Government of Western Australia
Department of Water and Environmental Regulation

Amendment Notice 4

Works Approval Number	W6132/2018/1
Licence Holder	Wodgina Lithium Pty Ltd
ACN	611 488 932
File Number:	DER2017/001949-1~7
Premises	Wodgina Operations Mining tenements M45/50, M45/381, M45/382, M45/923, M45/925 and M45/1252
Date of Amendment	12 July 2019

Amendment

The Chief Executive Officer (CEO) of the Department of Water and Environmental Regulation (DWER) has amended the above Works Approval in accordance with section 59 of the *Environmental Protection Act 1986* (EP Act) as set out in this Amendment Notice. This Amendment Notice constitutes written notice of the amendment in accordance with section 59B(9) of the EP Act.

Alana Kidd

Digitally signed by Alana Kidd
Date: 2019.07.12 09:31:56 +08'00'

Alana Kidd

Manager – Resource Industries

Regulatory Services

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

Definitions and interpretation

Definitions

In this Amendment Notice, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
AHD	Australian High Datum
Amendment Notice	refers to this document
ANZECC/ARMCANZ Guidelines	Australian and New Zealand Guidelines for Fresh and Marine Water Quality http://www.waterquality.gov.au/anz-guidelines
Category/ Categories/ Cat.	categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CEO	means Chief Executive Officer. CEO for the purposes of notification means: Director General Department Administering the *Environmental Protection Act 1986* Locked Bag 10, Joondalup DC WA 6919 info@dwer.wa.gov.au
Delegated Officer	an officer under section 20 of the EP Act
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986* (WA)
m^3	cubic metres
m^3/d	cubic metres per day
mtpa	million tonnes per annum
Prescribed Premises	has the same meaning given to that term under the EP Act.
Risk Event	as described in *Guidance Statement: Risk Assessment*
Works Approval Holder	Wodgina Lithium Pty Ltd

Amendment Notice

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. This notice of amendment is given under section 59B(9) of the EP Act.

This notice is limited only to an amendment for Category 5. No changes to the aspects of the original Works Approval relating to Categories 52, 54 and 89 have been requested by the Works Approval Holder.

The following guidance statements have informed the decision made on this amendment:

- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessment (February 2017)*

Amendment description

Wodgina Lithium Pty Ltd (WLPL) is currently approved to commission Beneficiation Plant Train 1 with ore and TSF 3 Extension (TSF3E) with total tailings to mid July 2019.

Compliance documentation for Beneficiation Plant Train 2 and groundwater monitoring results for TSF3 extension were submitted to DWER on 24 May 2019.

On the 7June 2019, WLPL submitted a works approval amendment application to extend the commissioning period for Beneficiation Plant Train 1 and TSF3E beyond 90 days. WLPL also requested approval to commission Beneficiation Plant Train 2 with ore.

DWER and WLPL met twice to discuss site water balance and seepage from TSF3E. On 10 June 2019, DWER expressed concern on how fast groundwater level was rising under TSF3E since commissioning had commenced. DWER also enquired about WLPL's capacity to use process water back into the process and the poor housekeeping around Train 1 and Spodumene concentrate shed. WLPL acknowledged that the tailings solid content produced by Train 1 is less than 60% solids and that WLPL requires more time to adjust the process to achieve design criteria.

On 25 June 2019, WLPL presented to DWER a simplistic concept for the water balance on site. In the approach, seepage was not taken into account. Current plant data shows that raw water usage is 12% above the consumption design. Consequently, less process water is being recovered from TSF3E than originally planned. WLPL is working on reducing the use of raw water and increasing consumption of process water in the process.

Additional information was provided to DWER on 28 June 2019, in relation to groundwater monitoring results, water balance for TSF3E and TSF inspection sheet logs.

Amendment history

Table 2 provides the amendment history for W6132/2018/1.

Table 2: Works approval amendments

Instrument	Issued	Amendment
W6132/2018/1	*19/09/2018*	*Amendment Notice 1 - amendment to extend the submission date for Specified Conditions 7 and 9*
W6132/2018/1	*13/02/2019*	*Amendment Notice 2 - amendment to extend the submission date for Specified Condition 9, include commissioning definition*

W6132/2018/1	*08/04/2019*	*Amendment Notice 3 - amendment to allow the TSF 3 Expansion with total tailings for 90 days and commissioning with ore of the Beneficiation Plant Train 1*
W6132/2018/1	***12/07/2019***	*Amendment Notice 4 - amendment to allow additional 90 days commissioning for TSF 3 Expansion (TSF3E) with total tailings and Beneficiation Plant Train 1 with ore.*

Location and receptors

Table 3 below lists the relevant environmental receptors in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 3: Environmental receptors and distance from activity boundary

Environmental receptors	Distance from Prescribed Premises
Two water courses, non-perennial	1.5km (Figure 1)
Wodgina Rock Holes	1.8km (Figure 1)
Groundwater	Depth to groundwater level is between 10 and 26 metres (WLPL groundwater monitoring data, June 2019).

Risk assessment

Table 4 below describes the Risk Events associated with the amendment consistent with the *Guidance Statement: Risk Assessments*. Both tables identify whether the emissions present a material risk to public health or the environment, requiring regulatory controls.

