



<b>Licence Number</b>	L7340/1997/9
<b>Licence Holder</b>	Pilbara Iron Company (Services) Pty Ltd
<b>ACN</b>	102 210 248
<b>File Number:</b>	DER2013/000903
<b>Premises</b>	Yandicoogina Iron Ore Mine NEWMAN WA 6753 Being AM70/00254
<b>Date of Amendment</b>	8 January 2018

## Amendment

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

**Alana Kidd**

**Manager Licensing – Resource Industries**

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

## Document changes

The condition numbers referenced in decision report dated 7 September 2017 that have been changed as part of this amendment are detailed in the table below.

Condition number (licence review decision report 7 September 2017)	Revised condition number (amendment decision report 8 January 2018)
6	Deleted
7	Deleted
8	10
9	11
10	12
11	13
12	14
13	15
14	21
15	22
16	23
17	24
18	25
19	26
20	27
21	Deleted

Table numbers referenced in decision report dated 7 September 2017 that have been changed as part of this amendment are detailed in the table below.

<b>Table number (licence review decision report 7 September 2017)</b>	<b>Revised table number ( amendment decision report 8 January 2018)</b>
3	Deleted
6	8
7	9
8	10
9	11
10	12

## Definitions and interpretation

### Definitions

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

**Table 1: Definitions**

Term	Definition
ACN	Australian Company Number
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 <i>Environmental Protection Act 1986</i> Locked Bag 33 Cloisters Square PERTH WA 6850 <a href="mailto:info-der@dwer.wa.gov.au">info-der@dwer.wa.gov.au</a>
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.
DER	Department of Environment Regulation
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EP Regulations	<i>Environmental Protection Regulations 1987 (WA)</i>
GL/a	Giga litres per annum
HDPE	High density polyethylene
JC	Junction Central
JSE	Junction South East
JTSI	Department of Jobs, Tourism, Science and Innovation
Licence Holder	Pilbara Iron Company (Services) Pty Ltd

m <sup>3</sup>	cubic metres
mbgl	metres below ground level
Mm <sup>3</sup>	Million cubic metres
Minister	the Minister responsible for the EP Act and associated regulations
ML/a	Mega litres per annum
MS	Ministerial Statement
mtpa	million tonnes per annum
Occupier	has the same meaning given to that term under the EP Act.
PMP	Probable maximum precipitation
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.
RL	Reduced Level metres Australian Height Datum (mADH)
Risk Event	as described in <i>Guidance Statement: Risk Assessment</i>
RTIO	Rio Tinto Iron Ore
TDS	Total dissolved solids
t/m <sup>3</sup>	Tonnes per cubic metre
WFC5	Waste Fines Cell 5

## Department of Water and Environmental Regulation

As of 1 July 2017, the Department of Environmental Regulation (DER), the Office of the Environmental Protection Authority and the Department of Water amalgamated to form the Department of Water and Environmental Regulation (DWER), see <https://publicsector.wa.gov.au/public-administration/machinery-government/2017-machinery-government-changes> for further details.

## Amendment

This amendment is made pursuant to section 59 of the *Environmental Protection Act 1986* (EP Act) to amend the Licence 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: Processing or beneficiation of metallic or non-metallic ore and Category 6: Mine dewatering. No changes to the aspects of the original licence relating to Categories 12, 54, 64 or 73 have been requested by the Licence Holder.

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

- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Risk Assessment (February 2017)*
- *Guidance Statement: Environmental Siting (November 2016)*

## Amendment description

On 1 February 2017, Pilbara Iron Company (Services) Pty Ltd (Licence Holder) submitted an application (RTIO, February 2017) to the then DER for an amendment to the Yandicoogina Iron Ore Mine Licence (L7340/1997/9). This amendment application relates to the construction and subsequent operation of Waste Fines Cell 5 (WFC5) located within the Junction Central pit (JC pit). No changes to the design or production capacity for category 5 have been requested.

During the assessment of the amendment application, DWER received the construction compliance documentation for the DO9A dewatering outlet. This outlet has been constructed in accordance with the conditions of the revised licence issued on 7 September 2017. Any conditions relating to the construction of this outfall have therefore also been amended.

## Amendment background

### 1. Waste Fines Cell 5

#### WFC5 Location and Design

The Licence Holder has applied for an amendment to construct Waste Fines Cell 5 (WFC5) within the JC pit void. No further areas are required to be disturbed. The pit walls are to form the boundaries of WFC5 to the east, south and western side. Fill material is to form the containment boundary on the northern side. The lowest pit rim elevation is RL 490 m at the northern end and RL 503 m at the southern end (RTIO-HSE-0304263).

WFC5 will have an approximate footprint of 120 hectares, the approximate boundary coordinates (MGA) of WFC5 are provided in Table 2.

**Table 2: Approximate boundary coordinates (MGA) of WFC5 (RTIO-HSE-0304263).**

Point	Easting (m)	Northing (m)
1	729,780	7,481,480
2	730,150	7,481,780
3	730,090	7,480,220
4	730,390	7,478,760
5	729,830	7,478,670
6	729,330	7,480,260

Figure 1 depicts the proposed extent of WFC5/JC pit and provides the location of the points referenced in Table 2.

**Figure 1: Proposed extent of WFC5/JC pit (RTIO-HSE-0304263).**



The total design storage capacity will be 14.3 Mm<sup>3</sup> based on an assumed average stored dry density of 1.4 t/m<sup>3</sup>. With a waste fines production rate of 1.25 Mtpa (20 million tonnes in total), the life expectancy of the facility is 16 years (2017 to 2032) (RTIO-HSE-0304263).

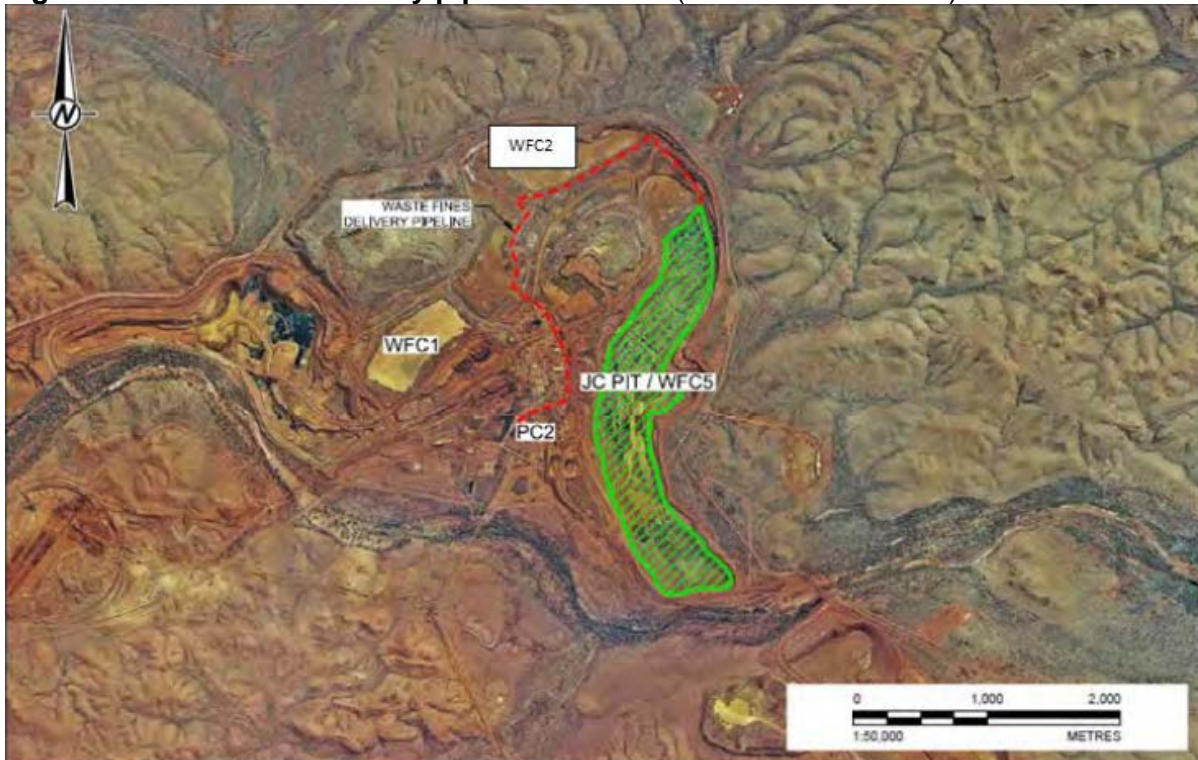
WFC5 will be designed to have “sufficient freeboard to accommodate inflows resulting from the 12 hour PMP rainfall event, atop the normal operating pond, whilst maintaining a 0.5 m total freeboard” (RTIO-HSE-0304263).

#### WFC5 Operation

Mining within the JC pit is to continue until quarter 3 of 2017 and containment embankment to separate mining and tailings disposal activities will be constructed. This containment embankment will be overtopped and submerged once mining activities cease (RTIO-HSE-0304263). It should be noted the safety of mine workers is regulated by the Department of Mines, Industry Regulation and Safety under the *Mines Safety and Inspection Act 1994* and is not considered under Part V of the EP Act.

Waste fines will be deposited from the northern end of WFC5 with the pipeline located within already disturbed areas following an existing haul road (RTIO March 2017). The red line in Figure 2 below depicts the location of the proposed pipeline.

**Figure 2: Waste fines delivery pipeline location (RTIO-HSE-0304263)**



*“The waste fines will be discharged from spigots located at the northern end of WFC5, with the waste fines beach sloping at approximately 0.5% towards the southern end of the facility”* (RTIO-HSE-0304263). The maximum tailings level will be RL 486m (RTIO-HSE-0304263) with a maximum elevation of 472m at the southern pit wall (RTIO, June 2017).

Figure 3 below depicts the initial tailings deposition within the first six months of operation. The red line depicts the containment embankment to allow mining within the JC pit to continue.

The waste fines are expected to segregate with coarser particles settling out to the bottom near the discharge point and finer particles settling out furthest from the discharge point. *“The consolidated dry density will therefore vary based on distance from the discharge point and also with depth”*. The capacity of the WFC5 has been conservatively estimated at 1.4 t/m<sup>3</sup> (RTIO-HSE-0304263).

Initially the waste fines beach will be exposed with the supernatant pond located only along the containment embankment. Dewatering is to continue at the Ridge North and Marillana borefields and using in-pit sump pumps to allow mining to continue within the pit void. During this period (anticipated to be the first six months of operation only) any seepage will be collected by dewatering activities. This is detailed further in the risk assessment section below.

Once mining within the pit void ceases and the Ridge North and Marillana borefields are turned off (after the first six months of operation), WFC5 will act as groundwater sink and a pond is expected to rise quickly to cover 90% of WFC5 forming a pit lake. This is detailed further in the risk assessment section below. The maximum pit lake elevation is to be RL 486m (RTIO-HSE-0304263). As the ingress of groundwater continues, the size of the supernatant pond will increase and the waste fines beach area will be submerged under water. Approximately 90% of WFC5 will be covered with water as depicted in Figures 4 to 7 below. Figure 7 depicts the tailings deposition and the supernatant pond for the life of the facility.



