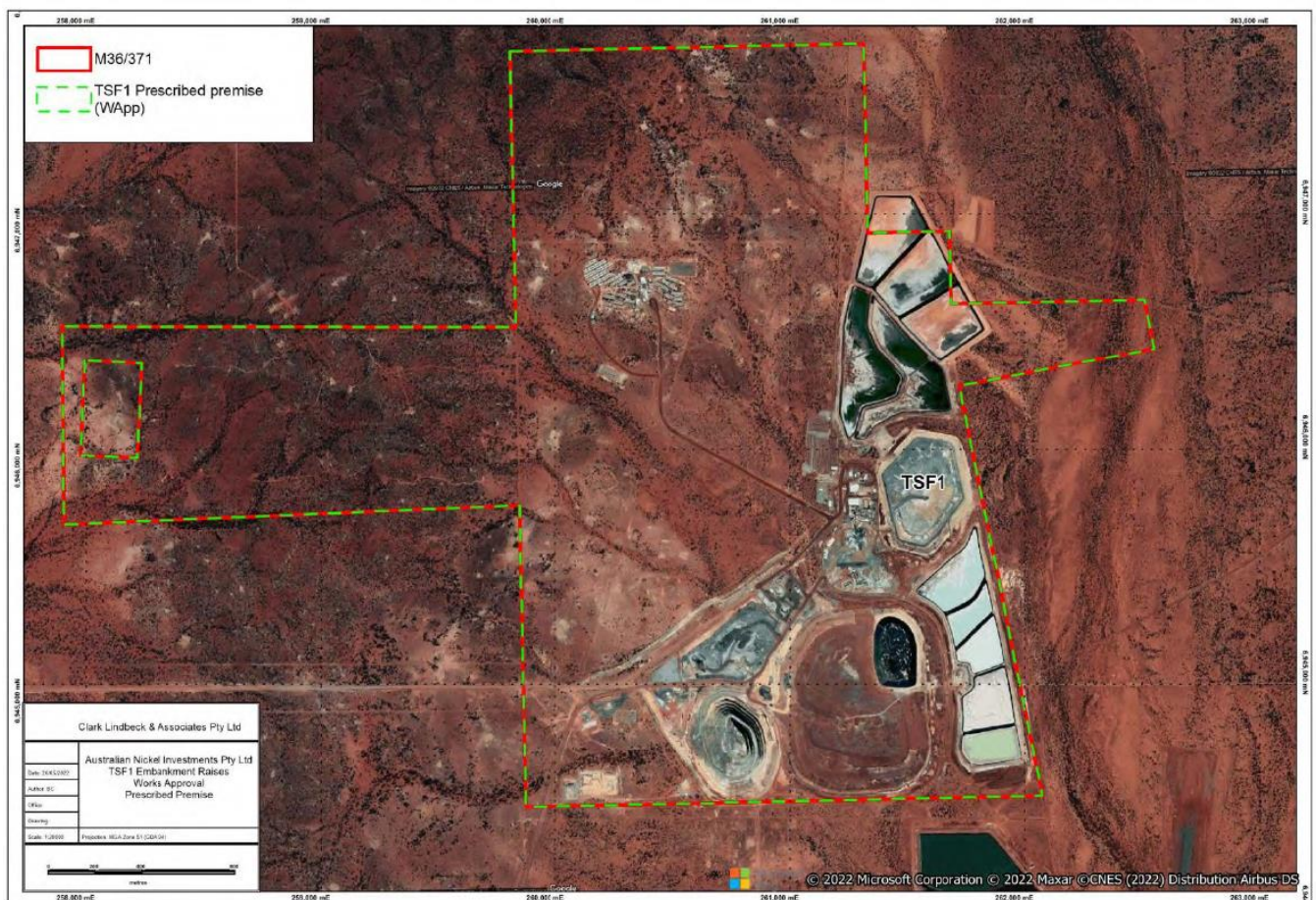
differs from the processing rate (up to 1.1 Mtpa) as a significant portion of the tailings will be transferred direct to the existing paste plant.

The existing TSF1 tailings storage volume and storage capacity for the two raises included in within the scope of this amendment application are summarised in Table 1.

**Table 1: Tailings storage capacity in TSF1**

Stage	Storage capacity (m <sup>3</sup> )	Storage capacity (tonnes)	Duration (days)	Date capacity reached
Current (approved)	23,799	35,699	81	December 2022
TSF1 Raise 1 (RL 495 m)	95,787	143,681	301	October 2023
TSF1 Raise 2 (RL 496.5m)	141,751	212,626	458	January 2025

While the processing plant has a final design capacity of 1.1 Mtpa (Stage 2), only a portion of the tailings generated will require storage in TSF1 (and future TSF3). The maximum expected tailings discharged to TSF1 is 220,000 tonnes per annual period (i.e. 80% of tailings will go to the paste plant).



**Figure 1: Location of TSF1**

### Licence History

The Cosmos Nickel Operation historically consisted of the Cosmos and Prospero underground mines. The operations commenced in October 1999 by Jubilee Mines. The Cosmos open pit was mined between 2000 and 2003 and subsequently underground operations at Cosmos

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commenced with associated mine dewatering and processing activities. The licence included a number of categories including category 5 processing or beneficiation of ore, category 52 electric power generation, category 85: sewage facility. The Cosmos project was placed on Care and Maintenance in 2012 due to the exhaustion of the Prospero ore body. The delegated officer at the time decided to amend the licence to remove these activities as they were not currently occurring on the premises. At that stage only category 6 remained on the licence. It was noted that future amendment applications would be required prior to recommencement of full operations at the Premises. In January 2021 the licence was amended to add categories 85 and 89 to the licence. In May 2021 the licence was amended to add category 52 to the licence.

