



Application for Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Works Approval Number W6345/2020/1

Applicant Western Areas Limited

ACN 091 049 357

File Number DER2019/000677

Premises Cosmic Boy Operation
Forrestania Nickel Operations
Forrestania - Southern Cross Road
FORRESTANIA WA 6359

Legal description -
Mining Lease M77/339

Date of Report 25 May 2020

Status of Report Final

Table of Contents

1. Definitions of terms and acronyms	4
2. Purpose and scope of assessment	6
2.1 Application details	6
3. Background	6
4. Overview of Premises	7
4.1 Operational aspects	7
4.2 Infrastructure	9
4.3 Exclusions to the Premises	10
4.3.1 Dangerous goods handling and storage	10
5. Legislative context	10
5.1 Contaminated sites	11
5.2 Part V of the EP Act	11
5.2.1 Applicable regulations, standards and guidelines	11
5.2.2 Works approval and licence history	11
5.2.3 Clearing	13
6. Consultation	14
7. Location and siting	14
7.1 Siting context	14
7.2 Residential and sensitive receptors	14
7.3 Specified ecosystems	14
7.4 Groundwater and water sources	15
7.5 Geology and Hydrogeology	16
7.5.1 Geology	16
7.5.2 Hydrogeology	16
8. Risk assessment	17
8.1 Determination of emission, pathway and receptor	17
8.2 Consequence and likelihood of risk events	20
8.3 Acceptability and treatment of Risk Event	21
9. Determination of Works Approval conditions	22
10. Applicant's comments	22
11. Conclusion	22
Appendix 1: Key documents	23
Appendix 2: Summary of Applicant's comments on risk assessment and draft conditions	24
Attachment 1: Issued Works Approval W6345/2020/1	26

Table 1: Definitions	4
Table 2: Documents and information submitted during the assessment process.....	6
Table 3: Prescribed Premises Categories in the Existing Licence	6
Table 4: Forrestania Nickel Operation existing infrastructure and proposed Category 7 infrastructure	9
Table 5: Relevant approvals and tenure.....	10
Table 6: Works approval and licence history	11
Table 7: Summary of Consultation	14
Table 8: Receptors and distance from activity boundary	14
Table 9: Environmental values	15
Table 10: Groundwater and water sources.....	15
Table 11. Identification of emissions, pathway and receptors during construction	17
Table 12: Identification of emissions, pathway and receptors during operation	18
Table 13: Risk rating matrix.....	20
Table 14: Risk criteria table.....	20
Table 15: Risk treatment table	21
Table 16: Summary of conditions to be applied.....	22

1. Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
AACR	Annual Audit Compliance Report
ACN	Australian Company Number
AER	Annual Environment Report
Applicant	Western Areas Limited
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CS Act	<i>Contaminated Sites Act 2003 (WA)</i>
Decision Report	refers to this document.
Delegated Officer	an officer under section 20 of the EP Act.
Department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the <i>Public Sector Management Act 1994</i> and is responsible for the administration of the <i>Environmental Protection Act 1986</i> along with other legislation.
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EP Regulations	<i>Environmental Protection Regulations 1987 (WA)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
Existing Licence	The Licence issued under Part V, Division 3 of the EP Act and in force prior to the commencement of, and during this Review

m ³	cubic metres
Minister	the Minister responsible for the EP Act and associated regulations
MREP	Mill Recovery Enhancement Project
mtpa	million tonnes per annum
NGER Act	<i>National Greenhouse Gas and Energy Reporting Act 2007</i>
Noise Regulations	<i>Environmental Protection (Noise) Regulations 1997 (WA)</i>
Occupier	has the same meaning given to that term under the EP Act.
PLS	Pregnant Liquor Solution
Prescribed Premises	has the same meaning given to that term under the EP Act.
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report
Risk Event	As described in <i>Guidance Statement: Risk Assessment</i>
µg/m ³	micrograms per cubic metre
µg/L	micrograms per litre

2. Purpose and scope of assessment

An application for a Works Approval was submitted by the Western Areas Limited (Applicant) on 17 December 2019 for a Prescribed Premises Category 7 Vat or in situ leaching of metal: premises on which metal is extracted from ore with a chemical solution, on Mining Lease M77/399 (the premises) in Forrestania Nickel Operations, Forrestania, WA 6359.

The Applicant proposes to add a Bacterial Heap Leach Facility (BioHeap™ Facility) with a maximum production capacity of 50,000 tonnes, to the existing Cosmic Boy Operations (CBO) at the company's Cosmic Boy Concentrator (CBC) site located within the Forrestania Nickel Operations (FNO), which will then treat the scats and rejects from the crushing and milling circuit of the concentrator process.

The premises operates a three stage crushing circuit as the first stage of exposing the sulphide mineral. A portion of the ore is resilient to the crushing process and therefore reject from the circuit as scats. Mill rejects and scats have been stockpiled within the apron of the TSF located at the Cosmic Boy concentrator site and currently there are 280,000 tonnes of scats. The volume of the scats produced, varies depending on the ore feed to the crushing circuit.

