Government of Western Australia
Department of Water and Environmental Regulation

Amendment Report

Application for amendment to a works approval

Division 3, Part V *Environmental Protection Act 1986*

Works approval number	W6088/2017/1
Works approval holder	Thunderbird Operations Pty Ltd
ACN	611 351 743
File number	DER2017/001386
Premises	Thunderbird Mineral Sands Project Great Northern Hwy WATERBANK WA 6725 Legal description – Mining Lease M04/459 & L04/85
Date of report	10 March 2020
Decision	Amendment granted

Amendment description

This amendment is made pursuant to section 59 of the *Environmental Protection Act 1986* (EP Act) to amend the works approval issued under the EP Act for a prescribed premises as set out below. Notice of amendment is hereby given under section 59B(9) of the EP Act.

The guidance statements which have informed the decision made on this amendment are listed in Appendix 1.

Purpose and scope of assessment

This amendment relates to a number of changes to the works approval regarding revisions to the original project design.

Background

The works approval holder proposes to construct and operate a large scale heavy mineral sands mine on the Dampier Peninsula, around 75 km southwest of Derby and 90 km northeast of Broome.

The project was formally assessed in 2017 by the Environmental Protection Authority (EPA) at the level of Public Environmental Review (EPA Report 1606) and approved by the Minister for Environment in August 2018 (Ministerial Statement 1080).

The proposed project includes mining of heavy mineral sands above and below the water table, dewatering within the Broome Sandstone aquifer, on-site mineral processing and transport of mineral products to the ports of Broome and Derby.

Works approval W6088/2017/1 was issued in August 2018 and provides authorisation for the commencement of mining, and construction and operation of the primary and secondary ore processing plants. An amendment by notice was subsequently issued in October 2019 and provides authorisation for construction and operation of an initial above ground tailings storage facility (TSF).

Proposed amendments

Due to a change in market conditions the works approval holder has determined to increase zircon production and modify the ilmenite circuit to produce only a primary ilmenite product. The proposed amendments relate to:

- detailed design of the wet concentrator plant (WCP) and mineral separation plant (MSP) involving modifying the ilmenite circuit to produce a primary ilmenite only, and removing the HiTi 88 leucoxene circuit; and
- increasing the mining and processing rates.

Further detail on changes that will result from the proposed modifications is provided below:

Mining operations

No changes are proposed to the mining method or overall mine design, however mining and processing is proposed at increased rates as detailed in the below table. The indicative mine schedule remains unchanged as per the original application, with mine schedules subject to regular revision during operations.

Characteristic	Description	Change from existing approval
Ore mining rate	Stage 1 (years 1 to 4) – 12.5 Mtpa Stage 2 (year 5 onwards) – 25 Mtpa	Increase from 7.5 Mtpa Increase from 15 Mtpa
Ore processing rate	Stage 1 (years 1 to 4) – 9 Mtpa Stage 2 (year 5 onwards) – 18 Mtpa	Increase from 7.5 Mtpa Increase from 15 Mtpa
Project duration	40+ years	No change

Water management

No changes are required to water management.

Proposed increased mining rates will likely result in pit dewatering and aquifer re-injection of surplus dewatering water being required around 2 years earlier than predicted, respectively – separate amendments to the licence will be sought closer to the time of requirement.

Monitoring during early operations will allow updated modelling to more accurately determine the timing of commencement of pit dewatering and aquifer re-injection, respectively.

Ore processing

Primary processing of mine ore in the WCP remains unchanged from the original approval, i.e. ore is taken in a slurry form and the heavy minerals are concentrated into a heavy mineral concentrate (HMC) using gravity separation techniques.

Secondary processing through the concentrate upgrade plant (CUP) and mineral separation plant (MSP) will change. The heavy mineral concentrate (HMC) will be further processed by a combination of gravity, magnetic and electrostatic separation methods in both wet and dry processes to separate the valuable minerals. However only four product streams will be produced instead of five: premium zircon, zircon concentrate, primary ilmenite and ilmenite concentrate. This will involve:

- removing the ilmenite processing circuit, such that only a primary ilmenite product will be produced. Low temperature roast ilmenite and titano-magnetite products will no longer be produced. Some primary ilmenite will also be blended with non-magnetic zircon tailings to produce an 'ilmenite concentrate' product;
- removing the HiTi 88 leucoxene circuit – HiTi 88 product will no longer be produced; and
- fitting the hot acid leach (HAL) with electrostatic separation equipment to provide an improved HAL magnetic-conductor stream to be blended with the CUP magnetic material which together will form a 'primary ilmenite' product.