The Licence Holder has a number of works approvals to upgrade and refurbish the Category 5 processing plant. The following works approvals are in place:

- W6605/2021/1 category 5 - to refurbish, reconfigure and install new equipment to increase the throughput of the plant to 900,000 tonnes per annum (tpa) and the second stage will involve works to increase the throughput capacity to 1,100,000 tpa. Construction is expected to be completed in September 2023. There will be a three-month commissioning period and a six-month time limited operations period.
- W6635/2021/1 category 5 – construction and installation of Cosmos Paste Plant and associated infrastructure. Construction was expected to take six months from April 2022, with commissioning expected in October 2022 for a period of six months.

The current licence has the following categories:

- Category 6 mine dewatering 3,000,000 tonnes per annual period
- Category 12 screening etc. of material 100,000 tonnes per annual period
- Category 52 electric power generation 12.5MW per annual period
- Category 85 sewerage facility 70m<sup>3</sup>/day
- Category 85 putrescible landfill 2,200 tonnes per annual period

This amendment is to allow the construction of an embankment lift for the TSF and does not authorise the recommencement of operation of the category 5 processing plant. Another amendment to the licence will be required, once the construction works associated with the upgrade to the plant has been completed under works approval W6605/2021/1 and W6635/2021/1.

It has been decided that category 5 will not be added to the licence as this would be better captured under another amendment that authorises the ongoing operation of the refurbished processing plant.

### 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 Amendment Report are detailed in Table 2 below. Table 2 also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary. Noise emissions associated with construction activities have been discounted from the risk assessment as there are no nearby sensitive human receptors

**Table 2: Licence Holder controls**

Emission	Sources	Potential pathways	Proposed controls
Dust	Earthworks associated with embankment lifts and increased vehicle movements	Air/windborne pathway	<ul style="list-style-type: none"> <li>• Water trucks will be utilised on roads and during construction activities to control dust as required.</li> <li>• During TSF earthworks, tailings and waste rock will be moisture conditioned to achieve maximum dry density.</li> <li>• Implementation of speed limits to reduce dust generation. Any dust complaints will be recorded, investigated and remedial action undertaken.</li> </ul>
Tailings and contaminated water.  Historical and on-going seepage  (Refer to section 3.3)	TSF	Seepage through base and embankments of TSF to soil and groundwater	<p><b>Construction:</b></p> <ul style="list-style-type: none"> <li>• Design and freeboard requirements have been undertaken in accordance with DMP (2015) guidelines <i>'Guide to the preparation of a design report for Tailings Storage Facilities (TSFs).'</i></li> </ul> <p><b>Operation:</b></p> <ul style="list-style-type: none"> <li>• Existing toe drain is in place around TSF.</li> <li>• Minimum of once daily inspections of the TSF.</li> <li>• Ongoing monitoring of groundwater bores surrounding the TSF in accordance with the licence. The existing licence has a target of 6 mbgl and a limit of 4 mbgl applies to groundwater levels in the monitoring bores around the TSF.</li> <li>• Use of existing TSF recovery bore network.</li> <li>• Tailings will be discharged sub-aerially and in discrete layers, ~300mm thickness, to allow the tailings to gain optimum densities and strength by subjecting each layer to a drying cycle.</li> <li>• Deposition will take place via multiple spigots located on the upstream edge</li> </ul>

Emission	Sources	Potential pathways	Proposed controls
			<p>of the crest of the TSF perimeter embankment.</p> <ul style="list-style-type: none"> <li>• Spigotting will be carried out such that the supernatant pond is maintained around the central decant structure of the TSF.</li> <li>• The tailings beach will be formed such that the development of pond from rainfall events will only occur around the central decant structure.</li> <li>• Water from the TSF will continue to be removed via an independent decant pump located within the central decant tower and piped back to the process plant for re-use.</li> <li>• Maintenance of decant pond as far as practically possible away from the perimeter embankment at all times. Regulating the size of surface water pond will reduce seepage and evaporation from the TSF and will assist in optimising water recovery and tailings density.</li> </ul>
Tailings and contaminated water.	Pipelines from process (existing pipelines used)	Tailings release due to pipeline leaks and spills	<ul style="list-style-type: none"> <li>• Tailings distribution pipework will be located at the internal crest margin with a cross-fall toward the centre of the TSFs to capture any pipe spillage or failures, preventing any erosion on the embankment due to pipeline spillage.</li> </ul> <p><b>Operation:</b></p> <ul style="list-style-type: none"> <li>• Daily inspections of pipelines</li> <li>• Active monitoring in the plant control room. In the event flow meter reading indicate failure, the affected pipeline will be shut down until repaired and spilled material is collected and / or pumped, as appropriate and deposited into the TSF. Spills will be controlled at the source, contained and cleaned up as soon as they occur. Contained material shall be disposed of off-site.</li> <li>• Select personnel will be trained in spill response activities.</li> </ul>
Tailings	TSF	Overtopping of TSF and direct discharge to	<p><b>Construction:</b></p> <ul style="list-style-type: none"> <li>• Crest of the perimeter embankment is to be constructed with an inwardly</li> </ul>