It is estimated that the ore present in the scats and rejects consists of an average nickel grade of approximately 1.5%. Therefore, it is proposed that these scats and rejects to be treated using the bioheap leaching process to generate a liquor stream rich in nickel, where this liquor will be then feed back to the existing bioleach plant to produce nickel concentrate.

Thus, this Decision Report assess the emissions and discharges associated with the bio heap leaching activities at the Forrestania Nickel Operation (Premises).

2.1 Application details

Table 2 lists the documents submitted during the assessment process.

Table 2: Documents and information submitted during the assessment process

Document/information description	Date received
Application for a Works Approval for Category 7 and supporting documents	17 December 2019

3. Background

Cosmic Boy Operations is a prescribed premises and is subject to an existing Licence L8041/1990/5. Table 3 lists the prescribed premises categories on the existing Licence.

Table 3: Prescribed Premises Categories in the Existing Licence

Classification of Premises	Description	Approved Premises production or design capacity or throughput
Category 5	Processing or beneficiation of metallic or non-metallic ore: premises on which — (a) metallic or non-metallic ore is crushed, ground, milled or otherwise processed; or	680,000 tonnes per annual period

	(b) tailings from metallic or non-metallic ore are reprocessed; or (c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam.	
Category 6	Mine dewatering: premises on which water is extracted and discharged into the environment to allow mining of ore	6,400,000 tonnes per annual period
Category 12	Screening, etc. of material: premises (other than premises within category 5 or 8) on which material extracted from the ground is screened, washed, crushed, ground, milled, sized or separated	150,000 tonnes per annual period
Category 54	Sewage facility: premises — (a) on which sewage is treated (excluding septic tanks); or (b) from which treated sewage is discharged onto land or into waters	110 cubic metres per day
Category 89	Putrescible landfill site: premises on which waste (as determined by reference to the waste type set out in the document entitled “Landfill Waste Classification and Waste Definitions 1996” published by the Chief Executive Officer, as amended from time to time) is accepted for burial	1,500 tonnes per annual period

4. Overview of Premises

4.1 Operational aspects

The Applicant proposed to construct and operate a BioHeap™ Facility within the existing Cosmic Boy operations to treat the scats rejected from the crushing and milling circuit in the concentrator process. The established infrastructure at the Cosmic Boy Operations includes: Cosmic Boy concentrator, ROM and TSF; Workshop; Cosmic Boy Bioleach Facility; Cosmic Boy village and related infrastructure; fuel storage; gravel pits; septic evaporation ponds; internal haul roads; core yard; dewatering infrastructure; Contractor’s lay down; and former TSF rehabilitation area.

Since 2010, the mill rejects have been stockpiled in the apron of the existing TSF located in the Cosmic Boy operations. The BioHeap Leach facility will be constructed to treat these scats and following processes or activities will be carried out.

Feed Preparation Pad

A front end loader will transport the scats at the stockpile to the feed preparation unit and then will be fed into the mill emergency feeder, which consists of feed bin, plate feeder and conveyor belt. The milled scats will then feed to a drum magnetic separator for removal of the ball mill fragments contained in the feed material. The rejected material will then be directed to the Cosmic Boy scrap metal stockpile for offsite recycling. Non-magnetics will direct to the heap leach stockpile conveyor. An Inoculum slurry (2% of solids) will then be added to the feed materials on the stockpile conveyor. Material will then be reclaimed from the stockpile by front-end loaders and will be transported to the Heap Leach pad.

Heap Leach Pad

Material from the heap leach stockpile will be stacked into layers by the front-end loaders. When the stack height increases, a ramp will be constructed using un-inoculated scat material to

facilitate the truck access to the heap. The heap leach pad is designed as a single use pad with a capacity of 20,000 tonnes. The pad is divided into three cells using two inter-cell bunds, thus can be operated under three different conditions for testing purpose. The drainage layer recovers leach solution, whereas an inverted partially slotted PVC pipe delivers air into the heap. The pad slopes approximately 1% and cell drainage pipes convey solution to an external pond which is known as Pregnant Liquor Solution Pond (PLS pond). Separate discharges will be directed to the PLS from the cells to facilitate sampling. PLS overflows to a storm water event pond, which is lined with compacted clay.

Heap Irrigation

Three cells in the Heap Leach pad consists with separate feed pumps and draw PLS from the PLS pond to reticulate to the heap. Emitter type drippers (2L/h) are placed across the cell in square grid pattern at 0.4m and the irrigation will be operated at a rate of 12L/m².h. Acid is dosed into in-line mixers on the pump discharge lines controlled by pH probe in the mixer discharge line. Pressure and flow are also monitored for each cell.