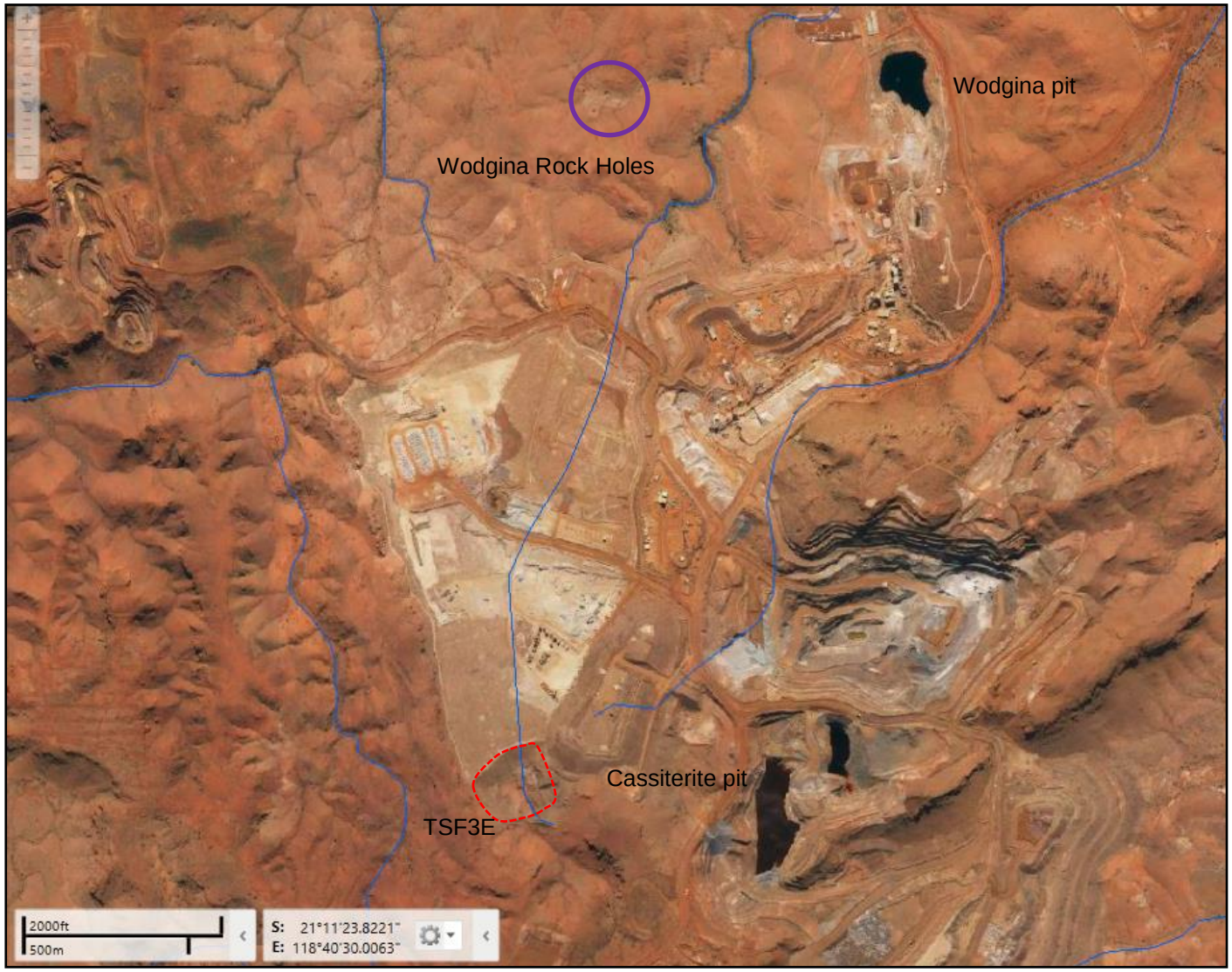

Figure 1: Wodgina Lithium Mine – Environmental receptors. The red dotted line depicts TSF3E, the blue lines represent surface water lines.

Table 4: Risk assessment for proposed amendments

Risk Event						Consequence rating	Likelihood rating	Risk	Reasoning
Source/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**				
	Extend TSF3E commissioning period for Train 1 tailings only	Tailings seepage	Underlying groundwater	Infiltration through underlying soils to groundwater.	Contamination of groundwater capable of beneficial use	*Moderate but possibly Major*	*Possible*	*Medium/ High*	*Further data is needed to better quantify the risk.* *Refer to discussion*
			Ephemeral surface water systems and pools	Hydraulic interactions between groundwater and surface water systems.	Impacts to surface water quality and aquatic fauna. Possible Impacts offsite and to heritage sites	*Moderate*	*Possible*	*Medium*	
Category 5	TSF3E commissioning period for 90 days with Train 1 AND Train 2 tailings	Tailings seepage	Underlying groundwater	Infiltration through underlying soils to groundwater *noting issues with adequate decant removal*	Contamination of groundwater capable of beneficial use	*Moderate but possibly Major*	*Possible*	*Medium/ High*	*Further data is needed to better quantify the cumulative risk.* *Additional groundwater results are required to better understand the level of seepage and water quality.* *Refer to discussion*
			Ephemeral surface water systems and pools	Hydraulic interactions between groundwater and surface water systems.	Impacts to surface water quality and aquatic fauna	*Moderate*	*Possible*	*Medium*	
	Extend Beneficiation Plant Train 1 commissioning	Off-specification tailings Storage of off	Underlying groundwater	Infiltration through underlying soils to	Increase water content in tailings leading to more seepage	*Moderate*	*Possible*	*Medium*	