Emission	Sources	Potential pathways	Proposed controls
		land and seepage to soil and groundwater	<p>graded crossfall of 2% to direct incident rainfall towards the TSF basin.</p> <ul style="list-style-type: none"> <li>Design and freeboard requirements have been undertaken in accordance with DMP (2015) guidelines <i>'Guide to the preparation of a design report for Tailings Storage Facilities (TSFs)'</i> and ANCOLD (2019).</li> <li>TSF designed to contain a 1 in 100 year, 72-hour AEP event above normal operating decant pool level (0.5m).</li> <li>Construction of the embankment raises will occur adequately in advance of additional capacity being required such that adequate stormwater storage is provided.</li> </ul> <p><b>Operation:</b></p> <ul style="list-style-type: none"> <li>Minimum of once daily inspections for the TSF.</li> <li>A total freeboard of 0.5m will be maintained to ensure this capacity is available.</li> <li>Hydrological analysis (Golder, 2022) also indicate that the Cosmos TSF1 at RL 496.5m can retain at least 48-hr probably maximum precipitation event without overtopping.</li> </ul>
Dust	Erosion of deposited tailings and generation of dust	Air/windborne pathway	<ul style="list-style-type: none"> <li>Tailings will be kept at a slurry of ~55% solids.</li> <li>Depositing tailings into the TSF in these layers will maintain a consistent beach around the facility. If tailings are continually deposited in layers, the potential of the tailings particles by wind erosion will be reduced. This is important, as it has been noted through laboratory examination that there are fibrous particles in the tailings.</li> <li>Tailings will ultimately be covered with waste rock. There will be no exposed tailings on the surface following completion of operations (i.e. at closure).</li> </ul>
Contaminated stormwater runoff from	PAF material within TSF embankments	Direct discharge to land	<ul style="list-style-type: none"> <li>The application states that local drainage pathways around the TSFs have been maintained. Where</li> </ul>



Emission	Sources	Potential pathways	Proposed controls
TSF embankments			<p>drainage pathways have been interrupted by various stages of mine infrastructure development, runoff has been directed into diversion channels that discharge into the natural drainage pathways south-east of the TSF1 and process plant.</p> <ul style="list-style-type: none"> <li>As part of their closure concept, the Licence Holder has proposed to manage water from the embankments to achieve minimal erosion by surface water management (embankments) shedding of runoff from embankments towards perimeter collection drains.</li> </ul>

### 3.1.2 Receptors

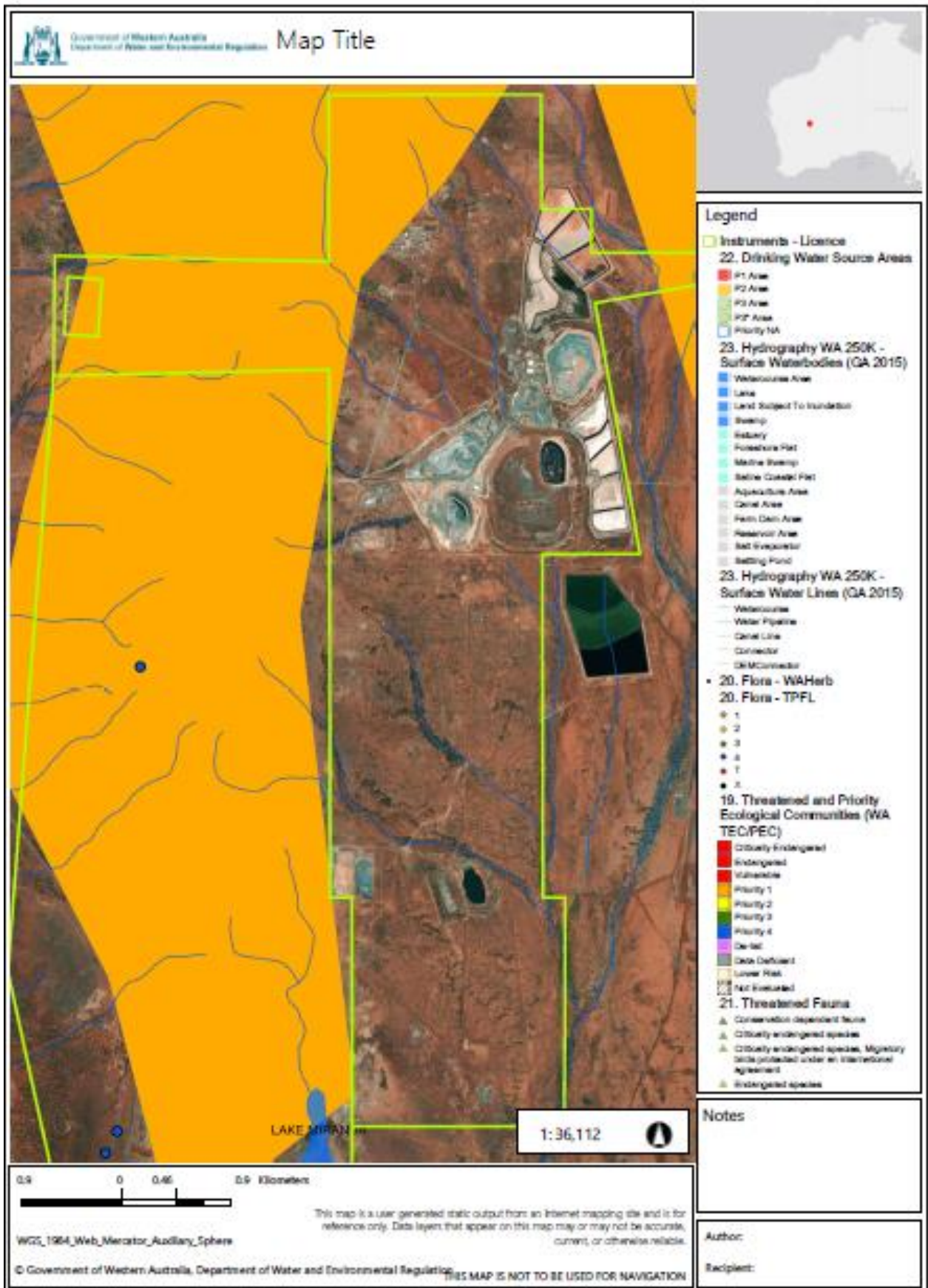
In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded employees, visitors and contractors of the Licence Holder's from its assessment. Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under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

Table 3 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises (*Guideline: Environmental siting* (DWER 2020)). The closest human receptor to the site is the Yakabindi Pastoral Station, approximately 4.5km northwest of the Cosmos mine.

