Our Ref: 115146.04. L02b

16 November 2017

Aus Tin Mining Limited
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ATTENTION: Peter Williams

TARONGA TIN MINE STAGE 1 EIS – WATER BALANCE MODELLING CLARIFICATION

1 INTRODUCTION

Aus Tin Mining Limited (Aus Tin) received a request for further EIS clarification from the Director of Development, Planning & Regulatory Services of the New South Wales EPA via email on 30 October 2017 in relation to the proposed Taronga Tin Mine Development. This letter provides a response to the points raised in Attachment A of the EPA request, relating to the following items:

11. *The proponent must provide results from water-balance modelling with a daily time-step over an appropriate period with a climatic sequence that includes average, wet and dry rainfall years to estimate the potential annual overflow frequency. The proponent should address, but not be limited to the following issues:*

- *Spill volume must not reset to zero at the beginning of each financial year*
- *Results must be shown beyond the projected two year timeline*
- *- Storage volume in Farm Dam B appears to reach zero in some climatic/operational conditions, information must be provided on the likelihood, frequency and impact of no water in storage, including operational impacts and impacts on the Tailings Dam cover*
- *- Overflow frequency must be provided in terms of design storm exceedance rather than annual average probability.*
- *- Farm Dam B has a 99% probability of overflowing each year. Although the design storm is not provided, this overflow frequency is higher than best practice standards for a clean water dam (noting that in the site's proposed configuration, Farm Dam B is not considered a clean water dam as it will contain contaminated seepage).*

12. *The proponent must clarify whether the full potential catchment has been considered for rainfall events above the design storm for the clean water diversion drains (noting the drains will still provide a diversion benefit).*

13. *The proponent must clarify whether the Rejects Dam required environmental freeboard is 7.7 ML plus 2 ML to accommodate overflow from the Tailings Storage Facility (not a need for 9.7 ML plus 2 ML), or if 11.7 ML of freeboard is required and the Dam is undersized for the stated design storm.*

14. The proponent must clarify sizing requirements of each water control and interactions between each element and justify sizing based on the impact assessment.

2 BACKGROUND

2.1 General Water Balance Model Description and Climate Data Input

ATC Williams Pty Ltd. (ATCW) developed an Interim Water Management Plan report[1] (ATCW, 2016) for Aus Tin which details proposed water management for the site. The assessment included a water balance model of proposed site water infrastructure.

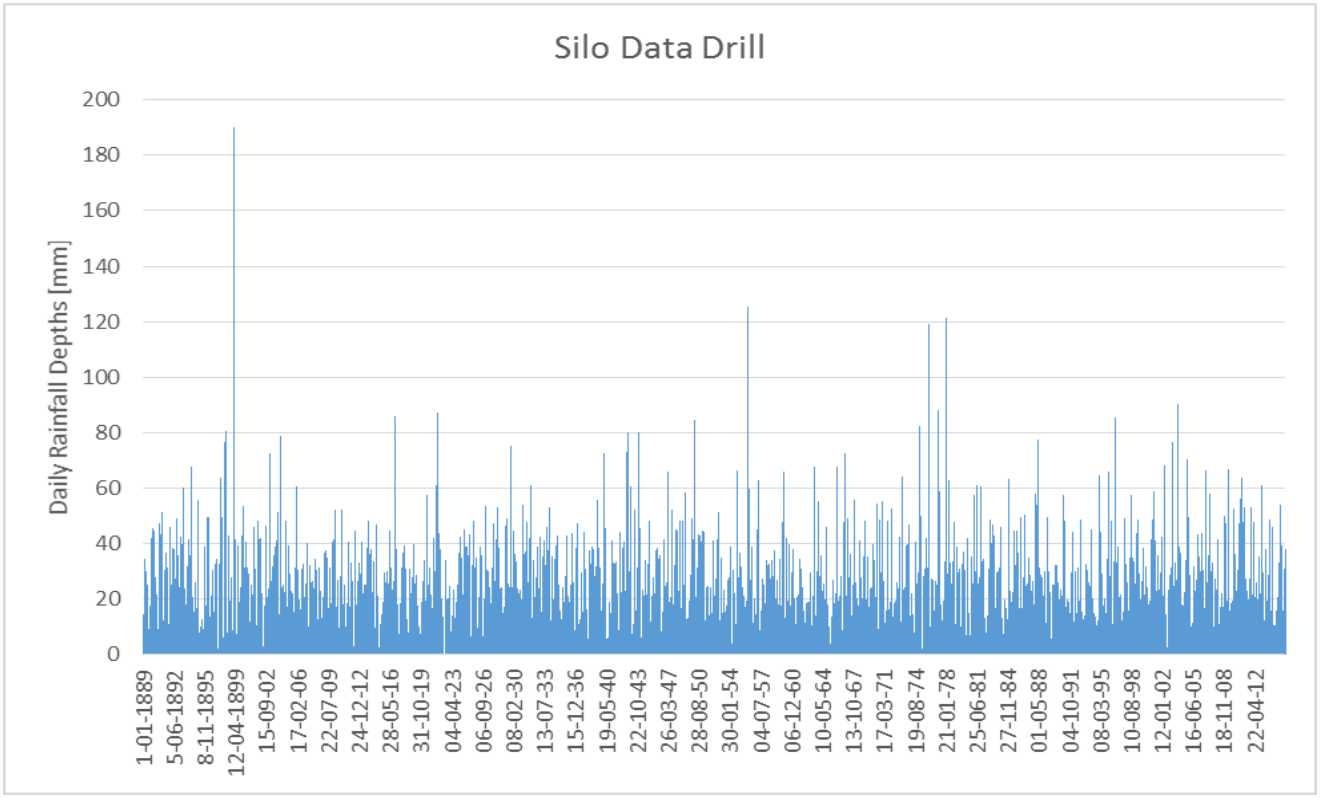
A daily time step water balance model (WBM) was completed using GoldSim Pro to simulate the site water management system, including the TSF Cell 1, TSF Cell 2, Farm Dam A, Farm Dam B and Pit Sump. Results were reported in volumetric and probabilistic formats to reflect containment requirements in the context of process water demands for the proposed Taronga Mine. These outcomes are directly influenced by local climatic parameters.