	period	specification material onsite. Process water not reused in the process		groundwater underneath TSF3E	from TSF3E				
	Beneficiation Plant Train 2 commissioning	Off-specification tailings Additional off specification material stored onsite Additional Process water not reused in the process	Underlying groundwater	Infiltration through underlying soils to groundwater underneath TSF3E	**Additional** increase of water content in tailings leading to further seepage from TSF3E	*Moderate but possibly Major*	*Likely*	*High*	

Discussion

Conditions 14 to 18 of Works Approval W6132/201/1 required WLPL to provide information in relation to groundwater level around TSF3E, water balance, TSF3 daily logs and groundwater quality during commissioning.

Ground Water Level

DWER assessed the information provided by WLPL and has identified that the groundwater level around TSF3E is rising rapidly. Figure 2 shows the locations of the monitoring bores sampled during commissioning.

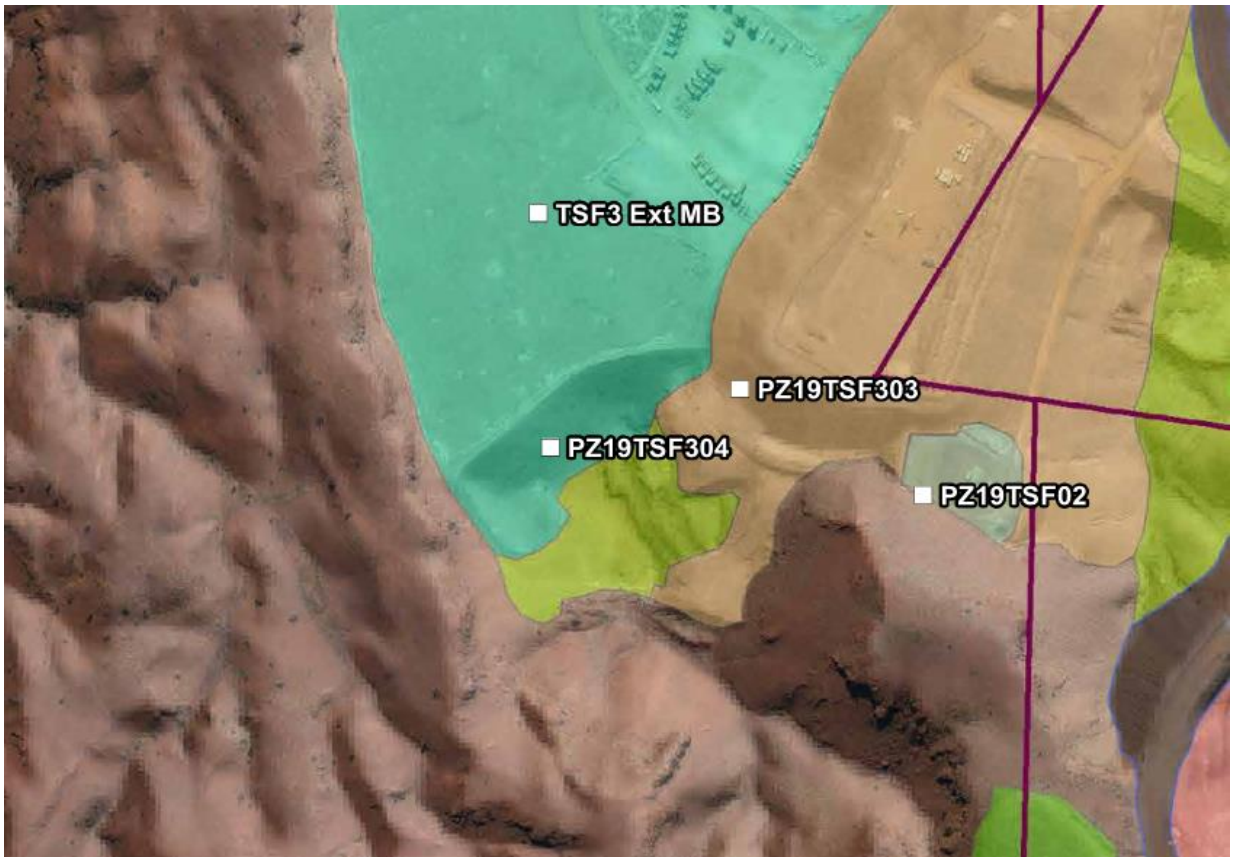

Figure 2: TSF3E monitoring bore and piezometers locations.