The initial PLS will be heated to achieve the designed temperature of 55^oc at the heap. Under this design, each cell would be brought on-line and heated separately. Heap temperatures are monitored by nine thermocouples embedded in each cell at 2, 4 and 6 m depths. A PLS Bleed pump transfers a portion of the PLS to the MREP (mill recovery enhancement project) facility for nickel recovery. Raw water is added to the PLS pond to make-up solution inventory and is used the hypersaline ground water from the FNO dewatering system, which are stored at the Mossco Farm evaporation ponds.

Heap Aeration

A low-pressure blower distributes air to each cell for aeration. Aeration pipes are spaced at 3 m intervals, supplied from a header. Each individual pipe can be isolated, flushed and drained if precipitate builds up.

Inoculum Tankage

Inoculum is added to the feed preparation stockpile conveyor. The MREP bacteria farm facility will be used to supply the heap leach facility. Inoculum slurry will be transferred from the MREP to the heap leach day tank at approximately 2 m³/h once per day. The day tank is agitated and insulated, but not heated or aerated.

Acid Storage

Acid for the heap leach facility is provided from a hired 60 m³ (purpose built) storage tank from the acid supplier. From this storage tank, three pumps dose acid to each cell irrigation in-line mixer. One of the pumps also supplied acid to the inoculum tank during the stacking phase. The tank will have bunded protection in place to prevent spills/leaks to the environment.

MREP Requirements

The PLS bleed to MREP is estimated to peak at 1.7 m³/h. This flow rate is considered manageable in the existing MREP circuit without modification. The bleed solution will be added to the polishing tank of the MREP for impurity precipitation prior to nickel sulphide precipitation. The PLS bleed pipeline will use existing (disturbed) infrastructure corridors.

Power Supply

Electrical power for the heap leach electric drives, instrumentation and controls will be by a dedicated local diesel generator sets. One 20 kVA unit will power the Feed Preparation Pad area for the short period of time required. The Heap Leach Pad area requires an 80 kVA generator set when heating is complete. The heating circuit requires a further 150 kVA. All fuel storage will have bunded protection in place to prevent spills/leaks to the environment.

4.2 Infrastructure

The Forrester Nickel Operation comprises various infrastructure, as it relates to Category 5, 6, 12, 54 and 89 activities. The current proposal is for a BioHeap Leaching facility and therefore does not include infrastructure related to that prescribed premises category.

Table 4 lists infrastructure associated with the current operation and the proposed Category 7 prescribed premises category.

Table 4: Forrester Nickel Operation existing infrastructure and proposed Category 7 infrastructure

	Infrastructure	Site Plan Reference
	Prescribed Activity Category 5,6,12,54 and 89	
Existing infrastructure		
1	Cosmic Boy Concentrator, ROM and TSF	
2	Workshop	
3	Cosmic Boy Bioleach Facility	
4	Cosmic Boy Village and related infrastructure	
5	Fuel Storage	
6	Gravel Pits	
7	Septic evaporation ponds	
8	Internal haul road	
9	Core yard	
10	Dewatering infrastructure	
11	Contractor's lay down	
12	Former TSF rehabilitation area	
	Prescribed Activity Category 7	
Proposed works to infrastructure		
1	Earth Works	Figure 1: Proposed BioHeap Leach plant footprint
2	Installation of scats preparation and stockpiling facilities	Figure 2: Proposed BioHeap Leach Plant Layout plan
3	Construction of scats heap leach cells	Figure 3: Proposed BioHeap Leach Plant sections and details
4	3 cell BioHeap Pad: <ul style="list-style-type: none"> Lined with 1.5mm HDPE overlain a compacted clay layer 300mm Leak detection sumps underlain the HDPE draining via 	

	Infrastructure	Site Plan Reference
	<ul style="list-style-type: none"> a PVC pipe Mega-flow drainage piping above the HDPE to collect leachate Pumping and irrigation system 	
	Surface Water Pond <ul style="list-style-type: none"> Lined with 1.5mm HDPE overlain a compacted clay layer 300mm 	
5	PLS Pond <ul style="list-style-type: none"> Lined with 1.5mm HDPE overlain a compacted clay layer 300mm Leak detection sump(s) underlain the HDPE draining via a PVC pipe 	
6	PLS pumping, acid dosing and heating facilities	

4.3 Exclusions to the Premises

4.3.1 Dangerous goods handling and storage

The bulk storage of fuel and or hydrocarbons are excluded from the scope of this assessment. Forrestania operation stores bulk fuel/hydrocarbons to generate electrical power for the heap leach electric drives, instrumentation and controls. Also the premises consist of a 60m³ acid storage tank, which will be used for acid irrigation to the heap leach facility.

However, if the aggregate volume of these material exceed 1000 m³, the Applicant is required to amend the licence to include the Category 73 activities which are;

Category 73: Bulk storage of chemicals, etc: premises on which acids, alkalis or chemicals that —

- (a) contain at least one carbon to carbon bond; and
- (b) are liquid at STP (standard temperature and pressure), are stored.