Figure 3: Tailings deposition during the first 6 months of the facility (RTIO-HSE-0304263)

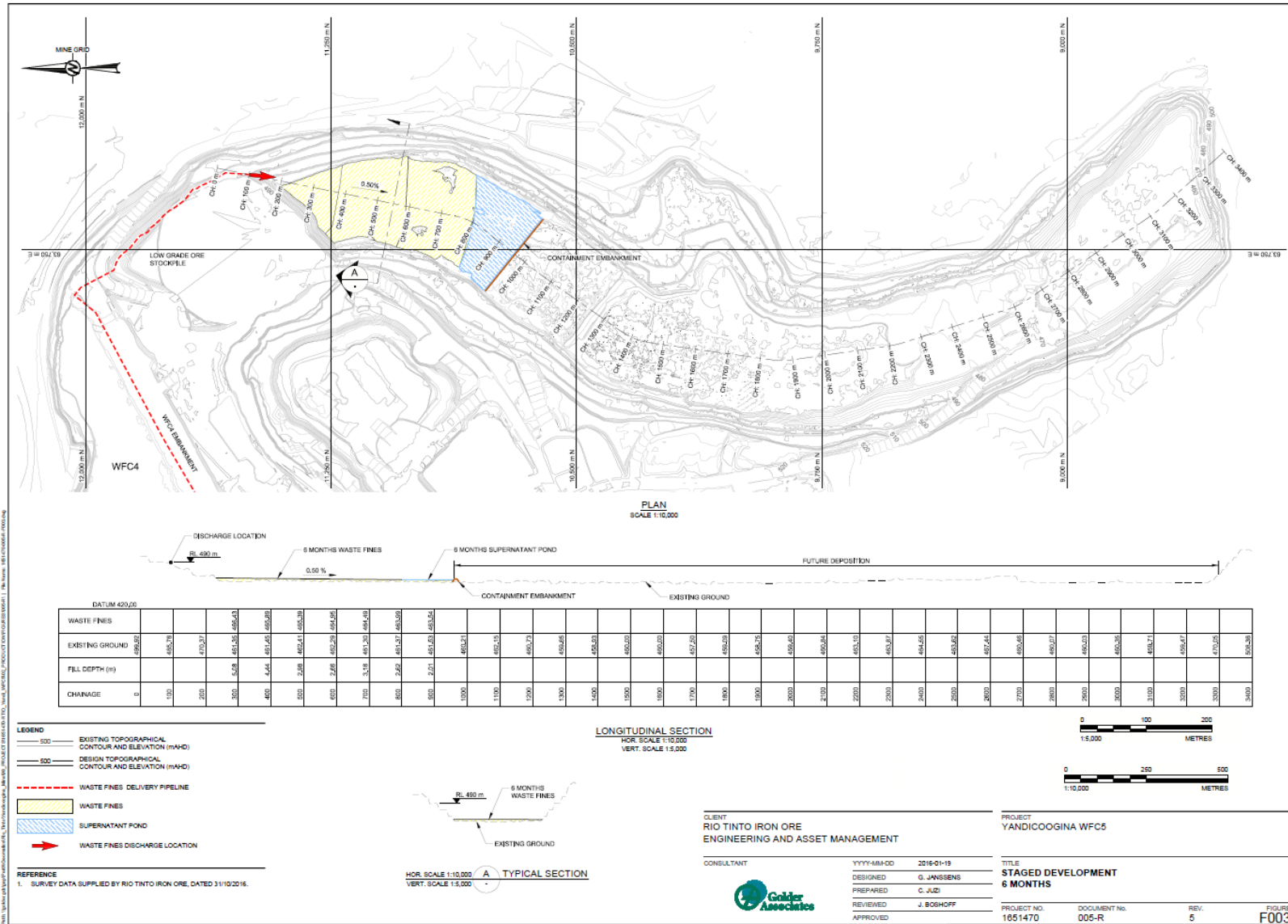


Figure 4: Tailings deposition at five years (RTIO, 27 October 2017)

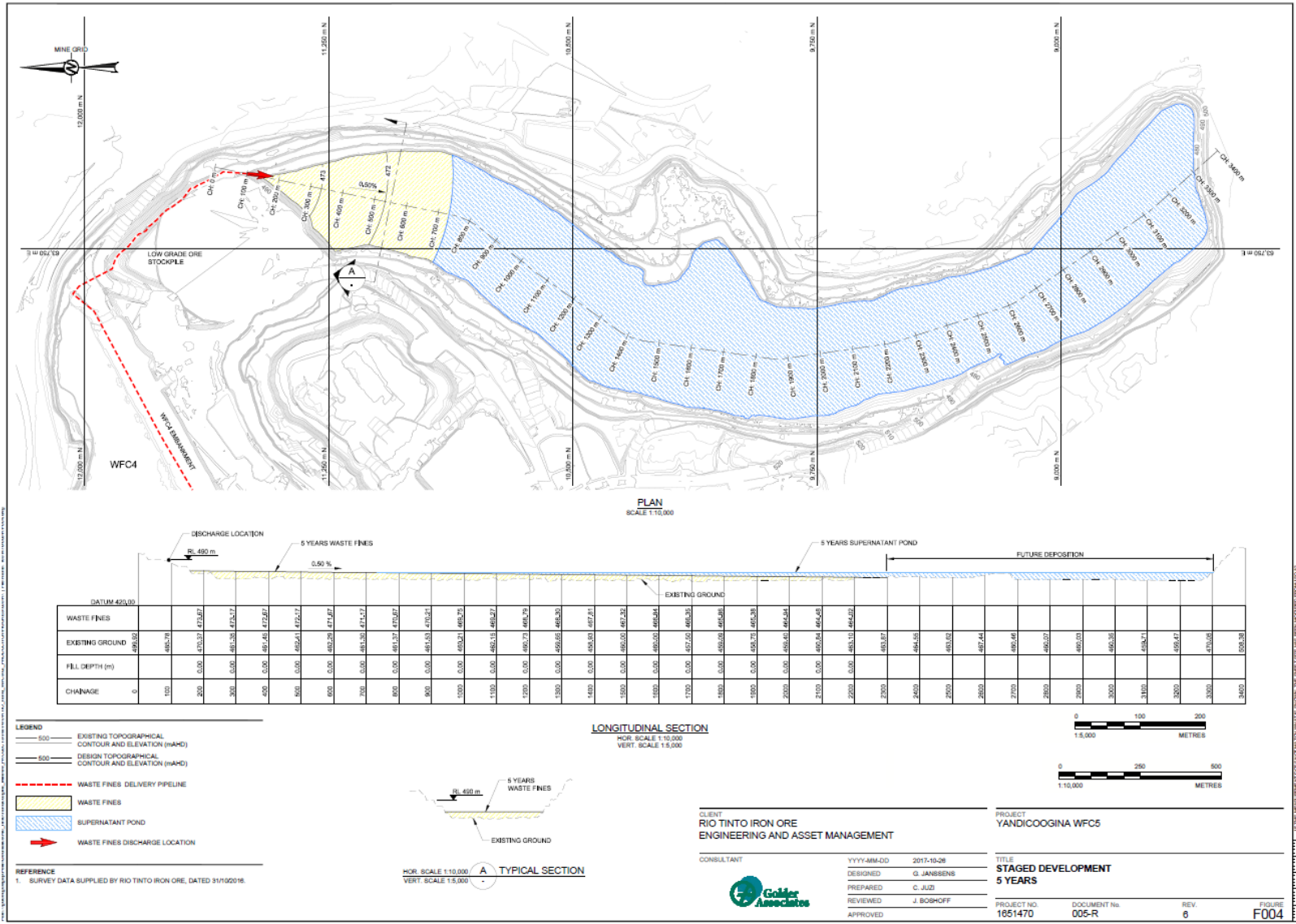


Figure 5: Tailings deposition at 10 years (RTIO, 27 October 2017)

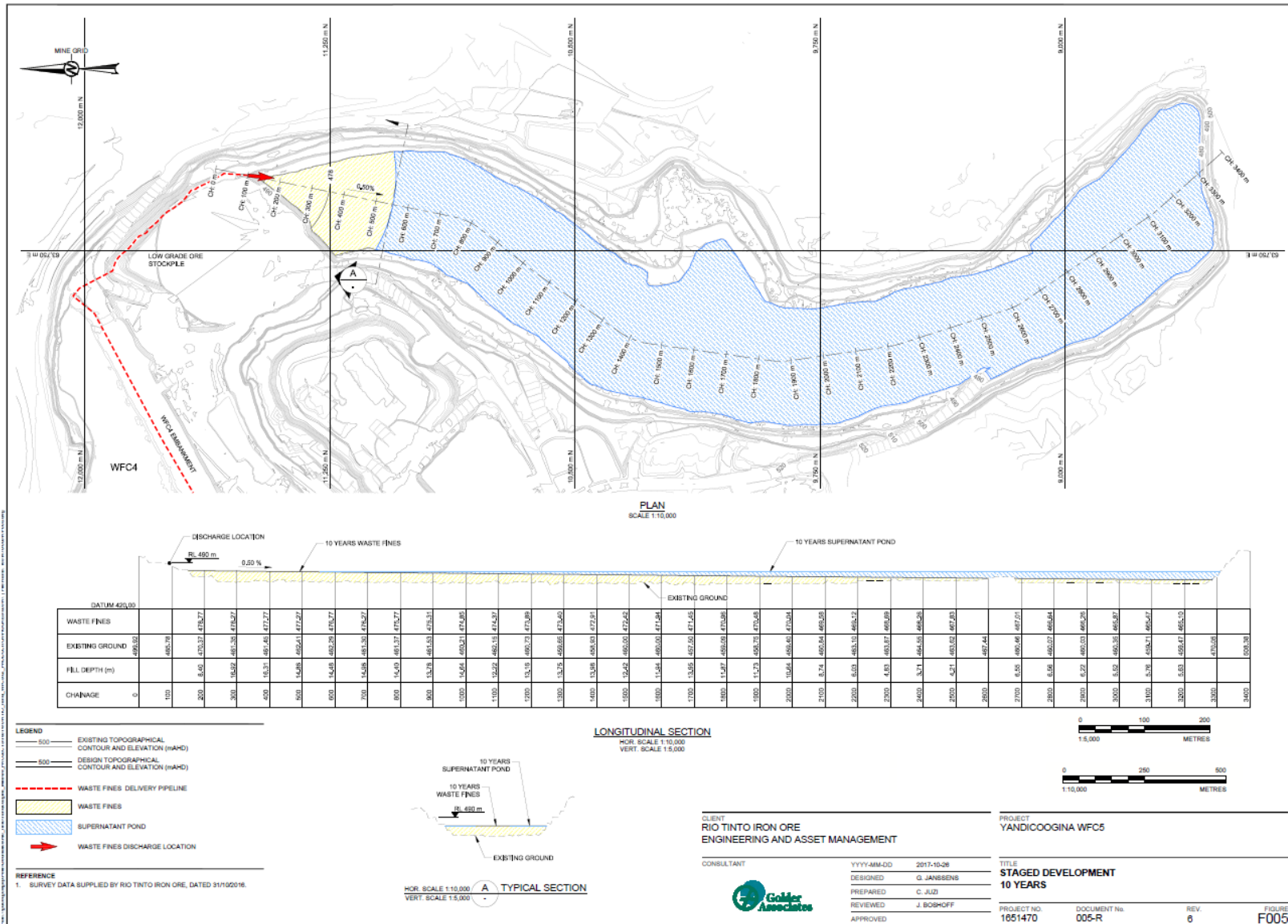


Figure 6: Tailings deposition at year 15 years (RTIO, 27 October 2017)