Input climatic data included Daily Rainfall (mm/day) and Class A Pan Evaporation (mm/day), was adopted from the SILO Data Drill Program (QLD Government: DSITI, 2017). Specifically, a SILO Data Drill was obtained for the site location – which provides an uninterrupted daily climate record spanning from 1 January 1890 to present. The Data Drill is based upon observed weather station data proximate to the site, with suspect and/or missing data entries supplemented (interpolated) from nearby regional stations.

The input climate data therefore considers the full range of climatic sequences available within the historical record. The daily rainfall (mm/day) records as sourced from SILO is presented graphically in **Plate 1**.

[1] *ATC Williams (2016), Taronga Tin Project Interim Water Management Plan, Report Number 115146.02*, prepared for Aus Tin Mining Ltd

Plate 1
Water Balance Model Rainfall Data



The modelling period adopted for the Taronga project was some 30 months, with an initial timeframe (for the purpose of modelling) spanning from 1 April 2016 to 1 October 2018. The TSF Cell 1 and 2 is proposed to be constructed during the initial 8 months of project development with the commission date for the process/TSF assigned to 1 December 2016.

Based on the above modelling period, the climatic data record (SILO Data Drill) was sampled for each possible sequence commencing from 1 April, providing a Monte Carlo risk simulation for the WBM to assess the performance of the proposed site water management infrastructure under all available climatic sequences. This Monte Carlo simulation is in accordance with procedures described in Australian Rainfall and Runoff Book IV (Pilgrim et al, 1987) and provides assessment of the proposed site infrastructure up to a 1 in 200 Annual Exceedance Probability (0.005 AEP, or 200 Year Average Recurrence Interval).

2.2 Water Management Infrastructure

As described in the Interim Water Management Plan report, the TSF Cell 1 will be situated hydraulically up-gradient and north of the TSF Cell 2, and Farm Dam B would be located downstream of TSF Cell 2. These storages were modelled reflecting the following proposed geometry (see **Table 1**):

Table 1
Storage Characteristics

Storage		Element	Adopted Modelling Condition
TSF (TSF Cell 1)	-	Catchment Area (Upstream)	1.255 ha
	-	Surface Area (at FSL)	0.16 ha
	-	Storage Capacity	9.569 ML
Rejects Dam (TSF Cell 2)	-	Catchment Area (Upstream)	3.7 ha