These changes are illustrated in the below revised ore processing process flow sheet.

<u>Wet concentrator plant and concentrate upgrade plant</u>

The function of the proposed WCP and CUP remain unchanged, with the WCP producing a HMC for further processing in the CUP, and the CUP separating the magnetic minerals (mainly ilmenite) from the non-magnetic minerals (mainly zircon), and then further upgrading the non-magnetic fraction.

Management and disposal of waste streams of clay slimes, sand tailings and oversize material also remain unchanged. Revised process flow diagrams (PFDs) have been submitted that supersede the existing diagrams.

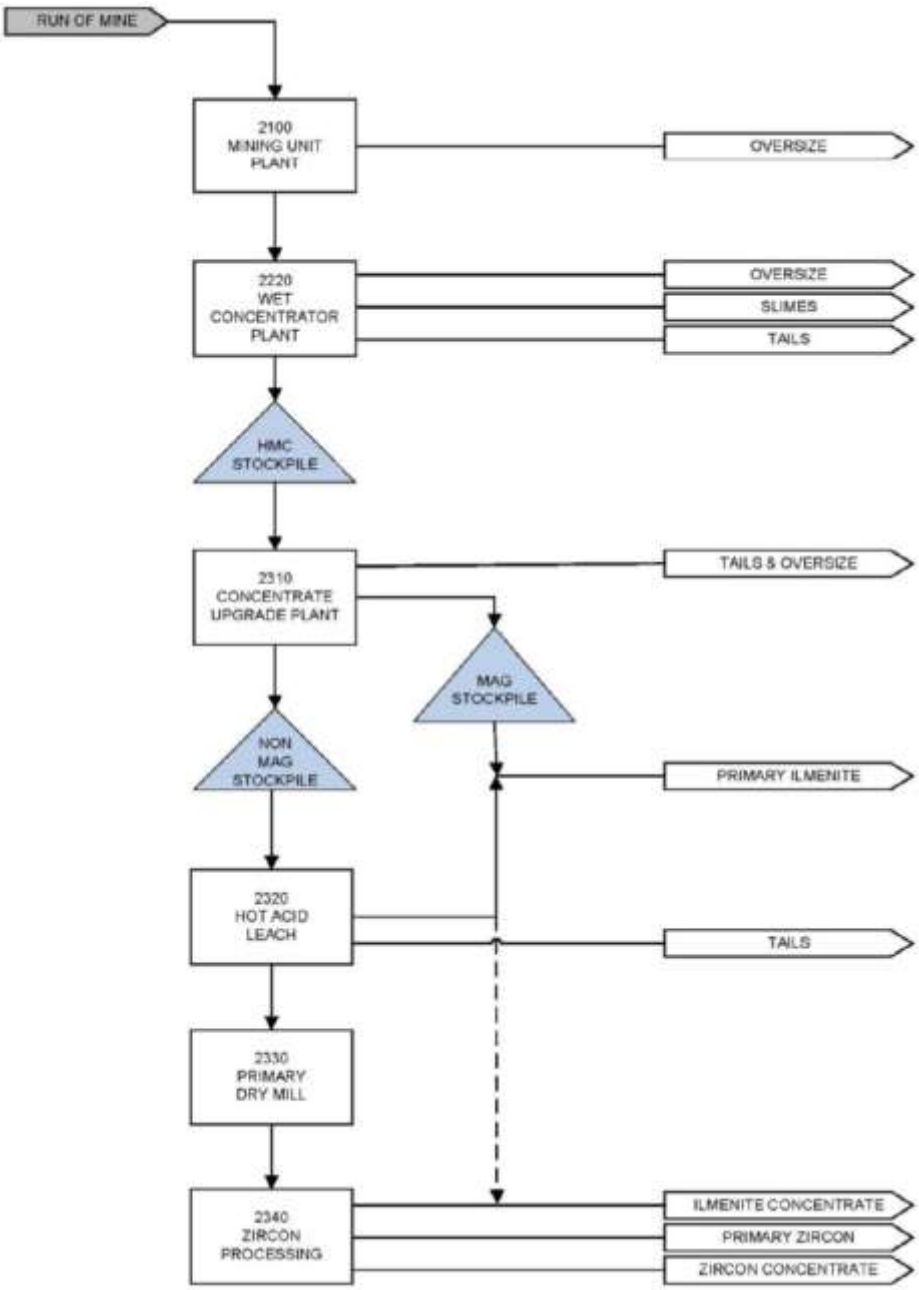
<u>Hot acid leach and gravity circuit</u>