5. Legislative context

Table 5 summarises approvals relevant to the assessment.

Table 5: Relevant approvals and tenure

Legislation	Number	Subsidiary	Approval
<i>Part IV of the EP Act (WA)</i>	<i>L8041/1990/5</i>	<i>Western Areas Limited</i>	<i>The Applicant holds a prescribed premises licence (L8041/1990/5) to operate the Forrestania Nickel Operation and associated activities.</i>
<i>Mining Act 1978 (WA)</i>	<i>Reg ID: 83371</i>	<i>Western Areas Limited</i>	<i>Revision and variation to approved mining activities on tenement M77/399 as approved by DMIRS.</i>

Legislation	Number	Subsidiary	Approval
	Reg ID: 60856	Western Areas Limited	Mine Closure Plan for the Forresteria Nickel Operation as approved by DMIRS.

5.1 Contaminated sites

The project area and the surrounding area falls under a contaminated sites classified as “Possibly contaminated – Investigation required” (CSS Site ID – 3068).

5.2 Part V of the EP Act

5.2.1 Applicable regulations, standards and guidelines

The overarching legislative framework of this assessment is the EP Act and EP Regulations.

The guidance statements which inform this assessment are:

- *Guidance Statement: Regulatory Principles (July 2015)*
- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessments (February 2017)*
- *Guidance Statement: Environmental Siting (November 2016)*

5.2.2 Works approval and licence history

Table 6 summarises the works approval and licence history for the premises.

Table 6: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
W4019/1990/1	17/11/2004	Works Approval for construction of dewatering operational and monitoring infrastructure at Flying Fox, to enable commencement of mining and subsequent disposal of mine dewater into the abandoned Flying Fox underground mine (stage 1), and the abandoned McMahon and Lounge Lizard open mine pits (stages 2 & 3).
L8041/1990/1	17/10/2005	New licence issued to authorise commencement of dewatering operations (2,000,000 tpa) at Flying Fox.
W4244/1990/1	09/10/2006	Works Approval for expansion of dewatering operations at Flying Fox to allow mining of the T5 zone (2,900,000 tpa). This included constructing a 22 km transfer pipeline from Flying Fox to Cosmic Boy, re-establishment of the Seagull and Liquid Acrobat reinjection borefields, and development of a new reinjection borefield (Sibelius).
L8041/1990/2	16/10/2006	Licence reissued for the Flying Fox mine.
W4243/1990/1	09/11/2006	Works Approval for construction of the Cosmic Boy Concentrator (350,000 tpa capacity) and TSF.
L8041/1990/2	31/08/2007	Amendment to Flying Fox licence to authorise discharge of dewatering effluent to the 3 reinjection borefields and to formalise commitments regarding groundwater and native vegetation monitoring.

L8041/1990/3	11/10/2007	Licence reissued for the Flying Fox mine.
W4465/2008/1	19/12/2008	Works Approval for construction of the Mossco Farm evaporation ponds, including 32 km of dewatering pipeline from the Cosmic Boy site.
L8233/2008/1	01/01/2009	New licence issued for dewatering operations at Digger Rocks (Diggers Rock South – stage 1).
W4465/2008/1	19/02/2009	Amendment to works approval for construction of the Mossco Farm evaporation ponds, to include an additional tenement that was omitted from the original approval.
L8331/2009/1	26/02/2009	New licence issued for the Cosmic Boy Concentrator & TSF.
L8041/1990/3	27/08/2009	Amendment to Flying Fox licence following complete review of operations and issue in new format. Conditions added requiring groundwater monitoring, groundwater discharge criteria (limits and targets) and exceedance reporting, native vegetation monitoring and annual audit compliance reporting (AACR). Additional tenements added to the premises description.
W4558/2009/1	03/09/2009	Works Approval for stage 2 upgrade of the Cosmic Boy concentrator to 600,000 tpa capacity.
W4499/2008/1	28/09/2009	Works Approval for construction of the Spotted Quoll mine and associated dewatering infrastructure.
W4499/2008/1	19/10/2009	Amendment to Spotted Quoll works approval for a temporary mobile screening operation.
L8041/1990/3	05/11/2009	Amendment to Flying Fox licence to include category 12 for a temporary mobile screening operation.
L8041/1990/3	04/02/2010	Amendment to Flying Fox licence to authorise dewatering at the new Spotted Quoll mine.
W4604/2009/1	11/02/2010	Works Approval for the McMahon clearwater pond expansion, to separate dewatering effluent from Flying Fox and the new Spotted Quoll mine, the latter of which contains higher salinity.
L8041/1990/4	15/10/2010	Licence reissued for the Flying Fox mine.
L8331/2009/1	15/10/2010	Amendment to Cosmic Boy TSF licence to increase licensed capacity to 600,000 tpa.
W4771/2010/1	11/11/2010	Works Approval for construction of a paste fill plant at the Spotted Quoll mine.
L8041/1990/4	02/12/2010	Licence amendment to the Flying Fox licence following a compliance inspection in November 2010.
L8041/1990/4	03/11/2011	Licence amendment to the Flying Fox licence to add the Mossco Farm evaporation ponds as an authorised discharge point for mine dewater.
L8233/2008/2	01/01/2012	Licence renewed for the Digger Rocks dewatering operation.
L8331/2009/2	25/01/2012	Licence renewed for the Cosmic Boy Concentrator & TSF.
L8041/1990/5	04/10/2013	Licence renewed for the Flying Fox mine, including amalgamation of all other instruments issued to Western Areas Ltd for the Forrestania Nickel Operations, being the Cosmic Boy Concentrator and TSF (L8331), Diggers Rock South mine (L8233), Cosmic Boy sewage facility (R1996) and Flying Fox landfill (R2311).
W5665/2014/1	21/08/2014	Works Approval for construction of a septic tank sludge drying lagoons in an old gravel pit east of the Spotted Quoll site.