Three piezometers are installed around TSF3E (Figure 2). The piezometers were installed to monitor water levels within the embankment, foundations and the adjacent waste, to allow assessment of seepage. Piezometer PZ19TSF304 was installed on the embankment between TSF3 and TSF3E, with end of casing installed near natural surface (Figure 3). The top of TSF3E embankment (and end of PZ19TSF304 casing) is 275m AHD. The base of TSF3E embankment is at 240m AHD.

Figures 4 and 5 show groundwater rising in TSF3E monitoring bore and piezometer PZ19TSF304, respectively based on the data provided by WLPL. Monitoring bore TSF3E MB was installed on 21 January 2019. At that time, groundwater level was found at 30 metres below ground level (mbgl). Rainfall recorded at Pilgangoora station during Cyclone Veronica, between 18 and 21 March 2019, was 500mm. Tailings deposition started on 11 April 2019. From 10 April to 18 June, groundwater has risen 5 metres.

A similar pattern has been observed at PZ19TSF304 located at the TSF3E embankment. During the same period, groundwater level has risen 6.9 metres. Based on the monitoring data,

groundwater level was one metre below the base of the embankment wall on the 18 June 2019.

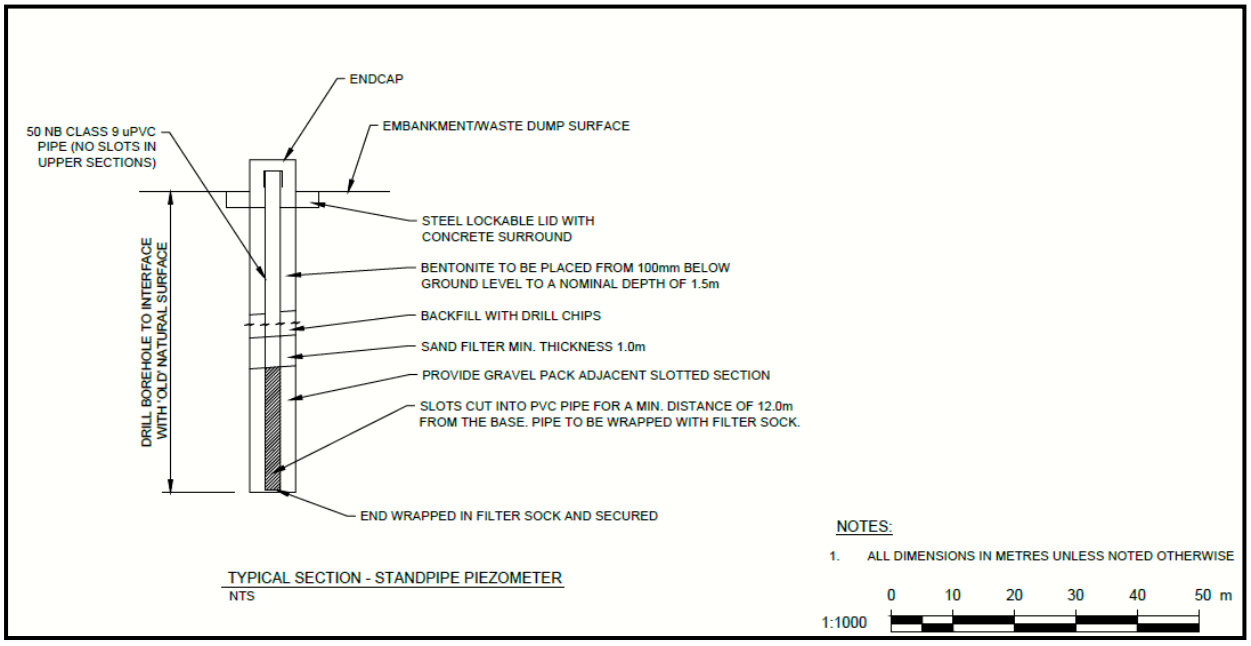

Figure 3: As built drawing for piezometers at Wodgina TSF3E (CMW, 2019).