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

Environmental receptors	Distance from prescribed activity
Groundwater	<p><u>Groundwater level</u></p> <p>Pre-mining groundwater levels in the area were about 15-20 mbgl (460m RL). Levels indicate a shallow groundwater gradient towards the south, which is consistent with a regional groundwater flow direction towards Lake Miranda.</p> <p>Dewatering activities have resulted in a drawdown cone around the mined pits.</p> <p>Groundwater mounding is expected to continue to occur beneath the TSF during operations.</p> <p><u>Groundwater quality</u></p> <p>Groundwater quality from annual monitoring indicates (as reported in the Annual Environmental Report 2021):</p> <ul style="list-style-type: none"> <li>Groundwater near the TSF is around 14 mbgl;</li> <li>Groundwater is neutral (pH 6.35 – 8.08);</li> <li>The electrical conductivity (EC) of the groundwater has varied overtime ranges from 753µS/cm to 152,000µS/cm; and</li> </ul>

	<ul style="list-style-type: none"> <li>• Low levels of arsenic, cadmium, nickel and zine are generally present as dissolved metals within the water column.</li> </ul> <p><u>Other groundwater users:</u></p> <p>There are five registered bores within 3km radius of the mine. The closest is Williams Well located adjacent to WMP2 and is no longer operational. The remaining four are unsuccessful exploration holes that were installed in 1988 and are understood to be no longer operational.</p>
Threatened / Priority flora	<p>No threatened flora recorded at the Premises.</p> <p><i>Grevillea inconspicua</i> (priority 4), approximately 3km SE of the TSF1.</p>
Threatened / Priority fauna	<p>Within 5km of premises boundary:</p> <p><i>Seringia exastia</i> (threatened)</p> <p><i>Swainsona Katjarra</i> (1)</p> <p><i>Dasyercus blythi</i></p>
Threatened and Priority Ecological Communities (TECs / PECs)	<p>PEC - Within prescribed premises boundary – Buffer zone of Violet Range (Perseverance Greenstone) BIF (Priority 1) (500m east of the TSF).</p> <p>3.77km southwest of the premises boundary – Yakabindie Calcrete PEC (Priority 1)</p> <p>Lake Miranda East PEC (Priority1) 4.9km east</p>
Surface hydrology	<p>Some minor non perennial watercourses in the area. One watercourse is located approximately 260m east of the base of the TSF. And Another watercourse located 350m west of the base of the TSF.</p> <p>3.81 km south of premises boundary – Lake Miranda</p> <p>Surface water drainage is generally to the south towards Lake Miranda.</p>
WRIMS - Aquifers	<p>Combined Fractured Rock West – Calcrete - Palaeochannel</p>



**Figure 2: Distance to sensitive receptors**

## 3.2 Risk ratings

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

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

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

The Revised Licence L7404/1999/9 that accompanies this Amendment Report authorises emissions associated with the construction and operation of the TSF lift. The conditions in the Revised Licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

**Table 4. Risk assessment of potential emissions and discharges from the Premises during construction, commissioning and operation**

Risk Event					Risk rating <sup>1</sup> C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions <sup>2</sup> of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
<b>Construction</b>								
Earthworks associated with embankment lifts, increased vehicle movements	Dust	Air/windborne pathway causing impacts to health and amenity	Vegetation and fauna within the vicinity of the Project. Mining camp 3.8km.	Refer to Section 3.1	C = <i>Minor</i> L = <i>Rare</i> <b>Low Risk</b>	Y	N/A	N/A Due to the short duration of construction and distance to receptors, the Department considers the risk low and additional controls are not required.
<b>Operation</b>								
Tailings delivery line and water return lines (to and from TSF)	Tailings (metals/metalloids etc.) .	Pipeline burst or leak, direct discharge, infiltration into soil, surface water or groundwater	Surface water specifically Lake Miranda 6km south of the southern embankment of TSF1. General native vegetation. PEC located within the boundary of the Premises. Groundwater	Refer to Section 3.1	C = <i>Moderate</i> L = <i>Unlikely</i> <b>Medium Risk</b>	Y	<u>Updated condition:</u> Condition 1 – row 13	<p>The licence holder has proposed daily monitoring of the pipelines during operation, flow meter readings at the control room and pipelines will be shut down if there is a failure.</p> <p>Given the medium risk of pipeline failure and potential impacts to the nearby PEC (500m east of TSF1), DWER has modified Condition 1 to specify the following:</p> <ul style="list-style-type: none"> <li>Equipped with telemetry systems and pressure sensors along pipelines to allow the detection of leaks and failures;</li> <li>Equipped with automatic cut-outs in the event of a pipe failure; or</li> <li>Provided with a secondary containment sufficient to contain any spill for a period equal to the time between routines.</li> </ul>