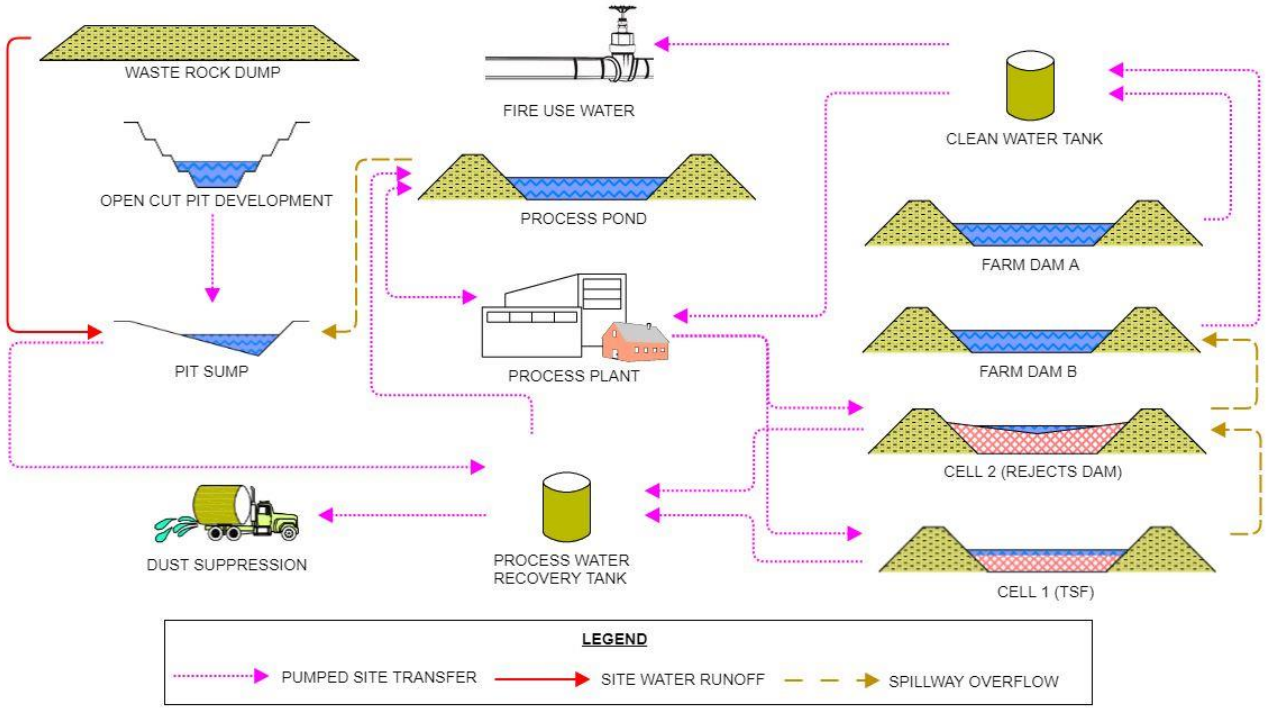
Storage	Element	Adopted Modelling Condition
	- Surface Area (at FSL)	3.1 ha
	- Storage Capacity	230 ML
	- Catchment Area (Upstream)	2.2 ha
Farm Dam A	- Surface Area (at FSL)	0.056 ha
	- Storage Capacity	0.87 ML
	- Catchment Area (Upstream)	22.54 ha
Farm Dam B	- Surface Area (at FSL)	0.63 ha
	- Storage Capacity	19 ML
	- Catchment Area (Upstream)	5.13 ha
Pit Sump	- Surface Area (at FSL)	0.1 ha
	- Storage Capacity	174.2 ML

The storages characteristics listed above were determined as part of an iterative WBM process to achieve spill risk in accordance with the NSW Dams Safety Committee based on the assessed Consequence Category as reported in ATCW (2016). The process water requirements/reliability was assessed based on acceptable risks as advised by Aus Tin. The TSF Cell 2 maximum operating level (MOL) was assigned as 224.2ML (5.8ML below the FSL capacity), which was determined based on the WBM to limit discharge via the spillway to Farm Dam B (and therefore the downstream environment).

2.3 Water Management Controls

The proposed site water management system (see Plate 2) aims to control the water levels in the TSF (Cell 1 and Cell 2) such that the water cover is maintained and that process water is sourced when available. The capacity of the TSF (including the tailings) and the pump rates (at a nominal rate of 30L/s for all site transfers) were adopted to limit the risk of uncontrolled release of mine affected water.

Plate 2
Site Water Management Flowchart



It is proposed that the TSF Cell 2 will not be filled beyond the maximum operating level during its operational life, to minimise spill risk. TSF Cell 2 is proposed to have sufficient capacity to store rejects and associated water, as well as provide flood capacity, as follows:

- Rejects Storage: 214.2ML
- Operational decant pond allowance: 10ML
- Total Freeboard, consisting of:
    - (1) Portion of Total Freeboard below FSL (Environmental Freeboard): 9.7ML; and
    - (2) Portion of Total Freeboard above FSL: 1m of vertical freeboard between FSL and the dam crest, in combination with the spillway, provides sufficient capacity for the Rejects Dam to pass the spillway design flood, which is a 10^{-4} Annual Exceedance Probability (AEP) flood event.

Based on the above water management the freeboard exceeds the DSC requirements, for a structure classified Significant.

2.4 Environmental Freeboard

The Environmental Freeboard determined for TSF Cell 1 and 2 is provided in Table 3. Critical Rainfall depth was determined from site IFD for the 1 in 10y AEP 72hr event as specified by NSW DSC for a Significant Consequence dam.