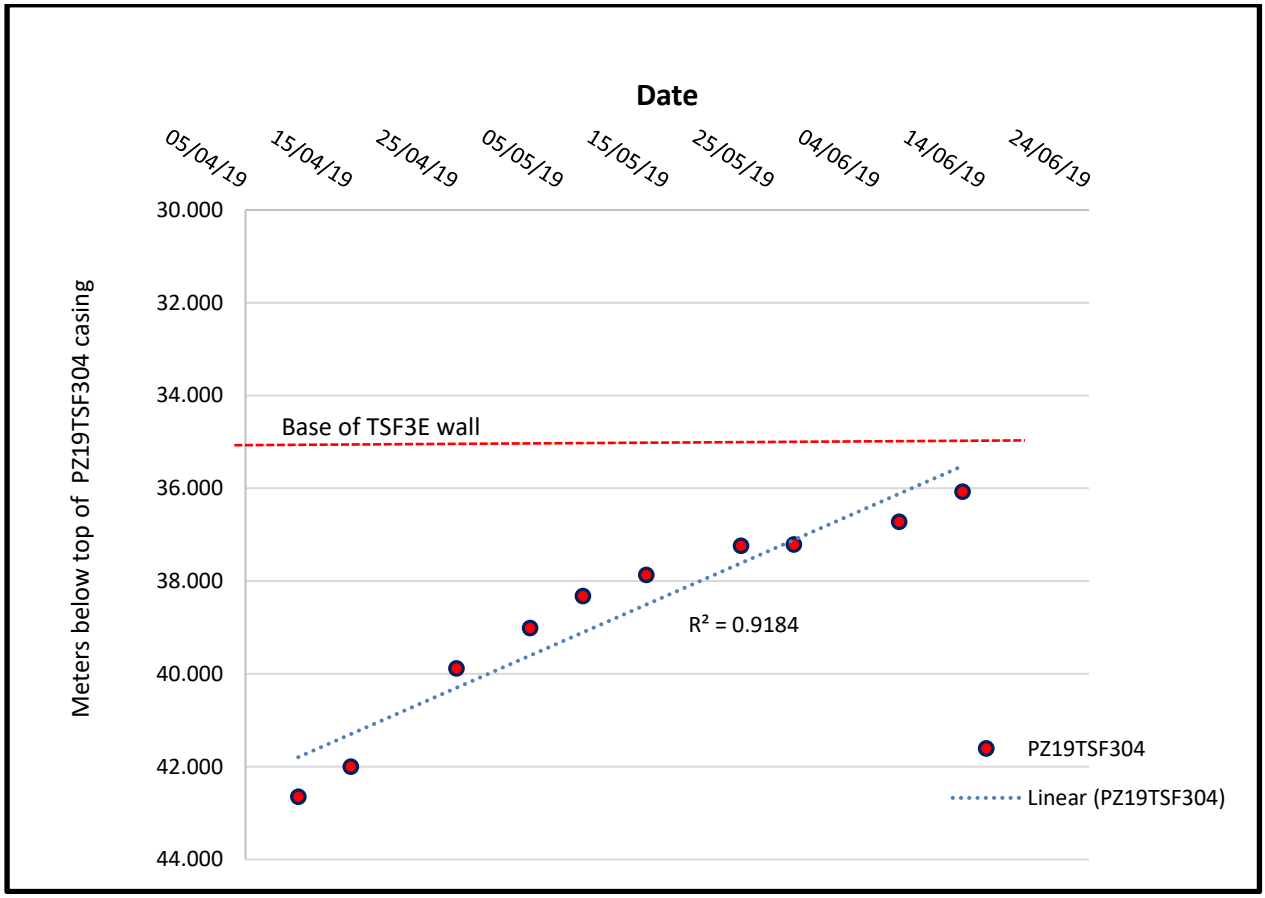

Figure 4: Groundwater behaviour at piezometer PZ19TSF304 between 10 March 2019 and 18 June 2019.