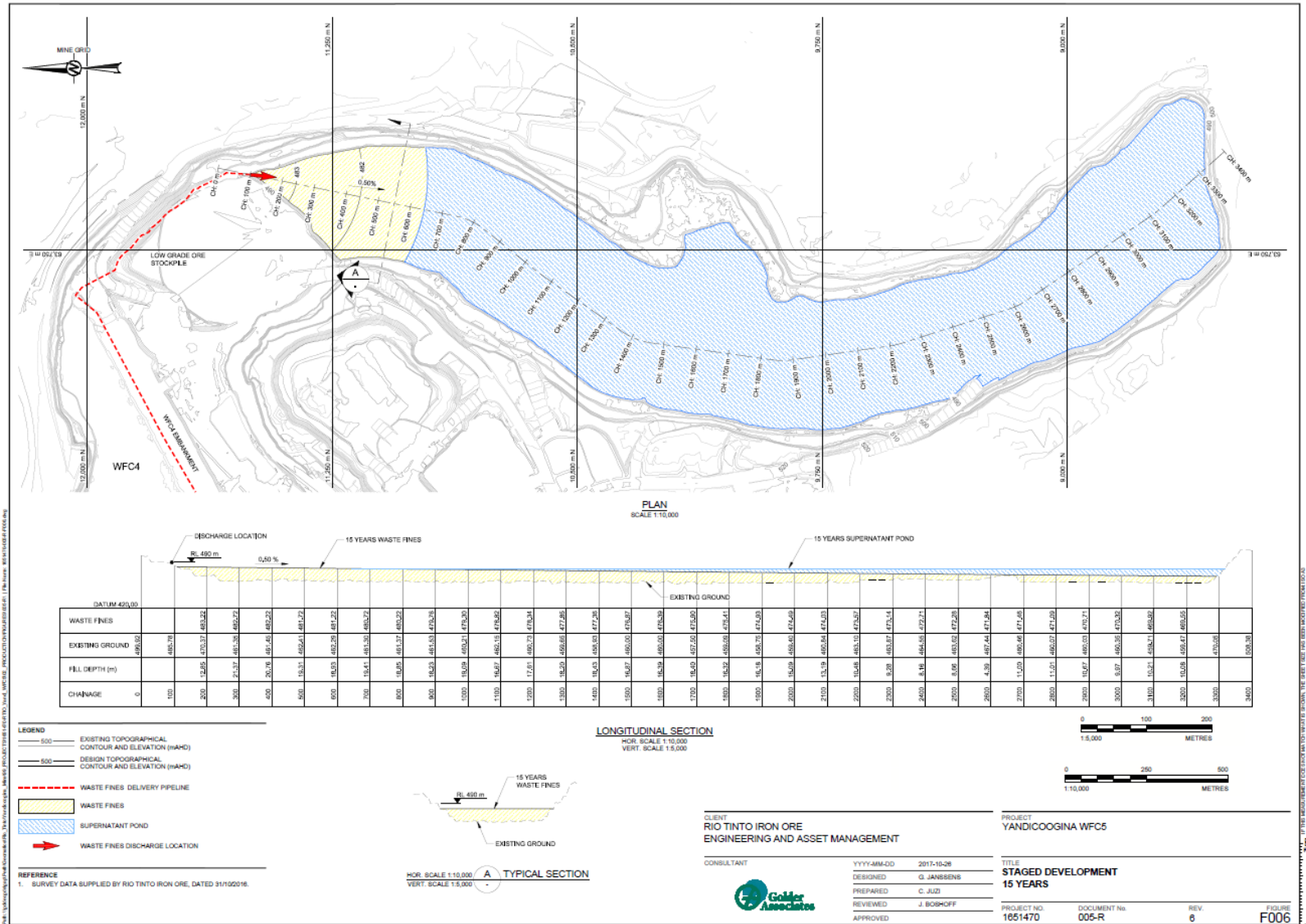
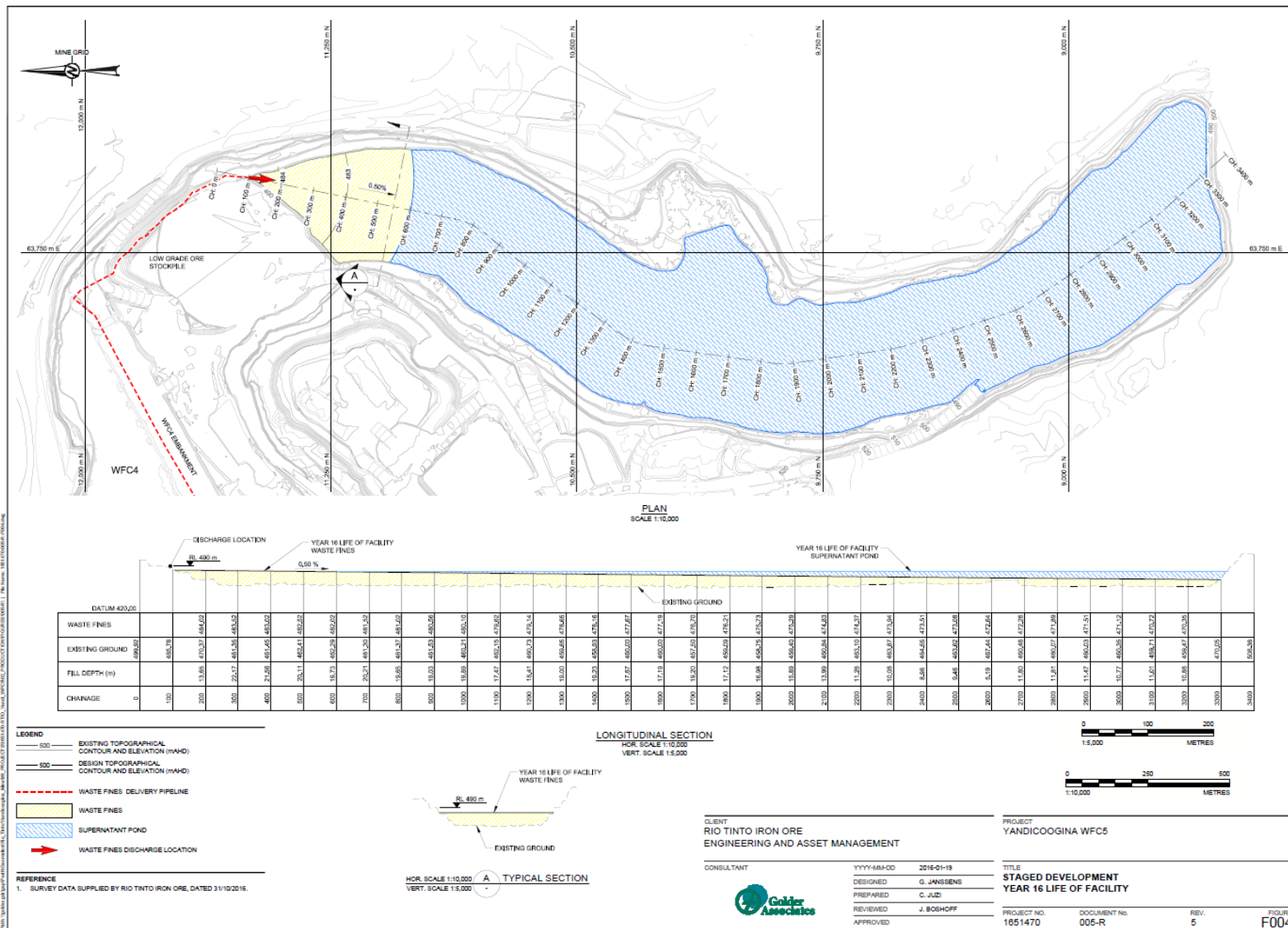


Figure 7: Tailings deposition during the 16 year life of the facility (RTIO-HSE-0304263)



Ministerial Statement 1038 conditions 6-1 to 6-7 (documented below) relate to the Mine Closure Plan therefore the long term water quality of the pit lake is not considered to be a matter under Part V of the *Environmental Protection Act 1986*.

**Ministerial Statement 1038** found at [www.epa.wa.gov.au](http://www.epa.wa.gov.au)

### **Rehabilitation and Decommissioning**

- 6-1 *The proponent shall manage the implementation of the Proposal to meet the following **environmental objective**:*  
 (1) *ensure that the Proposal is rehabilitated and decommissioned in an ecologically sustainable manner.*
- 6-2 *Within six months of the issue of this Statement or as otherwise agreed in writing from the CEO, the proponent shall prepare and submit a Mine Closure Plan in accordance with the Guidelines for Preparing Mine Closure Plans, May 2015 (or any subsequent revisions of the guidelines), to the requirements of the CEO, on advice of the Department of Mines and Petroleum and the Department of Water.*
- 6-3 *The proponent shall continue to implement the Yandicoogina Closure Plan (RTIO-HSE-0208486, April 2014) until the CEO has confirmed by notice in writing that the Mine Closure Plan satisfies the requirements of condition 6-2 to meet the objective required by condition 6-1.*
- 6-4 *The plan shall include a monitoring framework for the monitoring of groundwater levels and groundwater quality to demonstrate that the cessation of groundwater dewatering and discharge for the Proposal would not have a detrimental impact on the groundwater aquifers and surface water flows in Marillana and Weeli Wolli creeks that support the function of terrestrial and subterranean ecological communities, to demonstrate that the objectives in condition 5-1 would be met.*
- 6-5 *The plan shall define which pit voids will be backfilled and refine the conceptual and analytical models for the proposed pit lakes to demonstrate that the pit lakes will not have detrimental impact on groundwater and/or surface water systems, at intervals not exceeding those specified in condition 6-6.*
- 6-6 *The proponent shall review and revise the Mine Closure Plan required by condition 6-2 at intervals not exceeding three years, or as otherwise specified by the CEO, and submit the plan to the CEO at the agreed interval.*
- 6-7 *The proponent shall implement the latest revision of the Mine Closure Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 6-2.*

## **2. DO9A outfall**

During the assessment of the application to construct and operate WFC5, the Licence Holder submitted compliance documentation in accordance with previous condition 21 of the Licence. This pertains to the construction of dewatering discharge outlet DO9A. As a result, conditions relating to the construction of the DO9A outfall are no longer required on the licence. Changes to these conditions are documented in the decision section below.

### **Amendment history**

Table 3 provides the amendment history for L7340/1997/9.

**Table 3:** Licence amendments

<b>Instrument</b>	<b>Issued</b>	<b>Amendment</b>
L7340/1997/9	2 June 2016	Amendment to include the EPCM WWTP, upgraded village WWTP, YSP stacker and stockyard, Stage 1 of WFSF, operation of new landfill, construction and operation of waste dump landfill, construction and operation

		of DO3A outlet and other administrative amendments
L7340/1997/9	29 April 2016	Notice of amendment of licence expiry dates. Expiry date extended to 31 May 2036
L7340/1997/9	7 September 2017	Review of premises and licence conversion
L7340/1997/9	8 January 2018	Amendment: Construction and operation of waste fines cell 5, operation of DO9A dewatering outfall, other administrative amendments

## Location and receptors

Table 4 below lists the relevant sensitive land uses in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

**Table 4: Receptors and distance from activity boundary**

Residential and sensitive premises	Distance from Prescribed Premises
Phil's Creek accommodation village	Approximately 3.5 km north-west of WFC5
BHP Yandicoogina Camp	Approximately 13 km north-west of WFC5

Table 5 below lists the relevant environmental receptors in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

**Table 5: Environmental receptors and distance from activity boundary**

Environmental receptors	Distance from Prescribed Premises
Priority Fauna P4 (Mammals)	Approximately 1.2 km west of WFC5
Threatened Fauna (migratory birds)	Approximately 2 km south-east of WFC5
Marillana Creek system (drains to Fortescue Marsh)	Approximately 190 m south of WFC5
Weeli Wolli Creek system (drains to Fortescue Marsh)	Approximately 7 km to the east of WFC5
Fortescue Marsh Priority Ecological Community also listed on the Directory of Important Wetlands of Australia	40 km north west of WFC5. The premises is located within the Fortescue March management zone 3b – Marillana Plain
Groundwater bores. Groundwater is fresh (150-600 mg/L TDS (total dissolved solids))	Several bores are located within WFC5 and surrounding WFC5 that are operated by the Rio Tinto group of companies. All bores within 10 km of WFC5 are either owned by the Licence Holder or other mining operations (WIN database).  Current depth to groundwater (current dewatering) – 1m at base of pit, 50-60 mbgl at pipeline location (RTIO, 3 October 2017).  Depth to groundwater (post dewatering) pit lake will form within the pit, 30-40 mbgl at pipeline location (RTIO, 3 October 2017).

## Environmental Protection Authority - Part IV of the EP Act

Ministerial statement 1038 (MS 1038) has been assessed by the Environmental Protection Authority under a Public Environmental Review assessment. MS 1038 was signed by the Minister for the Environment on 30 September 2016. MS 1038 and its implementation

conditions supersede MS 914.

## **Department of Jobs, Tourism, Science and Innovation - Iron Ore (Yandicoogina) Agreement Act 1996**

The Premises falls entirely within tenure granted pursuant to the *Iron Ore (Yandicoogina) Agreement Act 1996* and therefore is not subject to the approval requirements of the *Mining Act 1978*.

## **Department of Mines, Industry Regulation and Safety**

The Department of Mines, Industry Regulation and Safety (DMIRS) does regulate health and safety aspects of the mining operation under the *Mines Safety and Inspection Act 1994*. An operational protocol exists between DMIRS and the Department of Jobs, Tourism, Science and Innovation (JTSI) on the environmental management of state agreement projects. DMIRS provide advice to JTSI on new proposals and variations to proposals. DMIRS has undertaken a geotechnical review of WFC5 which is detailed below.

### **WFC5 DMIRS Geotechnical Review**

DMIRS regulates health and safety aspects of the mining operations under the *Mines Safety and Inspection Act 1994*. However the approval requirements of the *Mining Act 1978* do not apply to WFC5 as the Premises falls entirely within the tenure granted pursuant to the *Iron Ore (Yandicoogina) Agreement Act 1996*.

The Licence Holder is only required to submit significant modifications for approval to the Minister for Mines and Petroleum under clause 9 of the *Iron Ore (Yandicoogina) Agreement Act 1996*, therefore approval for the design of WFC5 is not required under the *Iron Ore (Yandicoogina) Agreement Act 1996* or the *Mining Act 1978*.

Regulatory Services (Environment) provided DMIRS with the application supporting documentation on 14 March 2017. DMIRS responded on 19 May 2017, raising concerns about the potential failure of the JC southern pit slope and requested further information to enable a Geotechnical Assessment (DMIRS, May 2017). Rio Tinto provided further information on 1 June 2017 (dated 31 May 2017) and this was provided to DMIRS on 2 June 2017. This further information is provided in Appendix 1 (RTIO, June 2017).

Upon review of this further information (RTIO, June 2017) DMIRS responded on 5 July 2017 with a second request for further information. The request stated that the information provided does not consider the long term impact of the pit lake and extreme flood events on the stability of the southern pit wall post closure, and the potential for the Marillana Creek water to flow into the JC pit/WFC5 in the long term (DMIRS, July 2017).

Rio Tinto provided further information on 4 August 2017 which was provided to DMIRS on 7 August 2017. This further information is provided in Appendix 2 (RTIO-HSE-0313076).

After a review of this further information submitted by the Licence Holder, DMIRS responded on 10 August 2017 with final comments on their geotechnical review, concluding that there are still concerns around the long-term stability of the southern wall at JC pit. However they were satisfied that the proposed disposal of waste fines into JC pit will not increase the risk of pit wall failure. DMIRS also stated that they are satisfied that in the event of pit wall failure this will not result in the release of waste fines to the environment (DMIRS, August 2017).

Ministerial Statement 1038 conditions 6-1 to 6-7 relate to the Mine Closure Plan (post operation), therefore the Delegated Officer considers that this is a matter regulated through the Ministerial Statement and not within Part V of the EP Act. All correspondence related to



concerns about the long-term stability of the JC southern pit wall, and the potential flow of the Marillana Creek have been provided to EPA Services and Regulatory Services (Water) for their consideration.

Further correspondence from DMIRS was received on 18 October 2017 which provided confirmation that DMIRS completed a recent review of the Yandicoogina Mine Closure Plan (April 2017). DMIRS is liaising with EPA Services on management measures required at closure to ensure that the risk of creek diversion (due to pit wall collapse) into the JC Pit is assessed, managed and implemented (via installation of a diversion bund).