Risk Event					Risk rating <sup>1</sup>	Licence Holder's controls sufficient?	Conditions <sup>2</sup> of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls	C = consequence L = likelihood			
Operation of TSF1 deposition and storage of tailings and contaminated water	Tailings potentially containing element with environmental significance.	Overtopping of TSF, direct discharge, infiltration into soil, surface water or groundwater	Surface water specifically Lake Miranda 6km south of the southern embankment of TSF1. General native vegetation. PEC located within the boundary of the Premises. Groundwater.	Refer to Section 3.1	C = <i>Moderate</i> L = <i>Unlikely</i> <b>Medium Risk</b>	Y	<u>Updated condition</u> Condition 1 – TSF freeboard <u>New Conditions:</u> Conditions, 4, 5, and 6 – construction requirements	The licence holder proposed controls for the potentially overtopping of TSF1 have been included in the licence as regulatory controls. <u>Licence holder controls:</u> <ul style="list-style-type: none"> <li>The embankment heights have been specified in the licence. (Condition 4)</li> <li>A minimum freeboard specified by the licence holder has been included in the licence to ensure that overtopping of the TSF does not occur (condition 1).</li> </ul> The following conditions have been included in the licence: <ul style="list-style-type: none"> <li>Within 30 days of each lift being constructed the licence holder must audit the compliance and submit a compliance report certified by a suitably qualified engineer (conditions 5 and 6).</li> </ul>
Operation of TSF1 deposition and storage of tailings and contaminated water (at the increase embankment heights)	Increased Seepage (contaminated water)	Infiltration / seepage through TSF walls and floor causing mounding of groundwater, impacts to groundwater quality, threatened ecological	General native vegetation. PEC located within the boundary of the Premises. Groundwater.	Refer to Section 3.1	C = <i>Minor</i> L = <i>Possible</i> <b>Medium Risk</b>	Y	<u>Existing conditions</u> Conditions 14-15 – actions in response to groundwater action criteria <u>Updated condition</u> Condition 13: - additional monitoring bore Condition 16 :- groundwater mounding	Refer to Section 3.3

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Risk Event					Risk rating <sup>1</sup> C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions <sup>2</sup> of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
		communities and health of native vegetation.					limit applied to an extra monitoring bore.	
Runoff from tailings embankment containing potentially acid forming material (PAF)	Stormwater runoff containing PAF	Direct discharge to land	Localised soils  Native vegetation. PECs located within the Premises boundary.	Refer to Section 3.1	C = <i>Minor</i> L = <i>Unlikely</i> <b>Medium Risk</b>	Y	<u>Updated condition</u> Condition 1 – stormwater runoff to be captured	<p>The Licence Holder is proposing to use tailings material from the current TSF1 as the embankment material for the lifts. It has been reported that this material was PAF.</p> <p>Waste rock from the Cosmos WRD / underground is being proposed to be used as the waste rock cover on the outer embankments. Testing undertaken by EGI (2018) states that this material is classified as competent fresh rock and considered stable and largely non-acid forming (NAF) with low sulphur &lt;0.25%. Additionally, water extraction was undertaken to determine the potential for readily leachable metals and it is considered low.</p> <p>It was recommended in Graham Campbell and Associates 2022 memo that runoff-water from the outer-slopes of the TSF1-embankments should be managed as per stormwater for the plant site, and related infrastructure areas associated with mineralised mining streams.</p> <p><u>Licence Holder controls:</u></p> <p>The application states that local drainage pathways around the TSFs have been maintained. Where drainage pathways have</p>

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Risk Event					Risk rating <sup>1</sup> C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions <sup>2</sup> of licence	Justification for additional regulatory controls
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
								<p>been interrupted by various stages of mine infrastructure development, runoff has been directed into diversion channels that discharge into the natural drainage pathways south-east of the TSF1 and process plant.</p> <p>As part of their closure concept, the Licence Holder has proposed to manage water from the embankments to achieve minimal erosion by surface water management (embankments) shedding of runoff from embankments towards perimeter collection drains.</p> <p><u>DWER controls:</u></p> <p>Stormwater runoff from the embankments must be captured and retained onsite (Condition 1).</p>

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

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

## 3.3 Detailed risk assessment for TSF seepage

### 3.3.1 TSF seepage emissions

There are historical and current ongoing issues with seepage for TSF1 and groundwater mounding is expected to continue to occur beneath the TSFs during operations. However, the Cosmos pit acts as a groundwater sink and influences groundwater levels across the site. It is expected that seepage discharge from the TSFs will report to the pit in-perpetuity.

#### **Estimate seepage and groundwater flow direction:**

Golder's (2022) TSF design report estimated that the seepage rate at the base of the TSF during the returning operational phase is 7m<sup>3</sup>/day. The seepage rate is reflective of continuing seepage during the draindown period. It is expected from the Golder model that there is a 9.5-year lag time before water from the TSF lifts is manifested at the base of the TSF. It is expected that there will be an increase of seepage rates over the next 6.5 years fallow period with seepage rates increasing from 4.8m<sup>3</sup>/day to 5.5m<sup>3</sup>/day, caused by the deposition of tailings in the TSF lifts.

Additional groundwater modelling carried out by Groundwater Resource Management (2022) indicated that for raise 1 (495.0m RL) seepage rate will be ~207 m<sup>3</sup>/d (18% increase in seepage rates from the current estimated rate of 175 m<sup>3</sup>/d) and for raise 2 (496.5 m RL) seepage rates will be ~211 m<sup>3</sup>/d (21% increase in seepage rates from current seepage rate (175 m<sup>3</sup>/d).

The Groundwater Resources Management (2022) seepage rate is considered the upper bound rate as the model does not consider re-saturation of the tailings once deposition restarts. The Golder (2022) seepage estimate is considered the lower bound rate as that model does not consider potential preferential flow paths through the tailings. Actual seepage rates are expected to occur between these two figures.