The HAL circuit is designed to remove iron oxide coatings from the non-magnetics and to breakdown agglomerations and to remove ilmenite not captured in the CUP.

The proposed HAL is similar to that approved in the existing works approval, however with the addition of electrostatic separation equipment to provide an improved HAL magnetic-conductor stream. The non-magnetic concentrate stream will be passed to the primary dry mill for further processing. Revised PFDs have been submitted that supersede the existing diagrams.

<u>Primary dry mill</u>

The primary dry mill will process the non-magnetic concentrate from the CUP, to separate minerals with conductive properties (ilmenite, leucoxene and rutile) from non-conductive minerals (silica, zircon, monazite, alumino-silicates). The proposed primary dry mill has been modified by the removal of the HiTi 88 recovery circuit. It now produces a zircon concentrate which passes to the next stage of zircon processing.



▲ Revised ore processing process flow sheet

Wet and dry zircon processing plant

The wet and dry zircon processing plants, which will remove further impurities from the non-magnetic stream coming from the primary dry mill, remain unchanged. Revised PFDs have been submitted that supersede the existing diagrams.

A portion of the non-magnetic zircon tails will be blended with primary ilmenite to produce an ilmenite concentrate, which will reduce the amount of tailings requiring on-site disposal and slightly reduce the radioactive concentration of the blended tailings stream to be disposed within the TSF and mine pits.

Ilmenite processing

The magnetic output streams from the CUP and HAL will be combined and exported as a primary ilmenite product, therefore the originally proposed ilmenite processing circuit, which comprised an ilmenite dry plant, ilmenite low temperature roast and ilmenite magnetic separation, is no longer required and will not be constructed. The product and waste streams of these plants will not be produced.

Reagents handling

The reagents required for processing, and their storage and handling, remain unchanged. Revised PFDs have been submitted that supersede the existing diagrams.

Process water supply system

The proposed process water supply system remains unchanged. Revised PFDs have been submitted that supersede the existing diagrams.

Product load out

Primary ilmenite product will be stockpiled at the CUP mags process area (within WCP/CUP area) and HAL mags process area (within MSP area) for loading into road trains and bulk shipment from the port of Derby. A wet stream of CUP mags will be pumped to the MSP area and blended with the non-magnetic zircon tails to produce an ilmenite concentrate product, which will be stored within a covered shed within the MSP area, prior to loading into road trains and bulk shipment from the port of Derby.

Zircon product load outs remain unchanged, i.e. loaded into road trains for bulk shipment from the port of Derby. Premium zircon product will be sent to a final product storage bin for bagging into 2 tonne flexible intermediate bulk container (FIBC) bulk bags and shipment from the port of Broome. Revised PFDs have been submitted that supersede the existing diagrams.

Process wastes

The proportions of each residue stream produced from the WCP and MSP will change. The characteristics, disposal plan and proportions are detailed in the below table.