W5750/2014/1	15/01/2015	Works Approval for construction of a paste fill plant at the Flying Fox mine site.
W5767/2014/1	26/02/2015	Works Approval for construction of an additional septage evaporation pond for the workers accommodation village.
W5839/2015/1	20/08/2015	Works Approval for construction of a bioleach plant at the Cosmic Boy site, to improve nickel recovery from processing.
W5859/2015/1	08/10/2015	Works Approval for the Cosmic Boy TSF embankment raise and southern extension.
L8041/1990/5	14/04/2016	Licence amendment following full review. Category 12 added to authorise various on-site crushing and screening operations. Category 5 design capacity increased to 680,000 tpa. Expiry extended to 2027 to align with tenement expiry.
L8041/1990/5	14/12/2017	Amendment Notice 1 – update conditions relating to dewatering discharge to Mossco Farm evaporation pond and associated groundwater management.
L8041/1990/5	26/01/2019	Amendment Notice 2 – authorise discharge of mine dewater from Spotted Quoll underground operations, including construction of new dewatering pipeline.
L8041/1990/5	14/05/2019	Amendment Notice 3 – authorise operation of septic tank sludge drying lagoons constructed under W5665/2014/1.
W6273/2019/1	02/09/2019	Replacement works approval for the expired W5859.
W6372/2020/1	24/04/2020	Works approval for the southern extension cell
W6345/2020/1	25/05/2020	Works approval for Bioheap leaching facility for mill rejects (this approval)
W6345/2020/1	29/05/2020	Amendment to Works Approval to correct administrative errors.

5.2.3 Clearing

Most of the vegetation within or adjacent to the proposed project area is rehabilitated or regrowth from a former disturbance. Any vegetation clearing occurs during the project falls under EP Clearing Regulations under Schedule 1, Clause 2, subclause 2, and thus a clearing permit is not required.

6. Consultation

Table 7: Summary of Consultation

Method	Comments received	DWER response
Publicly advertised on DWER's Website from 16 February 2020 to 06 March 2020 Newspaper advertisement on 17 February 2020	No comments received	-
Stakeholder consultation – DMIRS Sent on 14 February 2020	9 April 2020	Supporting documents submitted as a part of the Works Approval are consistent with the mining proposal approved by DMIRS on 3 January 2020.
Stakeholder Consultation – LGA Sent on 14 February 2020	No comment received	-

7. Location and siting

7.1 Siting context

Forrestania Nickel Operation functions within the mining tenement M77/399 in a rural, unallocated crown land and is located approximately 450km east of Perth, 160 km south of Southern Cross, and 80 km east of Hyden, in the Shire of Kondinin. Any other significant operations are absent in the close proximity.

7.2 Residential and sensitive receptors

The distances to residential and sensitive receptors are detailed in Table 8.

Table 8: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Residential Premises	No sensitive premises or residential premises in close proximity Closest residential area is in the Wheatbelt region which is approximately 30km to the west

7.3 Specified ecosystems

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at or Emissions and Discharges from the Premises. The distances to specified ecosystems are shown in Table 9. Table 9 also identifies the distances to other relevant ecosystem values which do not fit the definition of a specified ecosystem.

The table has also been modified to align with the *Guidance Statement: Environmental Siting*.

Table 9: Environmental values

Specified ecosystems	Distance from the Premises
Threatened Ecological Communities and Priority Ecological Communities Ironcap Hills vegetation assemblages (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) (greenstone ranges) – Priority 3	Project area falls within the Priority ecological community
Biological component	Distance from the Premises
Threatened/Priority Flora	Few threatened/priority flora are located to the north of the project area within the Prescribed Premises Closest distance to the identified Threatened / Priority Flora is approximately 750m
Threatened/Priority Fauna Declared Threatened Fauna – Mammals	Few declared threatened mammals are located to the north of the project area within the Prescribed Premises Closest distance to the identified Threatened / Priority Fauna is approximately 1.3km

7.4 Groundwater and water sources

Forrestania Operation lies within the Salt Lake, or Salinaland, physiographic division, which includes most of the Wheatbelt region of Western Australia. This division is characterised by a string of salt lakes that act as surface water sinks; these are relic river systems.