## **Risk assessment**

Tables 6 and 7 below describe 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 human health or the environment, requiring regulatory controls. The overall rating of risk is determined by comparison with the Emissions Risk Matrix in documented in the *Guidance Statement: Risk Assessments*.

**Table 6: Risk assessment for proposed amendments during construction**

Risk Event					Consequence rating	Likelihood rating	Risk	Reasoning	
Source/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts					
<b>Cat 5</b> Processing or beneficiation of metallic or non-metallic ore	Construction of Waste Fines Cell 5	<b>Dust:</b> Associated with construction activities	Phil's Creek Mine accommodation village located approximately 3.5 km from Waste Fines Cell 5	Air: Particulate matter (fugitive dust)	Health and amenity impacts	Slight	Rare	Low	The Delegated Officer considers that the distance to human receptors to be too great for health or amenity impacts to arise.
			Marillana Creek riparian vegetation	Air: Particulate matter (fugitive dust)	Smothering of vegetation	Slight	Unlikely	Low	Noting the natural dust tolerance of vegetation species the Delegated Officer considers the consequence to be <b>slight</b> and the likelihood as <b>unlikely</b> . The Delegated Officer therefore considers the overall risk of dust impacts to riparian vegetation as <b>low</b> .
		<b>Noise:</b> Associated with construction activities	Phil's Creek Mine accommodation village located approximately 3.5 km from Waste Fines Cell 5	Air/ground: Noise and/or vibration of any frequency within the frequency response of the human ear	Health and amenity impacts	Slight	Rare	Low	The Delegated Officer considers that the distance to human receptors is too great for health or amenity impacts to arise.
			Underlying/ surrounding soils	Direct discharge	Localized contamination of soils impacting on soil profile	Slight	Possible	Low	All refueling and servicing will be undertaken in designated areas on site with drip trays and spills kits available (RTIO-HSE-0304263). The Delegated Officer considers that construction of WFC5 will not increase the risk to the environment as existing hydrocarbon management procedures are in place for the Premises, therefore the risk to

									soils from leaks and spills of hydrocarbons is <b>low</b> .
--	--	--	--	--	--	--	--	--	---

**Table 7: Risk assessment for proposed amendments during operation**

Risk Event					Consequence rating	Likelihood rating	Risk	Reasoning
Source/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts				
<b>Cat 5</b> Processing or beneficiation of metallic or non-metallic ore	Operation of Waste Fines Cell 5	<b>Dust:</b> Associated with dried tailings during operation	Phil's Creek Mine accommodation village located approximately 3.5 km from waste fines cell 5	Air: Particulate matter (fugitive dust)	Health and amenity impacts	Slight	Rare	Low  The Delegated Officer considers that the distance to human receptors is too great for health or amenity impacts to arise. The surface of WFC5 is likely to form a crust also.  The risk rating for dust impacts to the health and amenity of Phil's Creek Mine accommodation village is therefore <b>low</b> .
			Marillana Creek riparian vegetation	Air: Particulate matter (fugitive dust)	Smothering of vegetation	Slight	Unlikely	Low  Noting the natural dust tolerance of vegetation species the Delegated Officer considers the consequence to be <b>slight</b> and the likelihood as <b>unlikely</b> . The Delegated Officer therefore considers the overall risk of dust impacts to riparian vegetation as <b>low</b> .
		<b>Waste:</b> Discharge of dewater containing seepage from WFC5.	Marillana Creek	Direct discharge to creek through already authorised dewatering outlets to creek systems. Direct discharge from leaks and spills from	Impact to surface water quality and surface water ecosystems.  Uncontrolled release of dewater containing seepage from WFC5	Slight	Rare	Low  Refer to detailed risk assessment below (risk event 1).

Risk Event					Consequence rating	Likelihood rating	Risk	Reasoning	
Source/Activities	Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts					
			dewatering pipelines						
		<b>Waste:</b> Seepage from Waste Fines Cell 5	Groundwater with beneficial use. Marillana Creek	Infiltration to groundwater through base of cell 5	Impacts to groundwater and surface water quality.	Slight	Unlikely	Low	Refer to detailed risk assessment below (risk event 2).
		<b>Waste:</b> Associated with overtopping leading to the discharge of waste fines outside of the containment infrastructure	Marillana Creek. Localised soils and vegetation	Seepage of leachate	Impacts to soils/vegetation and surface water quality	Minor	Rare	Low	Refer to detailed risk assessment below (risk event 3).
		<b>Waste:</b> Supernatant pond formation containing undesirable water quality	Birdlife	Direct contact/feeding activities	Impacts to birdlife, bioaccumulation/ biomagnification in the food chain	Moderate	Possible	Medium	Refer to detailed risk assessment below (risk event 4).
	Delivery of tailings to Waste Fines Cell 5 via pipelines.	<b>Waste:</b> Tailings disposal pipeline failure	Groundwater with beneficial use (Groundwater Dependent Ecosystem)  Vegetation within the vicinity of the pipeline.	Direct discharge to land and seepage to groundwater	Adverse impacts to the health and survival of vegetation	Minor	Unlikely	Medium	Refer to detailed risk assessment below (risk event 5).

## Detailed Risk Assessment

### 1. Risk Event: Discharge of dewater containing seepage recovered from Waste Fines Cell 5 tailings (as dewatering activities and mining operation continue within the JC pit (WFC5))

#### Description of Risk Event

As mining continues in the pit void (first six months of operation only), any seepage from WFC5 will be collected by dewatering activities. Therefore, dewater discharged will contain seepage from WFC5 during the first six months of operation. The direct discharge of dewater containing seepage could cause an impact to the quality of surface water systems. The discharge of dewater to surface water systems is currently authorized by licence L7340/1997/9.

#### Identification and general characterisation of emission

Dewatering at the Ridge North Borefield and Marillana borefield (6 ML/day total for both borefields) and from in-pit sump pumps will occur as mining continues within the pit void (first six months of operation only).

Dewatering at these borefields and in-pit sump pumps maintains the groundwater levels at the base of the pit.

A containment embankment will separate mining activities and the initial disposal of waste fines. During this stage of disposal, supernatant liquor from the waste fines will collect against the containment embankment as depicted in Figure 3 above.

Any liquor that seeps through the containment embankment will be collected at in-pit sump pumps on the downstream side of the containment embankment. This liquor is mixed with other dewater collected, prior to discharge or reuse on site. Any seepage that will occur through the base materials will be collected by dewatering activities at the Ridge North and Marillana borefields. Anticipated maximum seepage as mining continues is expected to be 0.75 ML/day over a 6 month period. This equates to 12.5% of all dewater that will be collected by the Ridge North and Marillana borefields.

The combined seepage and other water collected through abstraction will either be used on site or discharged through dewatering outlets listed in Table 8 of Licence L7340/1997/9.

#### Solutes within PC2 decant

The levels of contaminants within the PC2 (source of tailings) decant provided, do not trigger the ANZECC 95% protection levels (ANZECC 2000). It is noted that the data provided for silver and vanadium is not at a sufficient detection level to allow a comparison against the ANZECC 95% protection level trigger value (ANZECC 2000).

Thallium levels are below the maximum contaminant limit of 0.002 mg/L which is the highest level allowed in drinking water in the United States of America (USEPA, 2009) [www.epa.gov](http://www.epa.gov) (cited 4 August 2017). The USEPA National Primary Drinking Water Regulation Table of Contaminants has been adopted as a reference value in the absence of any Australian reference level for Thallium.

The TDS content of the PC2 decant is 5335 mg/L which could cause impacts to livestock (ANZECC 2000). Nutrients are elevated when compared to the default trigger values for physical and chemical stressors in ANZECC 2000.

Table 8 provides the results from the analysis of contaminants within the PC2 decant.

Table 9 provides the results from the analysis of field parameters, major ions and nutrient

within the PC2 decant.

**Table 8: Contaminants within PC2 decant (RIO-HSE-0304263)**

Analyte mg/L	ANZECC 2000 Freshwater 95% or Tropical freshwater lake	ANZECC 2000 Livestock Drinking Water Trigger Value	PC2 Decant
Aluminium	0.055	5	0.01
Arsenic		0.5	<0.001
Barium			0.011
Boron	0.37	5	0.14
Cadmium	0.0002	0.01	<0.0001
Chromium	0.001	1	<0.001
Cobalt		1	<0.001
Copper	0.0014	0.4	<0.001
Gold			<0.001
Iron			<0.05
Lead	0.0034	0.1	<0.001
Manganese	1.9		<0.001
Mercury	0.0006	0.002	<0.0001
Molybdenum		0.15	0.001
Nickel	0.011	1	<0.001
Selenium	0.011	0.02	<0.01
Silicon			11.2
Silver	0.00005		<0.001
Strontium			0.093
Thallium			<0.001
Tin			<0.001
Uranium		0.2	<0.001
Vanadium	0.00006		<0.01
Zinc	0.008	20	<0.005

**Table 9: Field parameters and major ions within PC2 decant (RTIO-HSE-0304263)**

Analyte	Units	PC2 Decant
EC	uS/cm	823
pH (lab)	pH	8.01
Sodium	mg/L	69
Potassium	mg/L	6
Calcium	mg/L	36
Magnesium	mg/L	31
Chloride	mg/L	144
Sulfate	mg/L	56
Bicarbonate Alkalinity (CaCO <sub>3</sub> )	mg/L	82
TDS by calculation	mg/L	5335
Carbonate Alkalinity (CaCO <sub>3</sub> )	mg/L	<1
Hydroxide Alkalinity (CaCO <sub>3</sub> )	mg/L	<1
Total Alkalinity (CaCO <sub>3</sub> )	mg/L	82
Ammonia (N)	mg/L	0.02
Total Kjeldahl Nitrogen (N)	mg/L	<0.1
Nitrogen (Total)	mg/L	12.9
Bromide	mg/L	0.485
Fluoride	mg/L	0.8
Total Phosphorus (P)	mg/L	0.016
Sulfur (S)	mg/L	19
Total Organic Carbon	mg/L	2
Total Anions	mg/L	6.93
Total Cations	mg/L	7.5
Ionic Balance (Lab)	mg/L	3.98
Dissolved Organic Carbon	mg/L	2
Hardness (CaCO <sub>3</sub> )	mg/L	218

Once mining in the pit void has ceased (after 2017), the borefield will be decommissioned (RTIO-HSE-0304263) and groundwater levels will start to recover within WFC5.

### Description of potential adverse impact from the emission

Simultaneous disposal of tailings and the continuation of mining with the pit void will be of short term duration (first six months of operation only). The maximum volume of seepage expected to be recovered by dewatering activities equates to approximately 12.5% of the total volume of dewater collected from the Ridge North and Marillana borefields (RTIO, 8 November 2017). The PC2 decant results provided indicate that contaminants are below the 95% protection levels for toxicants in ANZECC 2000. TDS and nutrients are elevated when compared to the default trigger values for chemical and physical stressors in ANZECC 2000.

### Criteria for assessment

Relevant land and freshwater quality criteria include ANZECC 2000 for fresh and marine water quality.

### Licence Holder controls

The Licence Holder has a Monitoring and Management Plan (MMP) (RTIO, May 2016) to comply with MS 914 (now superseded by MS1038) that relates to dewatering discharges. This MMP includes water quality monitoring of surface waters.

### Consequence

Noting the quality of the PC2 decant is elevated in TDS and nutrients only and the expected volume of seepage compared to the total volumes of dewater abstracted through the borefields, the Delegated Officer considers the consequence to be **slight** (minimal on-site impact).

### Likelihood of Risk Event

Noting that the simultaneous disposal of waste fines and mining/dewatering activities will be of short-term duration, the Delegated Officer considers the likelihood to be **unlikely** (may only occur in exceptional circumstances).

### Overall rating of Risk Event

Noting that the Delegated Officer has compared the consequence and likelihood rating described above through the Emissions Risk Matrix and has determined the overall rating of risk as **low**.

## 2. Risk Event: Seepage from WFC5 during operation (after mining operation within JC pit have ceased)

### Description of Risk Event

Seepage from WFC5 causing the degradation of groundwater capable of beneficial use (TDS of groundwater in the area is between fresh and marginally saline (total dissolved solids range between 400 and 600 mg/L). The groundwater flows in a south-easterly direction towards the Marillana Creek.

### Identification and general characterisation of emission

The levels of contaminants within the PC2 (source of tailings) decant provided, do not trigger the ANZECC 95% protection levels (ANZECC 2000). It is noted that the data provided for silver and vanadium is not at a sufficient detection level to allow a comparison against the

ANZECC 95% protection level trigger value (ANZECC 2000).

Thallium levels are below the maximum contaminant limit of 0.002 mg/L which is the highest level allowed in drinking water in the United States of America (USEPA, 2009) [www.epa.gov](http://www.epa.gov) (cited 4 August 2017). The USEPA National Primary Drinking Water Regulation Table of Contaminants has been adopted as a reference value in the absence of any Australian reference level for Thallium.

The PC2 (source of tailings) decant has elevated TDS and nutrients above ANZECC trigger values for stock water and freshwater respectively. The TDS of the decant water is also elevated in comparison to local groundwater (source of dewatering effluent).