The models also indicated that groundwater direction and flow is influenced by dewatering of the cosmos mine pit which has resulted in groundwater drawdown around the pit. The TSF and water storage ponds on the premises are situated near or within the groundwater drawdown zone and groundwater flows mainly in a south westerly direction towards the mine pit.

The model indicates there will be no change to the groundwater patterns in response to the two proposed embankment lifts. However, the models do indicate that groundwater mounding may be slightly higher as a result of tailings deposition at the higher embankment heights (from 474.5 mRL to 476.4 mRL).

#### **Tailings characterisation:**

The Cosmos Nickel Operation historically consisted of the Cosmos and Prospero underground mines. The project was placed on care and maintenance in 2012 due to the exhaustion of the Prospero ore body. Australian Nickel Investments Pty Ltd (the Licence Holder) purchased Cosmos in September 2015 and subsequent drilling discovered the Odysseus nickel ore body below the Cosmos open pit.

The majority of the ore was sourced from the Prospero ore body with a new ore referred to as AM5D.

Three tailings' samples (Prospero<sup>1</sup>, AM5D, and a blended sample comprising 52.3% AM5D and 47.7% Prospero tailings) were subject to a laboratory testing as part of Golder (2011).

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<sup>1</sup> Prosper refers to the Prospero ore body.

Laboratory testing as part of Golder (2017a) reported that two tailings' streams will be disposed of into the TSFs. Golder conducted a geochemical assessment of tailings as part of TSF1 annual review (Golder, 2014). A summary of these results are presented below in Figure 3:

Property		Samples from 2011			Samples from 2017	
		AM5D	Prospero	Blend	FF	OF
Soil particle density (SG)		2.78	3.08	2.82	2.67	2.83
Particle size distribution	% passing 75 µm (silt + clay size fractions)	92	87	80	57	87
	% passing 2 µm (clay size fraction)	14	7	6	8	12
	USCS*	CL-ML	CL-ML	CL-ML	CL	CL
Atterberg Limits	Liquid Limit (%)	22	22	20	20	22
	Plastic Limit (%)	17	18	15	13	15
	Plasticity Index (%)	5	4	5	8	7
	Linear Shrinkage (%)	2	2	1	3	3
Settled density range (t/m <sup>3</sup> )	Min.	0.95	1.09	1.06	-	0.86
	Max.	1.22	1.37	1.31	-	1.2
Max. air dry density (t/m <sup>3</sup> )		1.31	1.47	1.36	-	1.7

Notes: \* Unified Soil Classification System

### Figure 3 Summary of 2017 results compared to 2011 results

Tailings particle density of 2.8 average between the overflow and full flow tailings, slurry density of 55% solids by mass and a deposition rate varying during the life of mine.

#### Geochemical characteristics:

The geochemistry of the tailings has been considered by Graham Campbell (2022), on behalf of Western Areas.

- It was concluded that the new tailings placed into the facility would be non-acid forming (NAF). However, it is acknowledged that the previous tailings deposited were potentially acid forming (PAF).
- Tailings were found to be enriched in nickel, chromium, copper, arsenic, selenium and bismuth.
- “The solubility of minor-elements was generally tightly constrained, however soluble Ni forms could be appreciable with potential leachable-ni loadings ranging up to ‘of the order’ 1 kg of Ni per tonnes of tailings (dry solids)” (Graham Campbell 2022).

Process water characteristics were provided by Western Areas to Golder on 24 February 2022 and tailings recorded total dissolved solids (TDS) of 88,170 mg/L and a pH of 7.07.

#### Groundwater levels:

A review of the licence Annual Environmental Reports (AER) 2021 found:

- The groundwater monitoring bores close to and surrounding TSF1 (MB16, MB21, MB17, MB10, MB09 and MB02) have standing water levels between ~6-10 meters below ground level;
- There is one groundwater monitoring bore south of the TSF (MB22) and the groundwater monitoring data provided in the AER reported the standing water level at 14 mbgl;
- One groundwater action level exceedance occurred during the reporting period. An exceedance of the 6 metres below groundwater level (mbgl) action limit occurred



within monitoring bore MB27 on 31 December 2019. The water level was recorded at 5.92 mbgl. This bore however is located 1km north of TSF1 and is not associated with seepage impacts from the TSF;

- A series of recovery bores have been installed to manage groundwater mounding around Water Management Ponds 6-8 and the TSF1. Overall, groundwater levels are being maintained at levels lower than the 6mbgl target.
- Groundwater at Cosmos generally ranges from neutral to slightly alkaline and is generally hypersaline. During the reporting period, electrical conductivity values of the groundwater typically ranged between 953 $\mu$ S/cm to 136,000 $\mu$ S/cm, and pH values were between 6.74 and 8.15. No distinct long-term trends in salinity or pH have been noted. Low levels of arsenic, cadmium, nickel and zinc are generally present as dissolved metals within the water column.

### **Existing controls:**

Condition 10 on the existing licence requires that the licence holder must undertake ambient groundwater monitoring at 18 monitoring sites. There is a groundwater action criterion for standing water level of <6 mbgl. The licence holder is also required to monitor pH, electrical conductivity and metals and metalloids from mounding impacts and water quality impacts at these 18 groundwater monitoring locations, see Figure 4.

Condition 11 specifies that the licence holder must carry out an investigation if the standing water level of 6 mbgl is reached.

Condition 12 specifies that the licence holder must suspend all discharges if actions carried out under Condition 11 are found to be ineffective.

Condition 13 specifies a ground water mounding limit of 4 mbgl. And that the groundwater recovery network is used so that groundwater does not exceed this limit.

Condition 14 - 16 specifies that the licence holder undertake an annual assessment of the health and condition of native vegetation with the in mounding radius of influence of the water management ponds (WMPs) and within at least one comparable control (reference site).