The distances to groundwater and water sources are shown in Table 10.

Table 10: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
Surface Water Sources Lake Cronin	Permanent surface water bodies are absent in the close proximity. Lake Cronin reserve is located approximately 22km North-east to the proposed project location.	This lake is listed on the 'Directory of Important Wetlands in Australia' as the best example of a <i>Melaleuca</i> dominated wetland in this bio-region.
Groundwater Kondinin-Ravensthorpe Groundwater Area (RIWI Act Groundwater Area)	Project area located in the RIWI Act Groundwater area	Groundwater at estimated 20 – 60 mbgl Saline – hypersaline (40,000 mg/L TDS)

7.5 Geology and Hydrogeology

7.5.1 Geology

The geology of the Forrestania area largely consists of a greenstone belt running on an axis from Mt Holland in the north to Hatters Hill in the south and includes many types of ancient metamorphic rocks. The Forrestania greenstone belt (FGB) is constrained by granitoid rocks that developed during the late Archaean /Proterozoic and form the western and eastern boundaries to the FGB.

The CBO are located on a typical greenstone belt with north-south trending suites of metasediments (schists), mafic and ultramafic rocks. The upper weathering profile typically consists of 10 to 15 m of clay developed above weathered mafic and ultramafic lithologies. Weathering extends to about 65 mbgl. Banded iron formations (BIF) and siliceous caprock material (after ultramafic rocks) are common.

7.5.2 Hydrogeology

Depth to groundwater in the Forrestania region are between at approximately 20m – 60m below ground level. Variation driven by tidal variation. Groundwater in the region occurs in weathered and fractured bedrock aquifers. The salinity ranges from saline to hyper-saline and is approximately 40,000 mg/L Total Dissolved Solids (TDS).

As a result of operation of the TSF, water levels have shown rising trends in the majority of nearby monitoring bores (WAL, 2020). Consequently, groundwater levels in the proposal area are higher than the natural groundwater levels of the region. Four recovery bores (RB01 – RB04) were installed on the north-western corner of the TSF to ensure that groundwater levels were maintained below the licence (L8041/1990/5) requirement of 4 mbgl.

8. Risk assessment

8.1 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment.

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. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 12.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Tables 11 and 12 below.

Table 11. Identification of emissions, pathway and receptors during construction

Risk Events					Consequence rating	Likelihood rating	Risk	Reasoning
Sources/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts				
Category 7 Vat or in situ leaching of metal: premises on which metal is extracted from ore with a chemical solution	Earthworks / Ground disturbance Vehicle movements on unsealed access roads Installation and construction of associated infrastructure	Dust	Surrounding vegetation	Air / wind dispersion	Smothering of vegetation from dust emissions.	Slight	Unlikely	Low The DO considers that although bulk earthworks occur, it is unlikely that there will be deposition of dust on the nearby vegetation, given the short term (approximately 1 month) and the intermittent nature of the works related to installation/construction of scats heap leach cells, stockpiling areas, PLS pond and associated infrastructure. Dust suppression equipment are also in available to control the dust generated during the construction phase. Also, speed limits are imposed to across the roads thus dust generation will be minimised. Therefore, adverse impacts are not anticipated.
		Dust and Noise associated with the construction works	No residences or other sensitive receptors in proximity. Closest receptor is approximately 30km away		Impacts to amenity and health	N/A	N/A	N/A The delegated officer considers that a pathway does not exist for noise and dust generated during construction works to impact on off-site human receptors considering the separation distance (approximately 30km). As such, the DO does not anticipate a risk to warrant further assessment.