Residue stream	Description	Anticipated % of processed material
MUP oversize (>2 mm)	Stockpiled for use as roadbase/ construction or returned to mine void	11.6
WCP sand tailings	Waste non-heavy mineral sand returned to mine void or initial TSF	62.3
WCP clay slimes	Initial gravity separation clay fraction. Deposited within initial TSF	15.0
Combined CUP and MSP tailings	Minerals from magnetic separation processes. Deposited within initial TSF	3.4
MSP rejects	Zircon plant rejects. Deposited within initial TSF	
Gypsum	Acid neutralisation residue from HAL circuit. Deposited within initial TSF	0.1

Tailings disposal

Tailings will be initially deposited within an above ground TSF until sufficient void space is available within the mining area for in-pit co-disposal for the remainder of the project. The increase in processing rate means the completion of the initial TSF and the transition to in-pit disposal will be required around 15 months earlier than originally planned.

Key note:
The works approval does not currently authorise in-pit tailings disposal. A separate amendment will be sought closer to the time of requirement, and once the works approval holder has confirmed the method of in-pit disposal.

Commissioning stages and timeframes

The project will be constructed and commissioned in the same phases as per the existing works approval. A revised schedule is detailed in the below table, incorporating changes to project delays since the original works approval was issued.

Phase	Infrastructure	Proposed construction commencement	Construction period	Commissioning period
1	Construction water	Quarter 2, 2020	5 weeks	1 week
	Mine access roads	Quarter 3, 2020	12 to 16 weeks	2 weeks
2	Accommodation camp stage 3 (to 328 rooms)	Quarter 2, 2020	6 months	4 weeks
	Accommodation camp stage 4 (to 500 rooms)	Quarter 4, 2020	6 months	4 weeks
	Sewage treatment plant	Quarter 2, 2020 (stage 1)	2 months	6 months following completion of stage 2
		Quarter 3, 2020 (stage 2)	2 months	
	Landfill	Quarter 2, 2020	2 weeks	1 week
	Pre-production mining	Quarter 2, 2020	8 weeks	N/A
3	Initial above ground TSF	Quarter 3, 2020	100 weeks	16 weeks
4	Process plant (WCP/CUP 1 and MSP 1)	Quarter 3, 2020	110 weeks	16 weeks
5	Process plant (WCP/CUP 2 and MSP 2)	Quarter 1, 2024		

Emissions to air

Due to removal of the ilmenite processing circuit, there will be less emissions to air from secondary processing. The following originally proposed stacks are no longer required and will not be constructed:

- stacks 4 and 16 – ilmenite drying plant fluid bed dryer;
- stacks 8 and 20 – ilmenite drying plant shell and tube re-heater;
- stacks 11 and 23 – ilmenite drying plant general dust collector; and
- stacks 12 and 24 – low temperature roast fume venture separator.

The proposed increase in ore processing throughput will result in a proportional increase in emissions from all other stacks.

Other approvals

Legislation	Number	Approval
Part IV of the Environmental Protection Act (WA)	Ministerial Statement 1080	Ministerial approval for implementation of the proposal (to construct and operate the Thunderbird mine)
Mining Act 1978 (WA)	Reg ID 76994	Mining proposal and mine closure plan for construction and mining (Years 1 – 3) at the Thunderbird Mineral Sands Mine
Rights in Water and Irrigation Act 1914 (WA)	CAW 021251(1)	Approval to construct 15 production bores in the Canning-Kimberley Groundwater Area, Canning-Broome aquifer
	GWL 201977	Groundwater abstraction licence for 13 GL/yr
Environment Protection and Biodiversity Conservation Act 1999 (Cth)	Decision Notice EPBC 2016/7648	The proposed action (to construct and operate a heavy mineral sands mine) is a controlled action, and requires assessment and approval under the EPBC Act before it can proceed