Tables 8 and 9 above provide the quality of the PC2 decant water.

Once dewatering activities cease, WFC5 will mostly act as a groundwater sink (RTIO-HSE-0304263). As the waste fines are deposited, groundwater flows will continue to enter the pit due to the high rate of evaporation. The anticipated timeframe for the supernatant pond levels to reach equilibrium with surrounding groundwater levels in the Channel Iron Deposit (CID) is approximately 10 years. This may take longer due to the low permeability of the waste fines restricting the rate of inflow of groundwater into the facility (RTIO, November 2017).

After groundwater levels have reached equilibrium with the surrounding groundwater levels, seepage from WFC5 may occur if water levels within the WFC5 pit are raised to a higher level than the surrounding groundwater levels in the CID. Seepage is only expected from the pit after a storm event ("*>20 mm of rainfall over a 24 hr period*") which may last for between several hours or several days. The "*potential rate of seepage from the pit is expected to be low. This is because groundwater levels will rise to a greater amount (and quicker) than pit water levels (due to aquifer porosity) and so there will be a tendency for groundwater flows to be into the pit void rather than elsewhere during rain events*" (RTIO, 8 November 2017).

In summary, WFC5 pond levels may briefly raise above the surrounding groundwater levels resulting in seepage from WFC5. This is not expected to occur during the first 10 years of operation as WFC5 water levels reach equilibrium with the surrounding groundwater levels. Seepage is unlikely to occur as there will be a tendency for groundwater flows into WFC5 rather than elsewhere during storm events (RTIO, 8 November 2017).

### Description of potential adverse impact from the emission

The underlying groundwater is fresh/marginally saline with total dissolved solids between 400-600 mg/L based on data provided from on-site bores. Any decrease in groundwater quality could impact on groundwater dependent ecosystems, the quality of the Marillana Creek and drinking water for livestock. However, the bores within 10 km of the facility are owned by the Licence Holder or other mining companies.

### Criteria for assessment

Relevant land and freshwater quality criteria include ANZECC 2000 for fresh and marine water quality and the ASC NEPM for soils and groundwater.

### Licence Holder controls

The Licence Holder currently monitors groundwater quality at Yandicoogina within the vicinity of WFC5 and also proposes to add three additional monitoring bores (already constructed) to the groundwater monitoring program. These additional bores include bores to the west and south of WFC5. The monitoring locations and parameters are depicted in Table 10 and Figure 9 below.

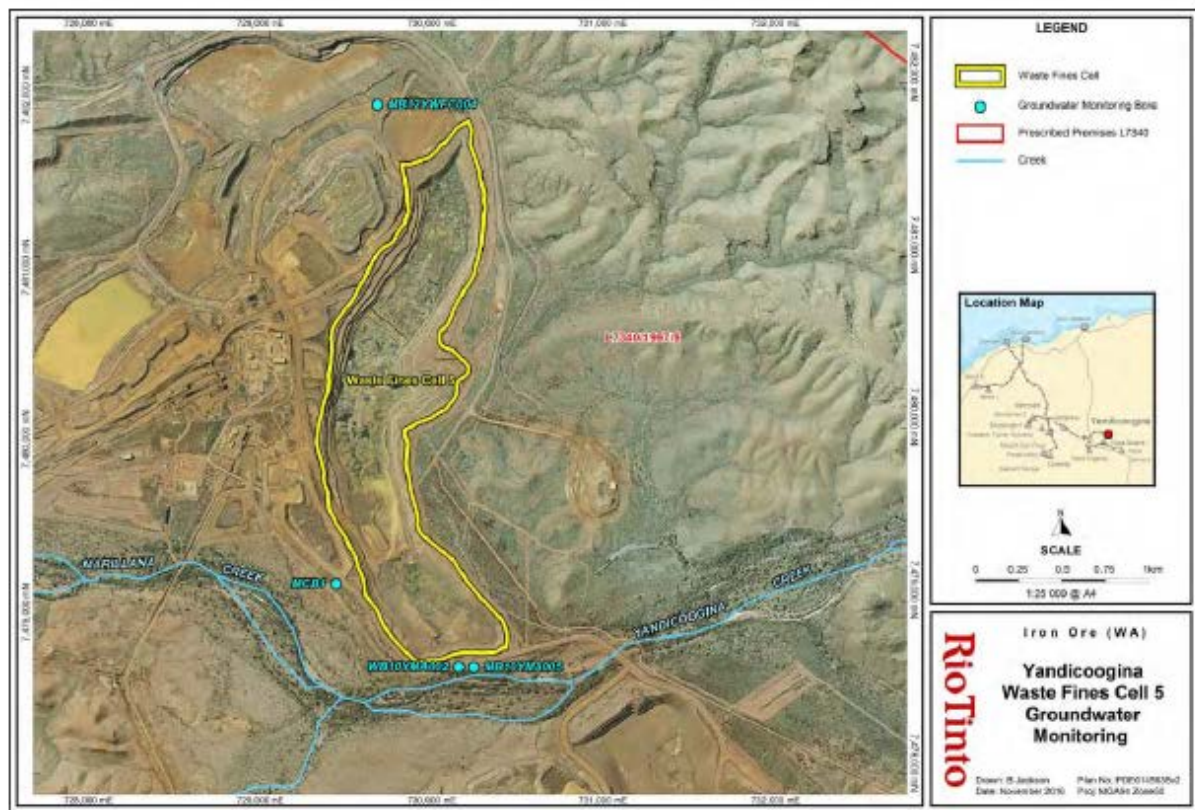


**Table 10: Groundwater monitoring sites with monitoring parameters (RTIO-HSE-0304263)**

Monitoring Site	Parameter	Frequency
MCB1 (proposed*) MB10YMA005 (proposed) MB12YWFC004 (existing)	Depth to water	Quarterly
WB10YMA002 (proposed) MB12YWFC004 (existing)	pH, Total Dissolved Solids	Quarterly
	Electrical Conductivity (µS/cm) Total Hardness (CaCO <sub>3</sub> ) (mg/L) Major Ions (mg/L) – Na, K, Ca, Cl, Mg, F, Br and SO <sub>4</sub> Metals (mg/L) – Cu, Fe, Mn, As, Cd, Cr, Ni, Co, Mn, Se, B, Hg, Mo, Sb, V, Zn and Tl	Annual

\*Note: proposed monitoring bores are existing bores. No new bores need to be constructed.

**Figure 9: WFC5 groundwater monitoring site locations (RTIO-HSE-0304263)**



### Consequence

Noting that WFC5 will mostly act as a groundwater sink, the quality of the PC2 decant and that contaminants will be diluted during a storm event, the Delegated Officer considers the consequence to be **slight** (minimal on-site impacts).

### Likelihood of Risk Event

Noting that seepage is not expected until water levels within WFC5 reach equilibrium with surrounding groundwater levels (expected after 10 years of operation) and the potential rate of seepage is expected to be low during a storm event, the Delegated Officer considers the

likelihood to be **unlikely** (risk event will not occur in most circumstances).

### Overall rating of Risk Event

Noting that the Delegated Officer has compared the consequence and likelihood rating described above through the Emissions Risk Matrix and has determined the overall rating of risk as **low**.

## 3. Risk Event: Overtopping of WFC5 during operation

### Description of Risk Event

Discharge of supernatant liquor containing solutes (salts, nutrients, metals and metalloids) from the overtopping of WFC5 during extreme storm events. Discharge of liquor could cause localized impacts to soils and impacts to vegetation. Any liquor discharge could seep through soils to groundwater. A release of supernatant liquor could contaminate stormwater and be discharged towards Marillana Creek.

### Identification and general characterisation of emission

The levels of contaminants within the PC2 (source of tailings) decant are equal to or below the adjacent JSE pit groundwater concentrations. Additionally the PC2 concentrations do not exceed the ANZECC 95% protection level (ANZECC 2000). It is noted that the data provided for silver and vanadium is not at a sufficient detection level to allow a comparison against the ANZECC 95% protection level trigger value, however (ANZECC 2000).

Thallium is below the maximum contaminant limit of 0.002 mg/L which is the highest concentration allowed in drinking water in the United States of America (USEPA, 2009) [www.epa.gov](http://www.epa.gov) (cited 4 August 2017).

### Description of potential adverse impact from the emission

The TDS content of the PC2 decant is 5335 mg/L which could impact livestock (ANZECC 2000). However, bores within a 10 km radius of the facility are owned by Rio Tinto and other mining companies (WIN database). Nutrients are elevated when compared to the default trigger values for physical and chemical stressors in ANZECC 2000.

### Criteria for assessment

Relevant land and freshwater quality criteria include ANZECC and ARMCANZ 2000 for fresh and marine water quality and the ASC NEPM for soils and groundwater.

### Licence Holder controls

**Table 11: Licence Holder's proposed controls for WFC water management**

Design aspect	Design Basis
Freeboard	Provide sufficient freeboard to accommodate inflows resulting from the 12 hour Probable Maximum Precipitation (PMP) event (1000 mm), atop the normal operating pond, whilst maintaining a 0.5 metre total freeboard. (RTIO-HSE-0304263)

### Consequence

Noting the levels of solutes in the supernatant liquor would be diluted after a storm event and the concentrations within the PC2 decant are below the ANZECC trigger values for 95% protection of species in freshwater ecosystems, the Delegated Officer considers the consequence to be **minor** (low-level on site impacts).

## Likelihood of Risk Event

Noting the Licence Holder's design accommodates a 12 hour PMP atop the normal operating pond, whilst maintaining a total 0.5 m freeboard, the Delegated Officer has determined that the likelihood of overtopping occurring will be **rare** (the risk event may only occur in exceptional circumstances).

## Overall rating of Risk Event

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk of overtopping is **low**.

## 4. Risk Event: Elevated contaminants within the pit lake water during operation.

### Description of Risk Event

Elevated levels of bioavailable contaminants that bioaccumulate and/or biomagnify in the food chain causing an impact to water birds.

### Identification and general characterisation of emission

Groundwater quality is likely to be altered within the cone of depression of the water table after dewatering activities cease and the water table rebounds. As groundwater flows through oxidized material within the cone of depression of the water table and into the waste fines cell, this may result in increased concentrations of major ions and contaminants such as sulfate, selenium and some metals such as cobalt, nickel, manganese, mercury and zinc within the pit lake water. No data has been provided with the application that provides the characterization of the material within the cone of depression of the water table; therefore the potential quality of groundwater that will enter WFC5 is unknown.

### Description of potential adverse impact from the emission

Elevated levels of contaminants that bioaccumulate/biomagnify within the pit lake water may impact on the health of birds accessing the pit lake.

### Criteria for assessment

Relevant land and freshwater quality criteria include ANZECC and ARMCANZ 2000 for fresh and marine water quality and the ASC NEPM for soils and groundwater. Expected pit lake water quality will be fresh and neutral pH, therefore palatable to wildlife.

### Licence Holder controls

The Licence Holder currently monitors groundwater quality at Yandicoogina within the vicinity of WFC5 and also proposes to add three additional monitoring bores (already constructed) to the groundwater monitoring program. These additional bores include bores to the west and south of WFC5.

The monitoring locations and parameters are depicted in Table 11 and Figure 9 above.

### Consequence

Noting that WFC5 is to be a groundwater sink and that as groundwater flows through the oxidized material within the cone of depression of the water table into the waste fines cell, there may be increased concentrations of contaminants that bioaccumulate and/or biomagnify, the Delegated Officer considers the consequence to be moderate (mid-level on-site impacts).

## Likelihood of Risk Event

Noting that the pit lake water quality is likely to increase in contaminant concentrations over time, and that a large pit lake will be established throughout the operational life of the facility, the Delegated Officer has determined the likelihood as **possible** (risk event may occur at some time).

## Overall rating of Risk Event

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk of overtopping is **medium**.

## Risk Event: Spills from tailings deposition pipeline

### Description of Risk Event

Spillage of waste fines to land due to pipeline failure. The uncontrolled release of waste fines from the pipeline could impact terrestrial vegetation and cause localized contamination of in-situ soils. The release of waste fines could impact the underlying groundwater 50-60 mbgl (current) and 30-40 mbgl post dewatering.

### Identification and general characterisation of emission

The waste fines consist of a solids to water ratio of 1:1. The concentrations of contaminants within the PC2 (source of tailings) decant do not exceed the ANZECC 95% protection level (ANZECC 2000). It is noted that the data provided for silver and vanadium is not at a sufficient detection level to allow a comparison against the ANZECC 95% protection level trigger value (ANZECC 2000).

Thallium levels are below the maximum contaminant limit of 0.002 mg/L which is the highest concentration allowed in drinking water in the United States of America (USEPA, 2009) [www.epa.gov](http://www.epa.gov) (cited 4 August 2017).

The TDS content of the PC2 decant is 5335 mg/L which could impact livestock (ANZECC 2000). However, bores within a 10 km radius of the facility are owned by the Licence Holder and other mining companies. Nutrients are elevated when compared to the default trigger values for physical and chemical stressors in ANZECC 2000.