### **Licence Holder proposed controls:**

The licence holder is proposing to manage seepage at the site with the use of existing internal drains, external recovery bores and arrays of piezometers to monitor changes in the phreatic surface within the TSF embankment and at the toe. To prevent lateral impacts from seepage and / or rising water levels, the following actions are proposed:

- The functionality of the piezometers should be checked annually, and malfunctioning piezometers replaced.
- The existing monitoring system is regularly checked for changes in the groundwater conditions.
- If a rising trend in the water levels is identified, the adequacy of the existing seepage recovery system should be reviewed and appropriately adjusted to conform with the requirements of the operating licence.

### **Decision:**

Consideration has been given to the Licence Holder's controls and the current licence conditions in the assessment of risk of seepage from the TSF. The risk rating for this event has been determined to be 'medium'. It is likely that seepage will increase as a result of the two proposed embankment lifts to TSF1, however as groundwater modelling has indicated that the direction of groundwater flow is towards the drawdown zone of the cosmos pit it is expected that low/mid-level onsite impacts will occur. The current licence conditions are adequate to manage this risk and no additional regulatory controls are required.

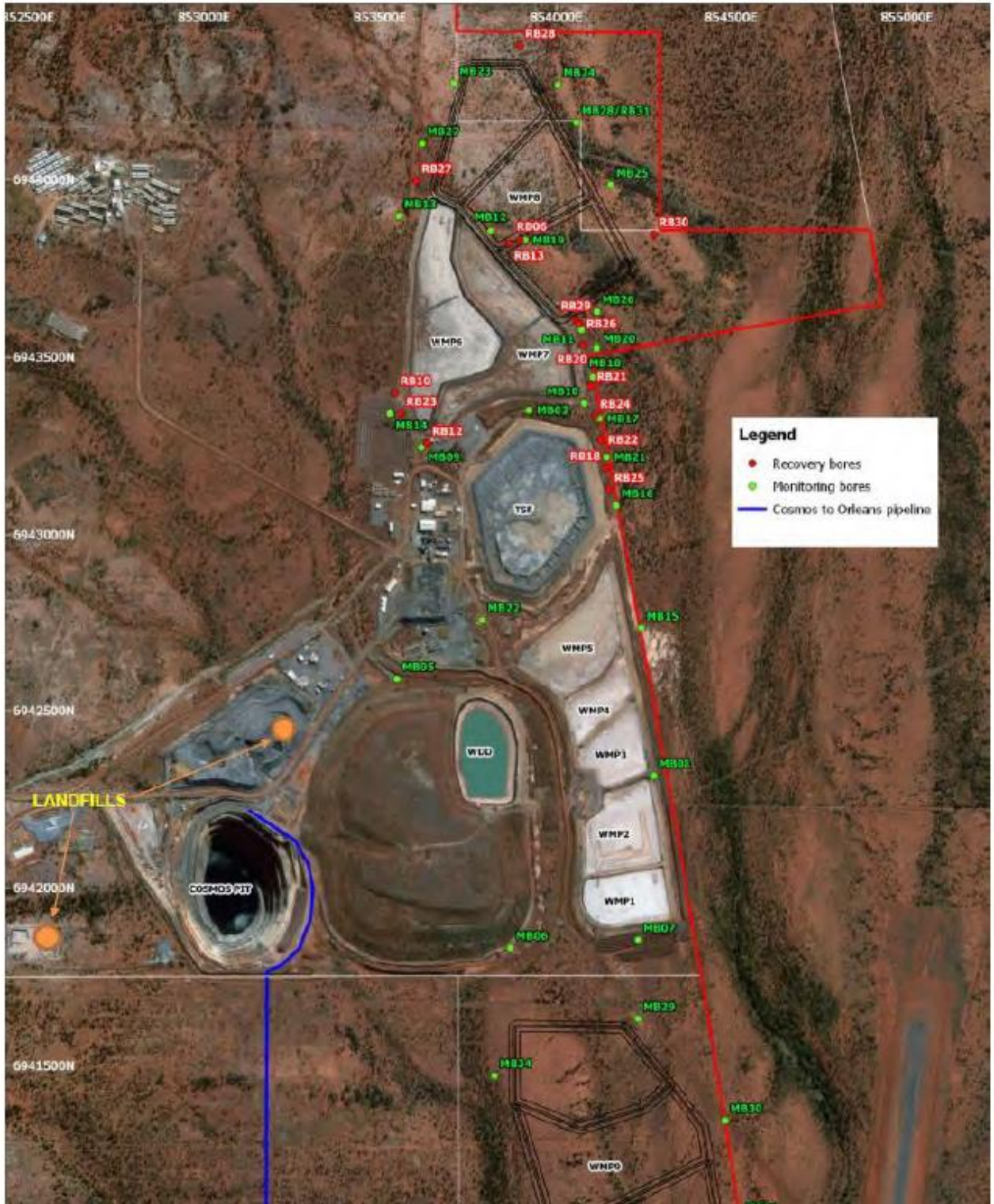


Figure 4: Location of monitoring bores and recovery bores

## 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	No comments received	N/A
<i>Local Government Authority advised of proposal 10 August 2022</i>	No comments received	N/A
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal 10 August 2022	<p>Comments provided on 7/9/2022</p> <ul style="list-style-type: none"> <li>A mining proposal has been received from Cosmos Nickel Operations for two upstream raises to maximum nominal height of 17.5m (RL 496.5m) at the Cosmos TSF1. The MP is under assessment, noting that the departments Geotechnical division has requested further information in support of the proposal (such as seepage and stability analysis results, dam break studies, third party audit report), which will be forwarded to the proponent this week.</li> <li>As the assessment is ongoing no further comment can be made in relation to significant changes or other findings.</li> </ul> <p>Comments provided on 13/12/2022</p> <ul style="list-style-type: none"> <li>The mining proposal is likely to be granted within the next few days.</li> </ul>	The Licence Holder provided a copy of the Mining Proposal – Odysseus Mine Development and surface construction – Cosmos and Kathleen Valley ID: 111609, issued on 23 December 2022.
Licence Holder was provided with draft amendment on 16/12/2022	<p>The Licence Holder provided the following comments on 24/12/2022:</p> <ol style="list-style-type: none"> <li>MB02 – Please see Attachment A an amendment #3 to licence L404 that was granted in 018. As detailed in this notice, MB02 was described as no longer serving the purpose of monitoring groundwater levels to protect vegetation to the north of the TSF. The amendment notice conditioned the replacement of MB02 with MB21, MB22, MB23 and MB24 to monitor / protect</li> </ol>	<ol style="list-style-type: none"> <li>Reference to MB02 has been removed and MB21, MB22, MB23 and MB24 are in place to monitor the impacts to vegetation.</li> <li>The SWL is noted.</li> </ol>

	<p>vegetation to the north of the TSF. All these replacement bores remain active part of the compliance monitoring schedule detailed in the current licence.</p> <p>2. The Current SWL of MB02 is 5.5 mbgl. As above and in accordance with Attachment A, this relatively shallow groundwater condition (between action and compliance limit) is not representative of the receiving environment Note: the compliance limit for SWL is &lt;4mbgl.</p>	
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## 5. Conclusion

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

### 5.1 Summary of amendments

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

**Table 6: Summary of licence amendments**

Condition no.	Proposed amendments