Risk Assessment

Risk Event				Consequence rating	Likelihood rating	Risk	Reasoning	Regulatory controls (refer to conditions of the granted instrument)
Source/ Activities	**Potential emissions**	**Potential receptors, pathway and impact**	**Licence holder controls**					
AMENDMENTS								
Removal of the ilmenite processing circuit and HiTi 88 leucoxene circuit Fitting electrostatic separation to HAL circuit	Nil – proposal will reduce emissions	N/A	N/A	**N/A**	N/A	**N/A**	The works approval holder has determined to remove the ilmenite and HiTi88 circuits from the project as it is no longer economically viable to produce the specific products from these circuits. The removal of these circuits will result in: • less air emissions (particulates), due to removal of the low temperature roaster; • reduced tailings requiring on-site deposition; and • slightly reduce the radioactive concentration of the blended tailings stream to be disposed within the TSF and mine pits (radioactive component will now form part of the primary ilmenite product). The delegated officer considers the removal of these circuits will result in an overall decrease to the environmental risk of the project.	Removing equipment from table 1 no longer required Update to PFDs in works approval
Increase in mining and processing rates	No change to original assessed emissions	N/A	N/A	**N/A**	N/A	**N/A**	The removal of these circuits will allow a significant increase in the proposed mining and processing rates, which the delegated officer notes will result in some aspects of the project, such as the initial TSF reaching capacity and timing for the commencement of pit dewatering and aquifer re-injection of surplus mine water, to be required around 2 years earlier than originally planned. Separate approvals for these aspects of the project will need to be sought well in advance of being required.	Update works approval to reflect increased mining and processing rates

Decision

DWER has previously assessed the risk of establishing the Thunderbird Mineral Sands Project (refer to decision report for the original works approval, dated August 2018) and considers this application to be an addendum to that risk assessment.

The removal of the ilmenite and HiTi88 circuits is considered to reduce the overall risk profile of the project, as it will result in less emissions to air (due to the removal of the low temperature roaster), reduced tailings requiring on-site disposal, and the low level radioactive component of what would have been a tailings stream will now form part of a product stream. The removal of these circuits however, will allow a significant increase in the proposed mining and processing rates that will have implications for other aspects of the project, such as the initial TSF reaching capacity quicker than originally planned and the timing for the commencement of pit dewatering and aquifer re-injection being required around 2 years earlier than planned.

In accordance with DWER's *Guide to Licensing* (June 2019), additional conditions have been added to allow commissioning of the infrastructure and time-limited operations. The works for each phase are required to be constructed in accordance with the engineering designs and drawings submitted with the application. Evidence of the completed works will be required to be submitted to the CEO in a construction compliance report, prior to the commencement of commissioning works.

Environmental commissioning reports will be required to be submitted to the CEO following the completion of commissioning of each phase, which includes a summary of commissioning activities and the environmental performance of the as constructed infrastructure and equipment. Commissioning of phases 3, 4 and 5 will be each restricted to a 16-week period, followed by a time-limited operational phase.

Consolidation

As part of this amendment package DWER has consolidated the works approval by incorporating changes made in the previous amendment notice for 'stage 1B'. No additional assessment has been conducted as part of this consolidation. The decision relating to the consolidated works approval is published in amendment notice 1, and in accordance with section 59(1) of the EP Act, incorporating these changes into a single amended works approval is not appealable.

In consolidating the works approval, the CEO has:

- updated the format and appearance of the works approval;
- revised condition numbers, and removed any redundant conditions and realigned condition numbers for numerical consistency; and
- corrected clerical mistakes and unintentional errors.

The decision report for the original works approval and amendment notice 1 will remain on the DWER website for future reference and will act as a record of DWER's decision making.

Consultation

The works approval holder was provided with drafts of the amended works approval and this amendment report on 28 February 2020 and provided minor clarifications only.

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 an amendment will be granted, subject

to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

Tim Gentle

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Date: 2020.03.10 16:27:17 +08'00'

Tim Gentle
MANAGER, RESOURCE INDUSTRIES
REGULATORY SERVICES

An officer delegated by the CEO under section 20 of the EP Act

Appendix 1: Key documents

Document title	In text ref	Availability
MBS, January 2020. Thunderbird Mineral Sands Project – Works Approval W6088/2017/1 – Amendment Application. Prepared for Thunderbird Operations by MBS Environmental	Application	DWER records (A1872550)
DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	DER, 2015a	accessed at www.der.wa.gov.au
DER, October 2015. *Guidance Statement: Setting Conditions.* Department of Environment Regulation, Perth.	DER, 2015b	
DER, February 2017. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	DER, 2017a	
DER, February 2017. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.	DER, 2017b	
DWER, June 2019. *Industry Regulation Guide to Licensing*. Department of Water and Environmental Regulation, Perth.	DWER, 2019	

Attachment 1: Amended works approval W6088/2017/1