### Description of potential adverse impact from the emission

Due to the pipeline being located in already disturbed areas, the likely adverse impact of the emission is localised contamination of soils and seepage to groundwater rather than impacts to terrestrial vegetation.

### Criteria for assessment

Relevant land and freshwater quality criteria include ANZECC and ARMCANZ 2000 for fresh and marine water quality and the ASC NEPM for soils and groundwater.

### Applicant/Licence Holder controls

The waste fines delivery pipeline will run from the PC2 processing plant to the northern end of WFC5. The proposed location of the pipeline is within already disturbed areas and follows an existing haul road. The pipeline is constructed of HDPE which is continuously welded with additional controls that consist of isolation valves. The Licence Holder has proposed to undertake daily inspection of the pipeline infrastructure (RTIO, March 2017).

## Consequence

Noting that the location of the pipeline is in already disturbed areas and the given depth to groundwater, the Delegated Officer has determined the consequence as **minor** (low level on-site impacts).

## Likelihood of Risk Event

Noting the Licence Holder's proposed controls, the Delegated Officer considers the likelihood as **unlikely** (the risk event will probably not occur in most circumstances).

## Overall rating of Risk Event

The Delegated Officer has compared the consequence and likelihood rating described above through the Emissions Risk Matrix and has determined the overall rating of risk as **medium**.

## Decision

Construction and the subsequent operation of WFC5 is authorised under this Licence amendment. Figure 2 of the Licence has been updated to include the location of WFC5. Figure 8 has been included, which depicts the location of WFC5 tailings pipeline. Conditions 6 to 9 have been added to the Licence and relate to the specifications for construction of the works for WFC5, including the requirement to submit compliance report to DWER upon completion of the works. Condition 9 also requires the tailings pipeline to be equipped with telemetry systems and/or pressure sensors along pipelines to allow the detection of leaks and failure.

The Licence Holder's proposed groundwater monitoring program has been included through condition 16 with the requirement to monitor the full suite of parameters for all bores with the addition of lead as a parameter. This monitoring is required to monitor groundwater entering WFC5 which will provide an early warning system for changes in water quality within WFC5 during operation. Reporting requirements have been added through condition 17 in relation to the AER.

Condition 18 has been included that requires the Licence Holder to undertake annual surface water sampling within WFC5 to monitor contaminant levels during operation. Condition 19 sets requirements for the reporting of this data in the AER.

Condition 20 requires all sampling undertaken in accordance with conditions 13, 16 and 18 to be analysed by a laboratory with NATA accreditation. Definitions relating to monitoring requirements have been included in the Licence. Figure 7 has been added to depict the location of groundwater monitoring sites and surface water monitoring sites.

Furthermore, during the assessment of the application to construct and operate WFC5, the Licence Holder submitted compliance documentation in accordance with previous condition 21 of the Licence. This pertains to the construction of dewatering discharge outlet DO9A. As a result, amendments have been made to the following conditions:

- Former conditions 6, 7 and 21 relating to the construction and reporting requirements for the DO9A outfall have been removed.
- Table 8 (formerly Table 6) is amended due to the DO9A outfall having been constructed.

Limits are not required for the DO9A outfall, as the Delegated Officer has determined that additional effective controls to rip-rap alone are in place to reduce erosion. The DO9A outfall has been constructed with a gabion structure and rip-rap.

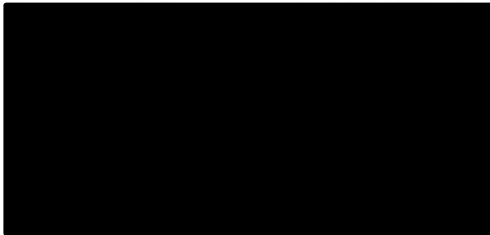
## **Licence Holder's comments**

The Licence Holder was provided with the draft Amendment on 23 November 2017. Comments received from the Licence Holder have been considered by the Delegated Officer as shown in Appendix 2.

## Appendix 1: Further information dated 31 March 2017

Rio Tinto

Rio Tinto Iron Ore  
GPO Box A42  
Perth Western Australia 6837  
T + 61 (8) 6213 0662  
F + 61 (8) 9366 5196



Date: 31 May 2017

**Our reference:** L7340/1997/9

**DER reference:** CEO390/17



**Application for an amendment to licence (L7340/1997/7) – Request for further information regarding Waste Fines Cell 5 - Licensee response**

Please find below a response to queries received in a letter from the Department dated 22 May 2017 regarding the licence amendment to L7340 for Waste Fines Cell 5.

### **DER Comment**

Provide a description of the materials type(s) in the southern wall of the JC pit and the material strength parameters used in the stability analysis; and the details of the stability analysis of the southern wall of the pit.

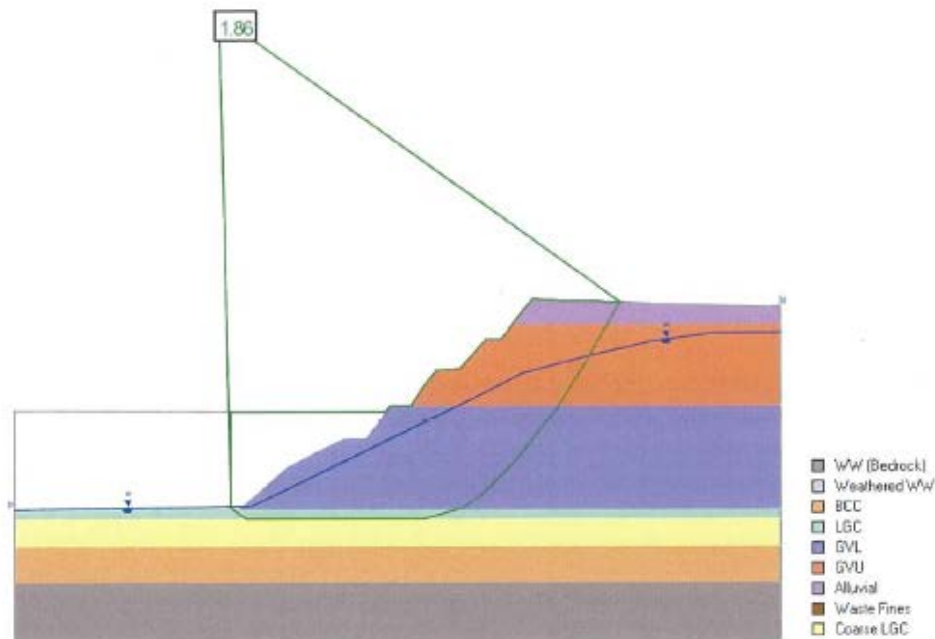
### **Licensee Response**

The geotechnical stability of the southern pit slope has been assessed using methods recommended by the ANCOLD 2012 guidelines. The material properties used in the stability analysis are summarised in Table 1. The stability analysis results are displayed in Figures 1 to 3, with the Factor of Safety shown.

The Limonite Goethite Channel Iron deposit (LGC) forms the foundation of WFC5, and is likely the weakest layer. The LGC material was observed to consist of lenses of clayey material, typically surrounded by rock or more clayey gravel (Golder, 2016b). The shear strength of the upper layer of LGC material has, therefore, been modelled as having an average strength between the clay lenses and the coarse LGC.

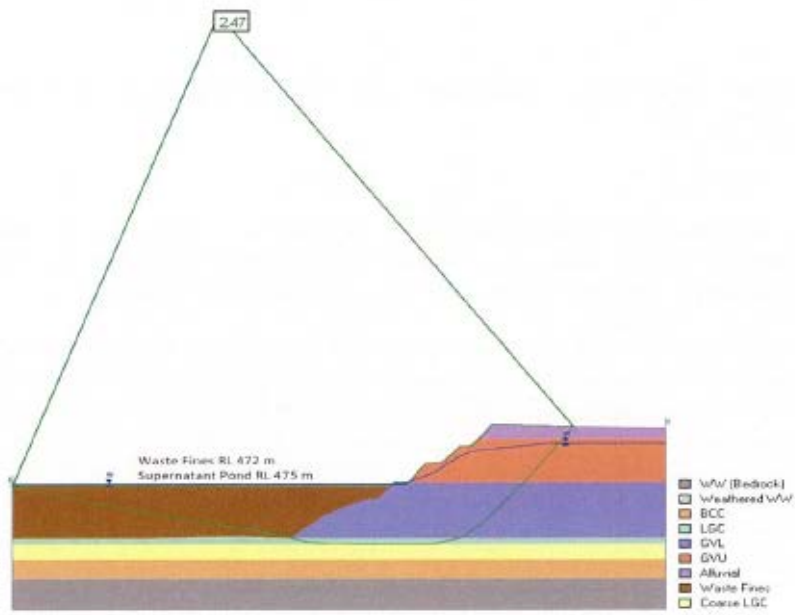
**Table 1:** Summary of material strength parameters for geotechnical stability analysis

Material	Unit Weight (kN.m <sup>3</sup> )	Strength Parameters			Data Source
		Friction Angle $\phi'$ (°)	Cohesion $c'$ (kPa)	Undrained Vertical Stress Ratio	
Surface Alluvial	17	25	20	-	Rio Tinto
Weathered Weeli Wolli Formation	27	35	335	-	Rio Tinto
Weeli Wolli Formation	27	35	335	-	Rio Tinto
Upper Vitreous Goethite (GVU)	27	40	427	-	Rio Tinto
Lower Vitreous Goethite (GVL)	27	32	308	-	Rio Tinto
Limonite Goethite Clay (LGC)	18	Shear Function			Golder Estimate based on presence of clay lenses (Golder, 2016b)
Coarse LGC	25	40	100	-	Golder Estimate
Basal Clayey Conglomerate (BCC)	22	35	335	-	Rio Tinto
Saturated Waste Fines	20	-	-	0.05	Golder Estimate

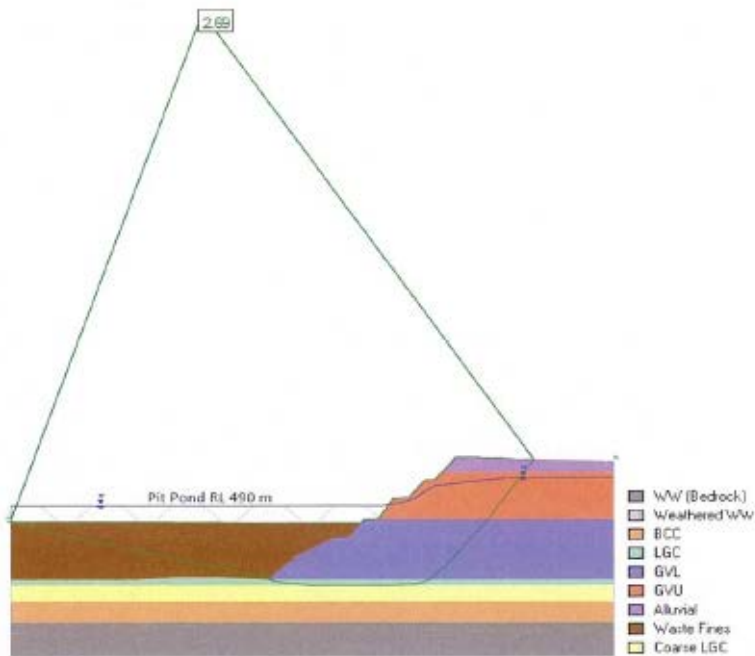


**Figure 1:** Stability analysis result - southern end of WFC5, prior to waste fines deposition





**Figure 2:** Stability analysis result - southern end of WFC5, full waste fines



**Figure 3:** Stability analysis results - southern end of WFC5, closure with pit lake

### **DER Comment**

Provide the minimum distance between the edge of creek water flow and edge of the pit (during average and peak water levels in the creek).