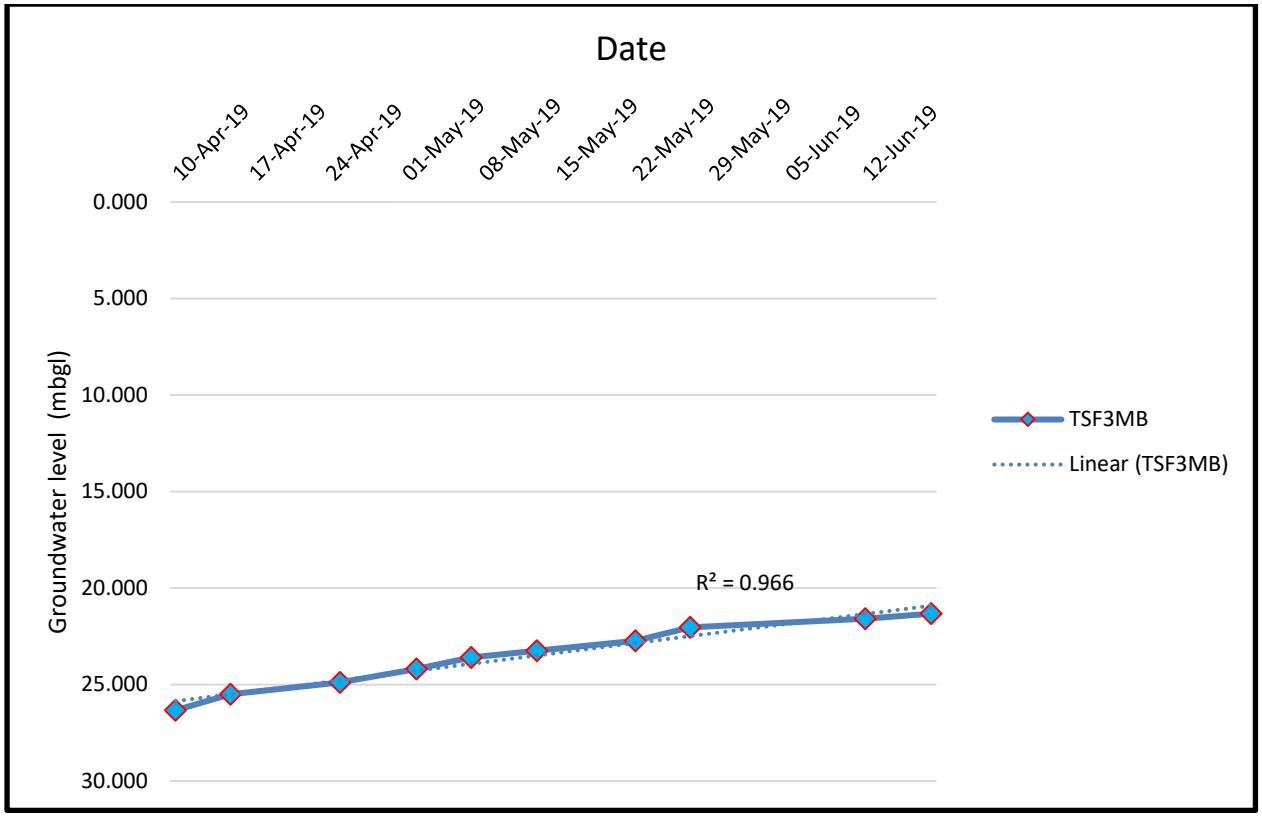

Figure 5: Groundwater behaviour at TSF3E monitoring bore between 10 March 2019 and 18 June 2019.

Water Balance

WLPL prepared a presentation for DWER to explain the water inventory in TSF3E. Design raw water use per train, is 1,927 metres cube per day (m^3/d). During commissioning of Train 1, raw water consumption increased to 2,194m^3/d. The increase is related to the use of raw water in dust scrubbers. In addition, the Cyclone Veronica event introduced 39,117m^3 of rainwater into TSF3E prior to tailings deposition. The analysis did not include water loss by seepage (Figure 6).

WLPL is looking to replace some raw water streams to process water by:

- Reducing raw water users;
- Change raw water make up in dam to process water;
- Change some/all cloth wash water to process water;
- Separating coarse fraction from tailings as dry tails; and
- Replacing raw water sources with recycled TSF3E decant water.

The proposed changes are hoped to result in a neutral TSF3E decant water balance.

WLPL will assess the potential to use decant water as a substitute for raw water into the plant through filtration or other related process. Decant water analysis results provided to DWER on 8 July were limited in the number of analytes and lithium was not tested. The level of lithium, in particular, in the decant water and seepage is therefore unknown at this stage.

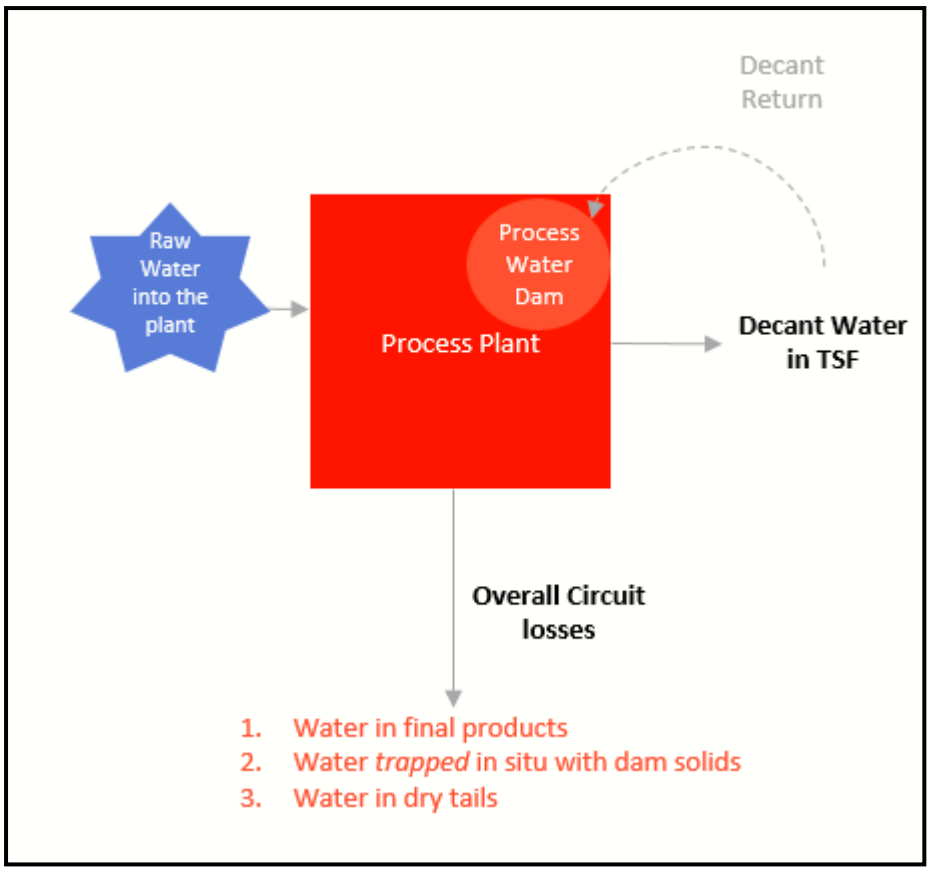

Figure 6: Simplified water balance for Wodgina Lithium Mine

Additional information was sent to DWER on 28 June 2019 detailing the amount of tailings deposited and decant water recovered for TSF3E and daily inspection log reports forTSF3E.