Existing Condition 1	Additional controls imposed for the TSF including freeboard and inspections. Additional controls included for the tailings and return water pipelines. Additional controls for stormwater management.
Existing conditions 4 - 26	Renumbered conditions 7 - 26
New condition 4	TSF construction requirements
New condition 5	TSF construction compliance and reporting
New condition 6	TSF construction compliance and reporting
Existing condition 10	Renumbered to 13 Ambient environmental monitoring updated
Existing condition 13	Renumbered to 16 Groundwater mounding limit condition updated

## 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. ANCOLD (2019) The Australian National Commission on Large Dams Guidelines on Tailings Dams; Planning Design, Construction, Operation and Closure.
5. DMP (2013) The Code of Practice for Tailings Storage Facilities, administered by DMIRS
6. DMP (2015) Guide to the preparation of a design report for tailings storage facilities, administered by DMIRS.
7. Golder (2011) Classification of AM5D tailings and Comparison with Prospero Tailings. Document reference no. 10745322-001-R-Rev0
8. Golder (2014) 2013 Cosmos Tailings Facility Annual Operation Review. Document Reference No. 137645065-001-R-Rev0
9. Golder (2017a) Design Studies and Analyses to Support Feasibility Study. Document Reference No. 1781571-007-R-Rev0.
10. Golder 2022, TSF Design Report, Golder Associates Pty Ltd
11. Graeme Campbell & Associates, Specialists in Materials Characterisation, Memo, 8 April 2022
12. Graeme Campbell & Associates, Specialists in Materials Characterisation, Memo, 12 April 2022: Cosmos Project, Geochemical Characterisation of Tailings Solids
13. Aquageo Pty Ltd FDEM Geophysical Study – Cosmos Nickel Mine – Western Australia. 19 February 2020.
14. GRM (2022) Groundwater Resource Management, Technical Memorandum, 11 November 2022



## Appendix 2: Application validation summary

SECTION 1: APPLICATION SUMMARY						
Application type						
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		13/06/2022				
Applicant and Premises details						
Applicant name/s (full legal name/s)		Australian Nickel Investments Pty Ltd				
Premises name		Cosmos Nickel Operations				
Premises location		M36/371				
Local Government Authority		Shire of Leonora				
Application documents						
HPCM file reference number:		DWERDT617313				
Key application documents (additional to application form):		<i>TSF Design Report</i> <i>GCA Tailings Characterisation Report – Existing Tailings</i> <i>GCA Tailings Characterisation Report – Odysseus Tailings</i>				
Scope of application/assessment						

Summary of proposed activities or changes to existing operations.	<i>Works approval</i> Construction of TSF embankment raises	
<b>Category number/s (activities that cause the premises to become prescribed premises)</b>		
<b>Table 1: Prescribed premises categories</b>		
Prescribed premises category and description	Proposed production or design capacity	Proposed changes to the production or design capacity (amendments only)
Category 5: <i>processing or beneficiation of metallic or non-metallic ore</i>	220,000 tpa	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? Mining tenement
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 checked="" type="checkbox"/> No <input type="checkbox"/>	Application reference No: Licence/permit No: RFI – Licence number not provided
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Name: N/A Type: Proclaimed Groundwater Area/Surface Water Area Has Regulatory Services (Water) been consulted? Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> Regional office:
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Name: N/A Priority: 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 type="checkbox"/>
Is the Premises subject to any other Acts or subsidiary regulations (e.g. <i>Dangerous Goods Safety Act 2004</i> , <i>Environmental Protection (Controlled Waste) Regulations 2004</i> , <i>State Agreement Act xxxx</i> )	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	N/A
Is the Premises subject to any EPP requirements?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	N/A
Is the Premises a known or suspected contaminated site under the <i>Contaminated Sites Act 2003</i> ?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Classification: possibly contaminated – investigation required (PC–IR) Date of classification: 20/07/2011