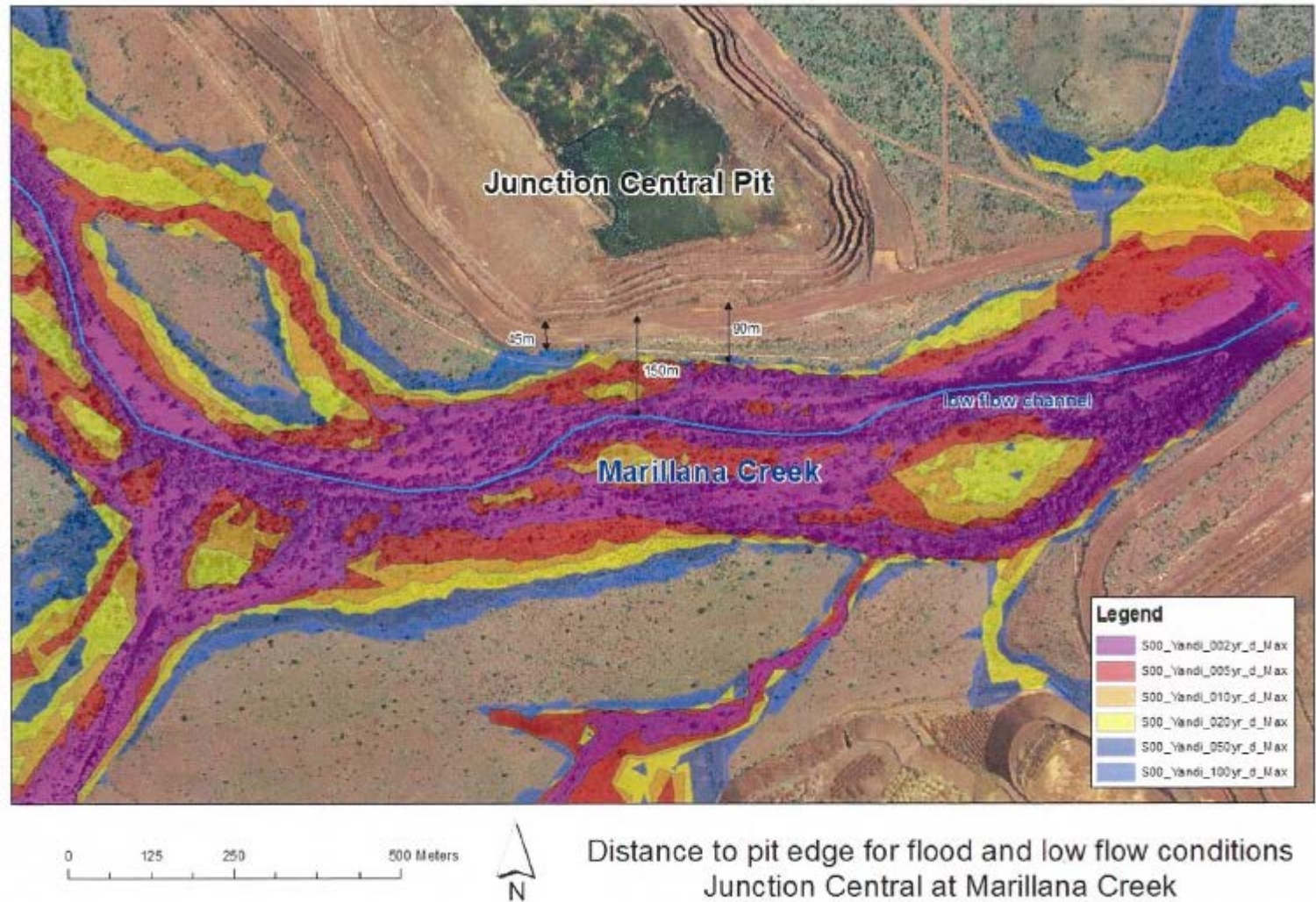
### **Licensee Response**

At the closest point the low flow channel is approximately 150 m away from the pit wall. For flood events, anything larger than the two year event is likely to result in flood water rising to be within 45m of the pit wall, with the flood water extending to the southern side of the haul road (Figure 4).

A theoretical rating curve has been derived for the creek reach at the southern end of the JC Pit (using a simple 1D hydraulic model) to provide an estimate of water elevation for flows up to 15,000 m<sup>3</sup>/s. It is acknowledged (and supported) by our hydraulic model stage-discharge modelling for the reach that the flood extent will be very close to the pit crest in a 1 in 100 year flood event, as shown in Figure 4. The ephemeral flow response for the creek is defined by an AWBM<sup>1</sup> rainfall-runoff model (daily time step) calibrated to Flat Rock GS and factored up to the 2176 km<sup>2</sup> catchment at this section of the creek. Stochastically generated climate data have been adopted to define the rainfall and evaporation series inputs to the AWBM.

---

<sup>1</sup> Australian Water Balance Model



**Figure 4:** Distance to the pit edge during varying flow conditions at Marillana Creek

### **DER Comment**

Additional information on the contingency embankment to separate mining activities at the southern end and waste fines slurry storage at the northern end of the JC pit (e.g. embankment dimensions, construction materials and method of construction, maximum water/slurry depth against the embankment while mining activities are taking place at the southern end.

### **Licensee Response**

The contingency embankment will be constructed using waste material sourced from the pit. This is expected to comprise mixtures of alluvial waste material (ALL), eastern clay conglomerate (ECC) and weathered channel material (WCH). The contingency embankment will be approximately 10 m to 20 m high (depending on the final location), with upstream and downstream batters of 1V:1.3H (angle of repose). Steeper side slopes are proposed for the contingency embankment due to its temporary use, as waste fines will eventually be deposited upstream and downstream of the interim embankment. The fill material will be end-tipped, and placed in a single 10 m high lift.

Total freeboard is defined in the ANCOLD guidelines (ANCOLD 2012) as the difference in elevation between the embankment crest and the maximum operating pond level. The notion of operating pond level refers to free-standing (supernatant) water above the stored waste level. The design guidelines in terms of freeboard applicable to WFC5 are summarised in Table 2.

**Table 2:** Freeboard design guidelines

<b>Design guideline</b>	<b>Design category</b>	<b>Design criteria</b>
DMP Guide (DMP 2013)	-	Accommodate inflows from 1:100 year 72 hour rainfall event, atop waste fines, whilst maintaining 0.5 m total freeboard
ANCOLD 2012 Guidelines (ANCOLD 2012)	High C	Accommodate inflows from 1:100 year 72 hour rainfall event, atop normal operating pond, whilst maintaining 0.5 m freeboard to cater for the 1:10 AEP wind wave run-up
RTIO D5 Standard (RTIO 2015b)	Major	Provide sufficient freeboard and/or spillway capacity to accommodate inflows from probable maximum flood (PMF)

### **DER Comment**

Information on the water balance including the rate of seepage through the base materials.

### **Licensee Response**

The groundwater/seepage rate into or out of WFC5 will depend on borefield pumping, the relative levels of near-pit groundwater and in-pit water levels above the waste fines during operations.

Seepage of groundwater into/out of WFC5 from the base/walls of the cell will occur as a result of the following:

1. Inflow when upstream groundwater levels are higher than the lake level within WFC5.

There is a general and consistent flow of water into WFC5 from the walls and base of the cell as a result of higher upstream ground water levels accounting for a total of 61 % of total inflow to WFC5. This inflow is relatively consistent throughout the year and is not overly variable temporally.

2. Inflow when the downstream groundwater levels are higher than the lake level within WFC5.

The inflow of groundwater to WFC5 from downstream groundwater accounts for periods when streamflow in Marillana Creek results in groundwater recharge downstream of WFC5 and temporarily

elevates groundwater levels to above the lake level in WFC5. During these periods, groundwater will flow into WFC5 through the walls and base of the cell from the downstream extent of WFC5 (accounts for 1.5% of total inflow to WFC5).

3. Outflow when the downstream ground water level is less than the WFC5 pit lake level.

Water will flow out of WFC5 into the downstream groundwater during periods where stormwater inputs raise the pit lake level in WFC5 above that of the downstream groundwater level (modelled at 0.6 % of total water outflow from WFC5).

Figure 5 represents the average inflows and outflows associated with the WFC5 pit lake water balance. The modelling results clearly demonstrate that evaporation losses from the pit lake are the dominate outflows accounting for approximately 99.4% of total losses over the simulation period (500 years).

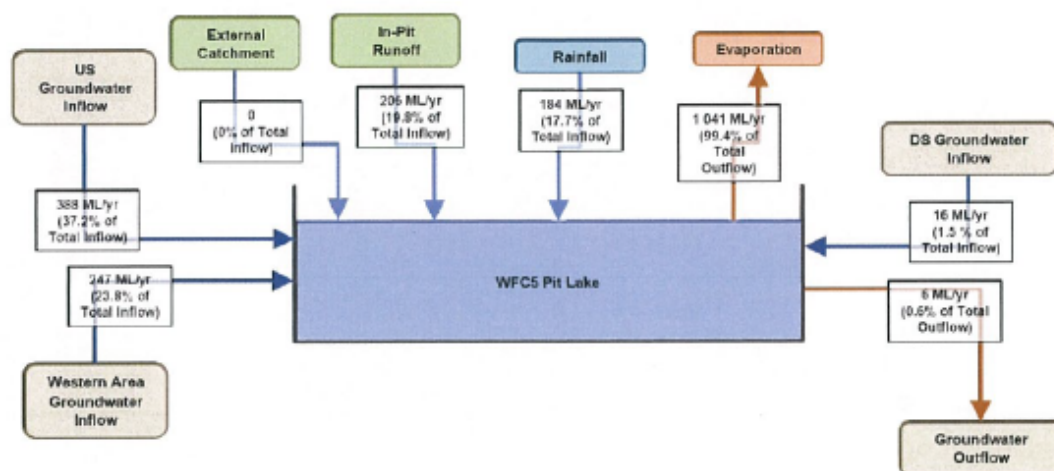


Figure 5: Average WFC5 pit lake water balance results

I trust the information provided above adequately covers the queries raised. Should you require any further information, please don't hesitate to contact me on [redacted] at [sean.savage@riotinto.com](mailto:sean.savage@riotinto.com).

Yours sincerely

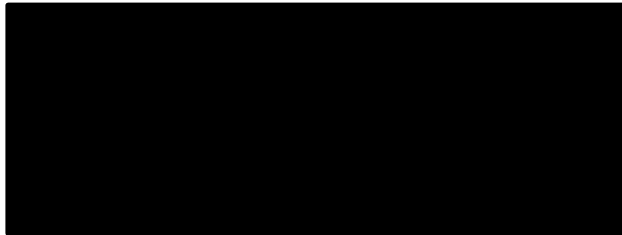
[redacted signature]

Superintendent, Government Approvals

## Appendix 2: Further information dated 4 August 2017

Rio Tinto

Rio Tinto Iron Ore  
GPO Box A42  
Perth Western Australia 6837  
T + 61 (8) 6213 0662  
F + 61 (8) 9366 5196



Date: 4 August 2017

Our reference: RTIO-HSE-0313076

DER reference: CEO369/17



**Application for an amendment to licence (L7340/1997/7) – Request for further information (6 July 2017) regarding Waste Fines Cell 5 - Licensee response**

Please find below a response to queries received in a letter from the Department dated 6 July 2017 regarding the licence amendment to L7340 for Waste Fines Cell 5 (WFC5).

### DER Comment

Please provide a Probable Maximum Flood (PMF) model for the Marillana Creek at the JC Pit (proposed WFC5) detailing the flood level, duration and flow rates.

### Licensee Response

The licensee has undertaken (and continually undertakes) reviews of extreme flood events for the Marillana Creek, as part of its wider closure planning and risk management assessments.

With regard to the proposed WFC5, the facility has an ANCOLD Consequence Category of 'Low to very low' which means the flood event can be estimated by means of a risk assessment. Regardless of this and given its location, we have considered the 1:100 year 72-hour duration storm event with regards to stability for WFC5. We do not believe that the consideration of the PMF for WFC5 is appropriate in this case, as to effectively define extreme (closure level) floods at specific locations on a large catchment of this nature to a PMF level, with numerous upstream influences on flood responses and levels would be an extremely complex process. The level of uncertainty associated with a localised PMF estimate for this facility would be extremely high.

The stability of the southern slope of WFC5 has been considered under a number of scenarios, including as if full saturation of the pit slope were to occur, which provides an assessment of geotechnical stability that exceeds what PMF modelling results would show. These results are discussed below.

### DER Comment

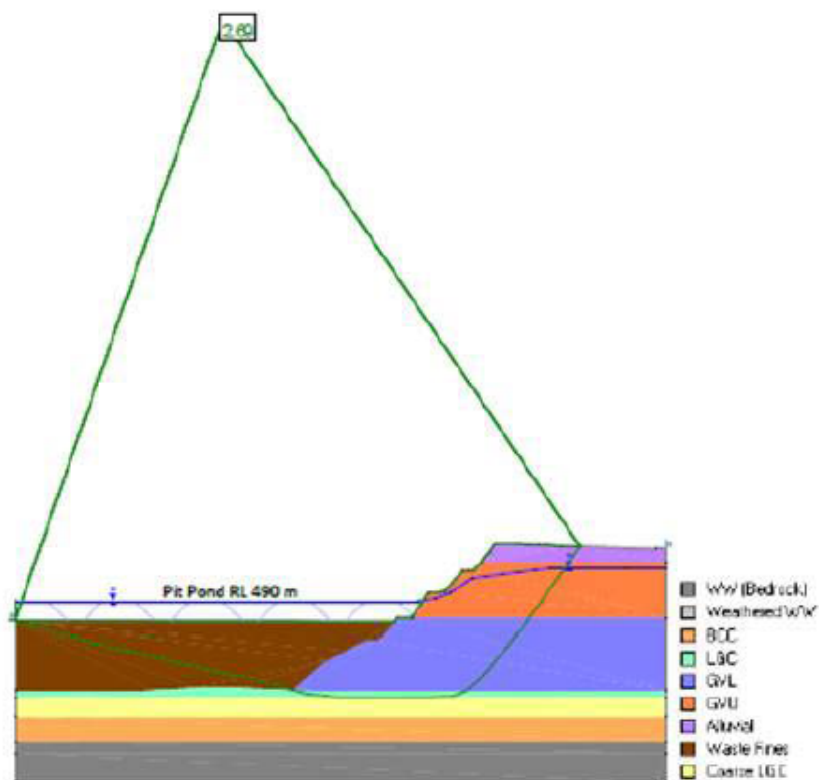
An assessment of the potential for saturation of the pit wall materials due to extreme rainfall leading up to the flood, and due to the flood itself; and

An assessment of the long term stability of the southern wall of the pit, taking into account the potential saturation of the pit wall materials as mentioned above and any surcharge load from a PMF.