A detailed water balance for TSF3E is shown in Table 5.

Data shows that TSF3E decant water recovery started on 6 May 2019. By the end of June, 299,211m^3 of tailings were deposited into TSF3E. WLPL estimated that the volume of tailings within TSF3E by the end of June was 60,000m^3 (WLPL, 28 June 2019).

The estimated amount of seepage from TSF3E during commissioning of Beneficiation Plant Train 1 was calculated as follows:

Tailings deposited – Evaporation – Decant Water Recovery – Estimated volume retained in TSF3E (aerial survey)

This equates to approximately 192,531m^3 of seepage from TSF3E, with a cumulative effect of tailings deposition.

Table 6 shows the average solid content in the tailings during commissioning. WLPL explained that the average tailings solids being below the design average of 60% solids, is a factor of the commissioning process.

Table 5: Wodgina TSF3E water balance between March and June 2019.

Month	Tailings deposited (m^3)	Volume water in tailings (m^3)	Volume solids in tailings (m^3)	Decant water recovered (m^3)	Evaporation (m^3)	Retained in TSF cumulative (m^3) ***seepage not considered***	TSF3E aerial survey[#] (estimated m^3)	Volume lost by seepage (m^3) ***calculated***
Mar-19		39,117				39,117		
Apr-19	45,416	40,394	5,022		1,350	83,183		
May-19	129,211	104,461	24,750	42,344	1,688	168,362	**60,000**	108,362
Jun-19	124,584	102,314	22,270	38,745	1,688	252,513	**60,000**	84,151
Total	***299,211***		***52,042***	***81,089***	***4,726***			***192,513***

*Cyclone Veronica
[#] WLPL data

Table 6: Beneficiation Plant Train 1 – tailings composition during commissioning.

Month	Solids in tailings (tonnes)	Water in tailings (tonnes)	% Solids Tailings
Apr-19	12,557	40,394	23.7
May-19	61,874	104,461	37.2
Jun-19	55,677	102,314	35.2

Groundwater Quality

Groundwater quality was provided for TSF3E monitoring bore. To date, only one sampling regime has been submitted to DWER. Table 7 show elevated levels of lithium, tungsten and uranium.

Table 7: TSF3E monitoring bore groundwater analysis

		Sample date
Unit	Parameter	14/05/2019
	pH	7.2
µS/cm	EC	5300
mg/L	TDS	5100
	Total N	0.9
	Total P	<0.05
	Br	<2.5
	B	0.89
	F	0.7
	Ca - sol	630
	K - sol	3.8
	Mg - sol	330
	Na - sol	380
	HCO3 as CaCO3	210
	CO32- as CaCO3	<5
	OH- as CaCO3	<5
	Total Alkalinity as CaCO3	210
	Cl	390
	SO4	3000
	Hardness as CaCO3	2900
	Si - sol	15
	Al-sol	<0.01
	Ar-sol	0.001
	Cd-sol	0.0001
	Co-sol	<0.001
	Cr-sol	<0.001
	Ce-sol	0.008
	Cu-sol	<0.001
	Fe-sol	<0.01
	Hg - sol	<0.00005
	Li - sol	13
	Mn-sol	0.062
	Ni-sol	0.002
	Pb-sol	<0.001
	Rb-sol	0.038
	Se-sol	<0.001
	Si - sol	15
	Th-sol	<0.001
	U-sol	0.0015
	W-sol	0.005
	Zn-sol	0.087
	U-Total	0.0016
	Th-Total	<0.0005
Bq/L	Gross Alpha	0.081
	Gross Beta	0.04

Decision

The risks associated with the extension of the commissioning period for TSF3E and Beneficiation Plant Train 1 are considered Medium but **possibly major** in the absence of further data.

Additional information is required to better assess this risk and the cumulative risk of commissioning Train 1 and Train 2. It is therefore considered necessary that further conditions/controls be added to this Amendment to enable further data and understanding of seepage, seepage recovery and decant water quality form TSF3E. Approval to the change in Condition 6, Table 3 to extend the commissioning period for Beneficiation Plant Train 1 and TSF3E is granted for a further 90 days.

The Department has reviewed the water balance and groundwater monitoring results provided by WLPL. According to the water balance, 76% of process water has been lost by seepage during commissioning of Train 1. The rapid rise in groundwater levels around PZ19TSF304 and TSF3E MB in data provided by WLPL, indicates TSF3E elevated seepage loss.

Process water from TSF3E has elevated concentrations of lithium, tungsten and uranium that can affect surface water quality near the mine site. To date, Train 1 is producing tailings with an average solid content of 35%, which indicates that the beneficiation process still requires significant adjustments to achieve the designed 60% solids.

There are four recovery bores to the north of TSF3 which have been used following cyclone Veronica. Groundwater data indicates there is seepage from the old TSF3. DWER has therefore also conditioned that data from these recovery bores be provided.

The proposed start of commissioning for Beneficiation Plant Train 2 will introduce more process water into TSF3E. The combined effect of process tailings out of specification from Train 2 and the limited capacity to recover and reuse water from TSF3E is considered a High risk for a system that has not yet demonstrated adequate management or design specification.