Table 12: Identification of emissions, pathway and receptors during operation

Risk Events					Consequence rating	Likelihood rating	Risk	Reasoning	
Sources/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts					
<p>Category 7 Vat or in situ leaching of metal: premises on which metal is extracted from ore with a chemical solution</p>	<p><i>Operation of BioHeap Leach System:</i> Transportation of the scats to the feed preparation pad using Front-end loaders Preparation of heap leach feed (separation of ball mill fragments) Preparation of heap leach Reticulation of PLS to the existing heap leach (MREP) Inoculum mixing Heap aeration Acid dosing</p>	Dust and Noise associated with the Heap Leach operation	No residences or other sensitive receptors in proximity. Closest receptor is approximately 30km away	Air / wind dispersion	Impacts to amenity and health	N/A	N/A	N/A	Based on the separation to off-site receptors (approximately 30 km), the delegated officer considers that a pathway does not exist for noise and dust generated during operation of the BioHeap Leach facility. Thus, a risk event is not anticipated.
		Overflow/ loss of containment of process liquid from heap leach pad, PLS pond	Soil and vegetation adjacent to the BioHeap Leach facility	Direct discharge	Soil contamination Vegetation death/harm from acidic liquor	Moderate (pads located to regrowth vegetation; small surface area compared to adjacent TSF)	Possible	Medium	Heap leach liquor (Pregnant Liquor Solution and barren liquors) are acidic pH 2.5 – 3. Proposed controls are HDPE liner, bunding (600 mm), approximately 1% slope to the PLS pond and design allowing for 300 mm minimum top of embankment freeboard. Inspections to check for freeboard during operations.
		Spill from PLS bleed pipeline				Moderate (pipeline near regrowth vegetation)	Possible		Medium
		Seepage through either the Heap Leach Pad or PLS pond liners	Vegetation	Inundation of the rootzone from groundwater mounding	Alteration of groundwater quality resulting in impacts to vegetation root zone	Moderate (mounding under the adjacent TSF is already elevated and contribution of acidic liquor to this mound may result in impacts to vegetation)	Possible (holes and tears are possible)	Medium	Both the pad and the PLS pond will store acidic liquor and are lined with a HDPE liner which is underlain with a leak detection system. Applicant control is dependent on the effectiveness of the leak detection system and frequency of inspections of the integrity of the liner system.
		Leaks and spills of dangerous and hazardous material	Soil and vegetation adjacent to the BioHeap Leach facility	Direct discharge	Soil contamination Impacts to the health of the vegetation	Major	Unlikely	Medium	The Applicant handles several types of dangerous and hazardous material onsite. Types of substances classified as dangerous goods include explosives, flammable liquids and gases, corrosives, chemically reactive or acutely (highly) toxic substances.

Risk Events					Consequence rating	Likelihood rating	Risk	Reasoning
Sources/Activities		Potential emissions	Potential receptors	Potential pathway				
			Groundwater (typically between 20-60 mbgl)	Infiltration	Groundwater contamination			<p>The following management measures will be implemented by the Applicant to manage any potential impacts to the environment as a result of dangerous goods and hazardous substances, where some of these measures are existing requirements on L8041 prescribe premises licence:</p> <ul style="list-style-type: none"> • WAL shall retain a register of all hazardous and dangerous goods on-site and ensure that personnel have access to their Material Safety Data Sheet (MSDS); • WAL shall ensure that environmentally hazardous materials are stored in accordance with the Code of Practice for the storage and handling of dangerous goods; and • Routine inspections will be undertaken to ensure bunding, refuelling and maintenance of equipment is undertaken on hardstand areas and ensure hazardous and dangerous spill procedures are in place.

8.2 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 13 below.

Table 13: Risk rating matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 14 below.

Table 14: Risk criteria table

Likelihood		Consequence		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		The following criteria has been used to determine the consequences of a Risk Event occurring:		
			Environment	Public health* and amenity (such as air and water quality, noise, and odour)
Almost Certain	The risk event is expected to occur in most circumstances	Severe	<ul style="list-style-type: none"> onsite impacts: catastrophic offsite impacts local scale: high level or above offsite impacts wider scale: mid-level or above Mid to long-term or permanent impact to an area of high conservation value or special significance[^] Specific Consequence Criteria (for environment) are significantly exceeded 	<ul style="list-style-type: none"> Loss of life Adverse health effects: high level or ongoing medical treatment Specific Consequence Criteria (for public health) are significantly exceeded Local scale impacts: permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	<ul style="list-style-type: none"> onsite impacts: high level offsite impacts local scale: mid-level offsite impacts wider scale: low level Short-term impact to an area of high conservation value or special significance[^] Specific Consequence Criteria (for environment) are exceeded 	<ul style="list-style-type: none"> Adverse health effects: mid-level or frequent medical treatment Specific Consequence Criteria (for public health) are exceeded Local scale impacts: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	<ul style="list-style-type: none"> onsite impacts: mid-level offsite impacts local scale: low level offsite impacts wider scale: minimal Specific Consequence Criteria (for environment) are at risk of not being met 	<ul style="list-style-type: none"> Adverse health effects: low level or occasional medical treatment Specific Consequence Criteria (for public health) are at risk of not being met Local scale impacts: mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	<ul style="list-style-type: none"> onsite impacts: low level offsite impacts local scale: minimal offsite impacts wider scale: not detectable Specific Consequence Criteria (for environment) likely to be met 	<ul style="list-style-type: none"> Specific Consequence Criteria (for public health) are likely to be met Local scale impacts: low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	<ul style="list-style-type: none"> onsite impact: minimal Specific Consequence Criteria (for environment) met 	<ul style="list-style-type: none"> Local scale: minimal to amenity Specific Consequence Criteria (for public health) met

[^] Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting*.