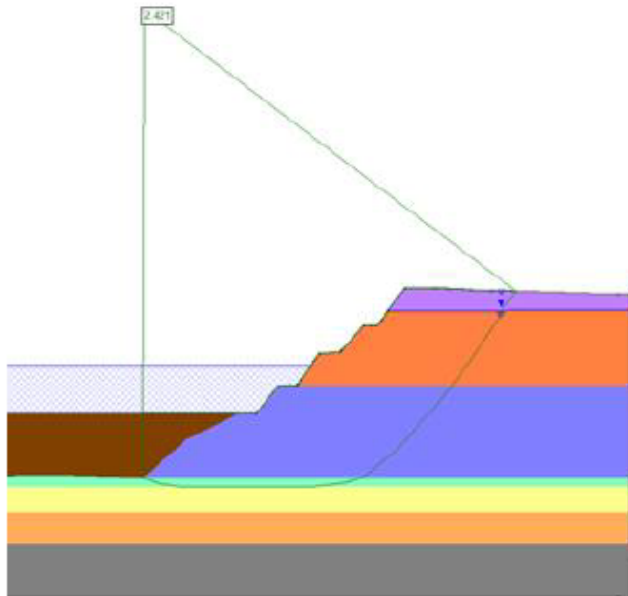
### Licensee Response

The geotechnical stability of the southern pit slope has been assessed as per the ANCOLD 2012 guidelines that recommend a minimum Factor of Safety (FoS) of 1.5. This level of FoS is required where there is a major consequence of significant environmental harm (i.e. creek diversion) and / or there is a risk to population from a wall failure. As detailed below, the FoS at all modelled scenarios exceeds the required 1.5 FoS.

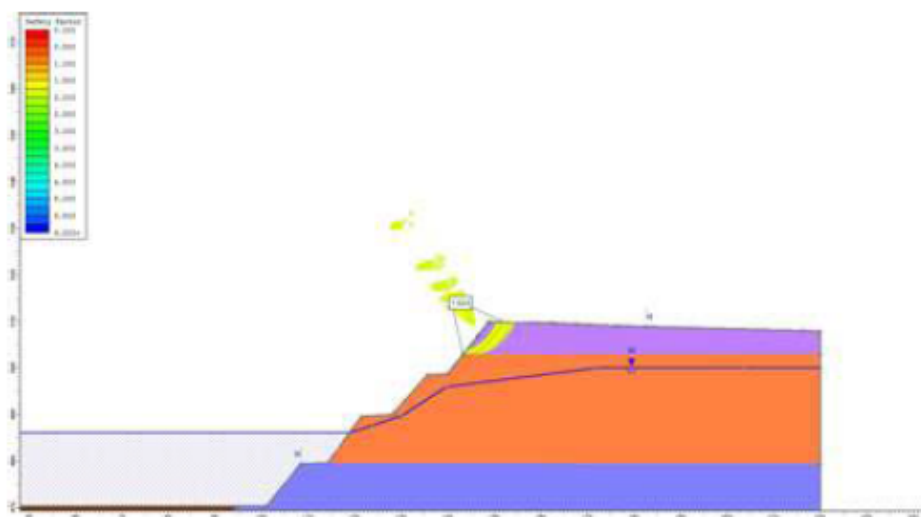
With regards to long term stability and saturation of the southern pit slope, we have considered the overall stability of the slope at maximum pit lake level (RL 490 m). The lowest pit rim elevation is at RL 490 m at the northern end and RL 503 m at the southern end. The resultant FoS against failure is 2.7. The relatively high phreatic surface is visible in the figure below and failure of the upper portions of the slope is unlikely due to the competent nature of the material.



Full saturation of the pit slope has also been considered to provide certainty around the stability of the southern slope of WFC5. We believe this scenario is highly unlikely as the pit can only fill up to RL 490 m which is the lowest pit rim elevation. The factor of safety against failure is 2.4. The relatively high phreatic surface follows the pit slope outline and is visible in the figure below.



A high level assessment on a local failure in the upper sections of the pit slope has also been conducted. The FoS is 1.64 with an off-set distance of approximately 5 to 10 m. This failure zone will not intersect the creek as the flood level of the creek is 45 m away from the edge of the pit. Failure in the upper BCC (Basal clayey conglomerate) is unlikely.





**Summary**

Based on the outcomes of studies associated with the design of WFC5, there has been no material change to the Yandicoogina Mine Closure Plan as a result of the WFC5 facility development and resulting closure landform. It is noted that there is a potential risk of flood inflows to closed pit voids post-closure and the licensee has highlighted the complexities of the interaction between the closure landforms, surface water and groundwater systems in the closure plan. Further development of the surface water management aspect of the site-wide Yandicoogina mine operation closure plan and strategy will be addressed in future iterations of the closure plan.

As discussed, the licensee is also planning to meet with the Department of Mines, Industry Regulation and Safety to present this information and discuss any further potential queries.

Should you require any further information, please don't hesitate to contact me on [REDACTED] or at [sean.savage@riotinto.com](mailto:sean.savage@riotinto.com).

Yours sincerely

[REDACTED]

### Appendix 3: Key documents

	Document title	In text ref	Availability
1	Licence L7340/1997/9 – Yandicoogina Iron Ore Mine	L7340/1997/9	accessed at <a href="http://www.dwer.wa.gov.au">www.dwer.wa.gov.au</a>
2	Licence Amendment Supporting Documentation. Yandicoogina Operation – L7340/1997/9 Waste Fines Cell 5 (RTIO-HSE-0304263)	RTIO-HSE-0304263	DWER records (A1371184)
3	Email from Rio Tinto received 13 March 2017 providing water quality results and direction of groundwater flow	RTIO, March 2017	DWER records (A1391683)
4	Letter received from the Department of Mines, Industry Regulation and Safety 19 May 2017	DMIRS, May 2017	DWER records (A1435604)
5	Letter dated 31 May 2017 providing further information for geotechnical review received 1 June 2017.	RTIO, June 2017	DWER records (A1450248)
6	Email received from the Department of Mines, Industry Regulation and Safety 5 July 2017	DMIRS, July 2017	DWER records (A1415460)
7	Letter received providing further information for geotechnical review received 4 August 2017 (RTIO-HSE-0313076)	RTIO-HSE-0313076	DWER records (A1499753)
8	Letter received from Department of Mines, Industry Regulation and Safety 10 August 2017	DMIRS, August 2017	DWER records (A1503740)
9	Monitoring and Management Plan (MMP)	RTIO, May 2016	DWER records (A1349052)
10	Email received from Rio Tinto 3 October 2017	RTIO, 3 October 2017	DWER records (A1533434)
11	Email received from Rio Tinto 27 October 2017	RTIO 27 October 2017	DWER records (A1550492)
12	Email received from Rio Tinto 8 November 2017	RTIO November 2017	DWER records (A1558087)
13	Email received from Rio Tinto 15 December 2017 providing comments on the draft amendment and decision document	-	DWER records (A1581594)
14	DER, October 2015. <i>Guidance Statement: Setting conditions.</i> Department of Environment Regulation, Perth.	DER 2015b	<a href="http://www.dwer.wa.gov.au">www.dwer.wa.gov.au</a>
15	DER, August 2016. <i>Guidance Statement: Licence duration.</i> Department of Environment Regulation, Perth.	DER 2016a	
16	DER, November 2016. <i>Guidance Statement: Risk Assessments.</i> Department of Environment Regulation, Perth.	DER 2016b	
17	DER, November 2016. <i>Guidance Statement:</i>	DER 2016c	

	<b>Document title</b>	<b>In text ref</b>	<b>Availability</b>
	<i>Decision Making</i> . Department of Environment Regulation, Perth.		
18	Ministerial statement 1038	MS1038	
19	Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), October 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, Chapters 1-7.	ANZECC 2000	accessed at <a href="http://www.agriculture.gov.au">www.agriculture.gov.au</a>
10	USEPA, May 2009 National Primary Drinking Water Regulation Table of Contaminants	USEPA 2009	accessed at <a href="http://www.epa.gov">www.epa.gov</a>
21	National Environment Protection Council, 1999 National Environment Protection (Assessment of Site Contamination) Measure	ASC NEPM	Accessed at <a href="http://www.nepc.gov.au">www.nepc.gov.au</a>

## Appendix 2: Summary of Licence Holder comments

The Licence Holder was provided with the draft Amendment on 23 November 2017 for review and comment. The Licence Holder responded on 21/12/2017. The following comments were received on the draft Amendment.

Condition	Summary of Licence Holder comment	DWER response
9	The Licence Holder does not believe that vibrating wire piezometers (VWP) are required within the southern pit wall as existing bores are adequate to monitor groundwater levels and responses during storm events.	DWER notes this response however since VWPs were listed in the design specification in the application submitted, the requirement to install VWPs will remain in condition 9. Condition 7 does provide flexibility on departures from construction requirements if the departure does not increase the risks to public health, public amenity or the environment. If the Licence Holder chooses to depart from this requirement, justification from a geotechnical engineer will be required in the compliance documentation required by condition 8 of the Licence.
9	Request to use existing bore MCB2 and MCB1 which are located to the south west and south east of the facility instead of installing bores to the east and west.	DWER notes this request and has included MCB1 and MCB2 in the monitoring regime within condition 16, Table 6. The groundwater flows in a south easterly direction towards Marillana Creek. The requirement to include additional bores within Table 6 has therefore been removed. This requirement has also been removed from the decision section of the decision report. Table 10 of the Licence has also been amended to include MCB2 as a monitoring bore for WFC5.
16	The Licence Holder has requested that groundwater monitoring for all waste fines cells is included in the Licence. The Licence Holder will then amend the Condition Environmental Management Plan required under Ministerial Statement 1038 so that there is no duplication between Part IV and Part V of the EP Act.	DWER notes this request but considers the request for significant changes to the Licence at this stage of the assessment to not be appropriate. Waste fines cells were not assessed under the Licence review dated 7 September 2017; therefore the appropriateness of the locations of the groundwater bores for waste fines cells 1, 2, 3 and 3A will require detailed assessment. The Licence Holder has been advised to apply for a Licence amendment after which a detailed assessment of the WFCs and monitoring regime will be undertaken. This assessment will also include a review of groundwater data for the proposed monitoring bores. The Licence Holder has confirmed that an amendment will be lodged early in 2018.
18	The Licence Holder has requested that the surface water monitoring is only undertaken if the sample point is safe to access.	DWER notes this request; however DWER must be able to determine compliance with the condition. If sampling is not undertaken due to access issues this must be reported in the Annual Audit Compliance Report. The Licence Holder has been given flexibility in providing the location of the sample point, and safety should be considered in any sampling program design. If the sample point requires changing, the Licence Holder will be required to apply for a licence amendment.
19(c)	The Licence Holder has requested that comparison is made to the 95% protection level for freshwater ecosystems instead of the 99% protection level on the basis that the ecosystem is an altered system.	DWER notes this request and has amended condition 19(c) accordingly. The decision report has also been updated to reflect this change.

Condition	Summary of Licence Holder comment	DWER response
21	<p>The Licence Holder has requested the removal of condition 21 below on the basis that this risk is a long-term risk more applicable to closure. The Licence Holder is to capture this as a concern in the stakeholder register and risk register within the Yandicoogina Closure Plan with appropriate actions identified.</p> <p><i>21. The Licence Holder shall submit to the CEO a report that determines the potential effects of contaminants within Waste Fines Cell 5 pit lake on aquatic invertebrates and waterbirds. The objectives of the report are to:</i></p> <p><i>(a) Provide a comparison of pit lake water quality data to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (ANZECC 2000) criteria for the protection of 95% (99% for substances that bioaccumulate and/or biomagnify – arsenic, cadmium, cobalt, chromium, copper, iron, mercury, manganese, nickel, lead, selenium and zinc) of species in freshwater ecosystems;</i></p> <p><i>(b) Detail the potential effects of pit lake water contaminants on aquatic invertebrates and waterbirds, identifying any species of conservation significance; and</i></p> <p><i>(c) Complete a risk assessment of impacts to aquatic invertebrates and waterbirds, deriving from exposure to contaminant concentrations of the pit lake waters.</i></p> <p><i>The report is required to be submitted to the CEO within 18 months of the JC Pit</i></p>	<p>DWER notes this request and has removed condition 21 on the basis that this will be captured in the Yandicoogina Closure Plan. Reference to condition 21 has been removed from the decision section of the decision report.</p> <p>If contaminants monitored through condition 18 become elevated during operation, further investigations may be required by the Licence Holder through a DWER initiated amendment.</p>

Condition	Summary of Licence Holder comment	DWER response
	<i>dewatering activities ceasing.</i>	
Figure 2 and Figure 7	The Licence Holder has provided a map depicting the groundwater and surface water monitoring locations for WFC5.	The Licence Holder has provided an update to Figure 2 and Figure 7 which have been included in the amended Licence.