The amendment to allow commissioning of Train 2 with ore is therefore not approved at this time, via this Works Approval Amendment. However, DWER will consider approval for Train 2 commissioning after:

- Accurate water balance demonstrating seepage reduction and decant water recovery is demonstrated;

- Beneficiation plant efficiency – tailings is achieving 60% solids; and

- Groundwater and piezometer data can demonstrate seepage reduction.

Works Approval Holder's comments

The Works Approval Holder was provided with the draft Amendment Notice on 10 July 2019. The Works Approval Holder responded via email on 11 July 2019 waiving the remaining comment period. No comments were submitted on the draft Amendment Notice 4.

Amendment

1. Condition 6 of the Works Approval is amended by the insertion of the text shown in bold and underline below as Specified Emissions in Table 3.

Emissions

6. The Works Approval Holder must not cause any Emissions from the Works authorised through this Works Approval except for specified Emissions and general Emissions described in Column 1 of Table 3, subject to the exclusions, limitations or requirements specified in Column 2, of Table 3.

Table 5: Authorised Emissions table

Column 1	**Column 2**
Emission type	**Exclusions/Limitations/Requirements**
Specified Emissions	
Commissioning of the Lithium Beneficiation Plant and TSF3 Expansion	Subject to Conditions 1, 2, 3 and 5 TSF 3 Expansion commissioning with total tailings[1] **from Train 1 only until the 11 October 2019.** Deposition of fine/wet tailings alone is not permitted.[1]

2. Condition 20 of the Works Approval is amended by the insertion of the text shown in bold and underline below:

20. The Works Approval Holder shall not use water from Wodgina Pit and **TSF3 Expansion decant water** for dust suppression until the remaining stormwater works for Beneficiation Plant Train 1 are completed.

3. The Works Approval is amended by the insertion of the following Conditions 21:

21. The Works Approval Holder must provide a monthly report to the CEO on the data recorded by conditions 14, 15, 16, 17 and 22.

4. The Works Approval is amended by the insertion of the following Condition 22:

22. The Works Approval Holder shall undertake the monitoring in Table 4 according to the specifications in that table and record the results.

Table 4: Monitoring of ambient groundwater quality[2]				
Monitoring point reference and location	**Parameter**	**Units**	**Averaging period**	**Frequency**
Recovery Bores RB1, RB2, RB3 and RB4	**Volume of water recovered**	**m^3**	**cumulative**	**daily**
TSF3MB, PZ19TSF304 and Decant Water	**pH[1]**	**pH units**	**Spot sample**	**Monthly**
	Electrical Conductivity	**mS/cm**		
	Total Dissolved Solids	**mg/L**		
	Aluminium	**mg/L**		
	Arsenic			
	Boron			
	Bromide			
	Caesium			
	Cadmium			
	Calcium			
	Calcium carbonate			
	Chloride			
	Chromium			
	Cobalt			
	Copper			
	Fluoride			
	Iron			
	Lead			
	Lithium			
	Magnesium			
	Manganese			
	Mercury			
	Nickel			
	Total Nitrogen			
	Total Phosphorus			
	Potassium			
	Rubidium			
	Selenium			
	Silicon			
	Sodium			
	Sulphate			
	Thallium			
	Tin			
	Uranium			
	Zinc			
	Gross-alpha	**Bq/L**		
	Gross-beta			

Note 1: In-field Non-NATA accredited analysis permitted.
Note 2: Level of detection is required to be sufficient to enable a comparison with ANZECC/ARMCANZ Guidelines.

5. The Works Approval is amended by the insertion of the following Condition 23:

23. Within 30 days from this amendment, the Works Approval Holder must provide to the CEO an Improvement Plan to increase reuse of decant water in the beneficiation process and minimise raw water use on site. The Plan shall include a timeframe, targets and procedures. The decant water use improvements must be recorded and auditable.

Appendix 1: Key documents

	Document title	In text ref	Availability
1	Works Approval W6132/2018/1 – Wodgina Lithium Mine	W6132/2018/1	accessed at www.dwer.wa.gov.au
2	Works Approval W6132/2018/1 – Amendment 3		accessed at www.dwer.wa.gov.au
3	Mineral Resources Tailings Dam Inspection log		DWER records (A1803131)
4	CMW Geosciences.Tailings Storage Facility, Wodgina Mine, WA – Construction Report Ref. PER2017-0428AS Rev 0	CMW, 2019	DWER records (A1774407)
5	Mineral Resources Wodgina Processing Tailings Water Discussion, June 2019 Power Point presentation		DWER records (A1800540)
6	Mineral Resources Wodgina TSF3 Water balance Excel file	WLPL, 28 June 2019	DWER records (A1803135)
7	Mineral Resources Wodgina TSF3_Downstream Bores SWL Excel file		DWER records (A1803133)
	Mineral Resources 228792-[R00] Results Water Analysis Laboratory report	Decant water analysis	DWER records (A1804415)
8	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.	DER 2015b	accessed at www.dwer.wa.gov.au
9	DER, November 2016. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	DER 2016b	
10	DER, November 2016. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.	DER 2016c	