* In applying public health criteria, DWER may have regard to the Department of Health's *Health Risk Assessment (Scoping) Guidelines*.

"onsite" means within the Prescribed Premises boundary.

8.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment Table 15 below:

Table 15: Risk treatment table

Rating of Risk Event	Acceptability	Treatment
Extreme	Unacceptable.	Risk Event will not be tolerated. DWER may refuse application.
High	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
Medium	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
Low	Acceptable, generally not controlled.	Risk Event is acceptable and will generally not be subject to regulatory controls.

9. Determination of Works Approval conditions

The conditions in the issued Works Approval in Attachment 1 have been determined in accordance with the *Guidance Statement: Setting Conditions*.

The *Guidance Statement: Licence Duration* has been applied and the issued licence expires in 2 years from date of issue.

Table 16 provides a summary of the conditions to be applied to this works approval.

Table 16: Summary of conditions to be applied

Condition Ref	Grounds
Infrastructure and Equipment Condition 1 to 4	These conditions are valid, risk-based and contain appropriate controls.
Environmental Compliance Condition 5 and 6	Environmental compliance is a valid, risk-based condition to ensure appropriate linkage between the licence and the EP Act.
Transition Condition 7 to 15	These conditions are valid, risk-based and enable flexibility in operations.
Information 16 and 17	These conditions are valid and are necessary administration and reporting requirements to ensure compliance.

DWER notes that it may review the appropriateness and adequacy of controls at any time and that, following a review, DWER may initiate amendments to the works approval under the EP Act.

10. Applicant's comments

The Applicant was provided with the draft Decision Report and draft issued Works Approval on 18 May 2020. The Applicant provided comments on 19 May 2020, which are summarised, along with DWER's response, in Appendix 2.

11. Conclusion

This assessment of the risks of activities on the Premises has been undertaken with due consideration of a number of factors, including the documents and policies specified in this Decision Report (summarised in Appendix 1).

Based on this assessment, it has been determined that the Issued Licence will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

Louise Lavery
Senior Environmental Officer
REGULATORY SERVICES

Delegated Officer under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	New Works Approval Application and supporting documents- Licence L8041/1990/5 - Western Areas Ltd - Forrestania Nickel Operations - Cosmic Boy BioHeap Facility	WAL,2020	DWER records (A1852696)
2.	Licence L8041/990/5 – Western Areas Limited - Forrestania Nickel Operations	L8041	accessed at www.der.wa.gov.au
3.	DER, July 2015. <i>Guidance Statement: Regulatory principles.</i> Department of Environment Regulation, Perth.	DER 2015a	accessed at www.dwer.wa.gov.au
4.	DER, October 2015. <i>Guidance Statement: Setting conditions.</i> Department of Environment Regulation, Perth.	DER 2015b	
5.	DER, August 2016. <i>Guidance Statement: Licence duration.</i> Department of Environment Regulation, Perth.	DER 2016a	
6.	DER, November 2016. <i>Guidance Statement: Risk Assessments.</i> Department of Environment Regulation, Perth.	DER 2016b	
7.	DER, November 2016. <i>Guidance Statement: Decision Making.</i> Department of Environment Regulation, Perth.	DER 2016c	

Appendix 2: Summary of Applicant's comments on risk assessment and draft conditions

Condition / Document	Summary of Licence Holder comment	DWER response
Decision Report – Table 12	The Heap Leach Pad is designed to hold 20,000 tonnes of ore. The Heap Leach Pad will be bunded to a height of 600mm; and slopes approximately 1% to the HDPE lined PLS Pond; and the PLS Pond overflows into a compacted clay stormwater pond (designed to account for local seasonal rainfall) where a 'minimum top of embankment freeboard' of 300mm is maintained (as per similar requirements within Licence L8041/1990/5).	The information supplied by the applicant as per the request by DWER.
Condition 1 – Infrastructure and Equipment	The PLS will be HDPE lined (1.5mm thickness) and designed to achieve permeability of at least 1×10^{-9} .	The information supplied by the applicant as per the request by DWER.
Condition 1 – Infrastructure and Equipment	<p>As described in the Supporting Information Document (WSA, December 2019);</p> <ul style="list-style-type: none"> • All pipelines containing environmentally hazardous materials will be either: <ul style="list-style-type: none"> ○ Equipped with telemetry systems and pressure sensors along the pipelines to allow the detection of leaks and failures; ○ Include daily physical inspections of the infrastructure; and ○ Provided with secondary containment (where practical). <p>This in in line with Condition 1.2.1 of Licence</p>	Noted and amended as requested.

Condition / Document	Summary of Licence Holder comment	DWER response
	L8041/1990/5. Therefore, WSA requests that the bunding requirement is removed in favour of 'telemetry systems/leak detection' and 'daily physical inspections'.	

Attachment 1: Issued Works Approval W6345/2020/1