Table 2
Environmental Containment Freeboard

Storage Facility	Rainfall Depth	Catchment	Environmental Freeboard
TSF Cell 1	140.9 mm	1.41 ha	2.0 ML
TSF Cell 2	140.9 mm	6.90 ha	9.7 ML

3 EIS CLARIFICATION RESPONSE

In response to the EPA request as outlined above, the following comments are provided:

Table 3
Environmental Containment Freeboard

Item	Clarification Sought	Comment
11	*The proponent must provide results from water-balance modelling with a daily time-step over an appropriate period with a climatic sequence that includes average, wet and dry rainfall years to estimate the potential annual overflow frequency. The proponent should address, but not be limited to the following issues:*	As described above (Refer Section 2.1), the water balance modelling was run as a daily time-step for all available climatic sequences sourced from Silo Datadrill – total of 122 climate realisations were simulated/possible.
	Spill volume must not reset to zero at the beginning of each financial year	The calculation accumulating spill volumes is restarted for each year to enable determination of the worst case for Annual Exceedance Probabilities. Please note that this process is cumulative to measure total volumes likely (based on the input climate data) over a 12 month period for each year of operation. It must be noted that no water is removed from any of the storages thorough this process at any time during the modelling period.
	Results must be shown beyond the projected two year timeline	Results were reported for the modelling period, selected relevant to the proposed mining and processing campaign. Modelling of post-closure site conditions was not undertaken, as full closure details were not available at the time. Additional modelling will be undertaken when these details are finalised. Notwithstanding, it is recognised that post operational conditions would need to be consistent with spill risk requirements for each structure.
	Storage volume in Farm Dam B appears to reach zero in some climatic/operational conditions, information must be provided on the likelihood, frequency and impact of no water in storage, including	The modelling performed indicates that sourcing can result in an empty Farm Dam B during prolonged dry climatic sequences. The probability of such events occurring and resulting in a site water supply deficit was expressed in the form of

Item	Clarification Sought	Comment
	operational impacts and impacts on the Tailings Dam cover	non-operating days. **Section 4.4.2** of the Interim Water Management Plan report indicates approximately 62 work days (not including Sundays) of non-operating days based on a 99th percentile climate sequence (Representing extremely dry conditions). It is noted that water is supplied to meet TSF Cell 1 cover requirements as a 1st priority (followed by processing requirements). The WBM results indicate that a one metre water cover layer was sustained during the modelling period. Mining of ore could continue during this time provided that water is sourced from alternative sources, to reduce the number of non-operating days.
	Overflow frequency must be provided in terms of design storm exceedance rather than annual average probability.	The WBM represents simulation of long term storage response/performance based on daily climatic data and
	Farm Dam B has a 99% probability of overflowing each year. Although the design storm is not provided, this overflow frequency is higher than best practice standards for a clean water dam (noting that in the site's proposed configuration, Farm Dam B is not considered a clean water dam as it will contain contaminated seepage).	Spill risk determination is based on a WBM and cannot be determined based on storm events. It is noted that NSW DSC DSC3F guidance form (NSW DSC, 2012) indicates for Low Consequence category TSF (noting that Farm Dam B has only clean water), design storm recurrence interval is 1 year. It should also be noted based on ATCW (2016) that the average spill volume per year from Farm Dam B is less than 24.64ML per annum. Based on the Dam Consequence as currently assessed, it is considered that the sizing and spill risk is appropriate.
12	*The proponent must clarify whether the full potential catchment has been considered for rainfall events above the design storm for the clean water diversion drains (noting the drains will still provide a diversion benefit).*	The clean water diversion drains were sized based on design rainfall AEP consistent with the TSF Significant Consequence AEP, designed to convey runoff from a 0.10 AEP rainfall event (1 in 10 year event). The full diverted catchment for the Clean Water Diversion Drain was considered for the water balance modelling and estimation of spill volumes from Farm Dam B. Spillway design was undertaken assuming that upstream diversions fail and runoff from the full catchment must pass through the relevant storages spillways.
13	*The proponent must clarify whether the Rejects Dam required environmental freeboard is 7.7 ML*	Calculation for the Environmental Freeboard is provided in **Section 2.4** (sourced from ATCW, 2016).

Item	Clarification Sought	Comment
	plus 2 ML to accommodate overflow from the Tailings Storage Facility (not a need for 9.7 ML plus 2 ML), or if 11.7 ML of freeboard is required and the Dam is undersized for the stated design storm.	The TSF Cell 2 environmental freeboard is 9.7ML, based upon the catchment area of 6.90 ha (inclusive of TSF Cell 2 extents). The TSF Cell 1 environmental freeboard is 2.0ML, which is based upon an upstream catchment area of 1.41 ha (inclusive of TSF Cell 1 extents)
14	*The proponent must clarify sizing requirements of each water control and interactions between each element and justify sizing based on the impact assessment.*	The capacity of the TSF and the pump rates were adopted to limit the risk of uncontrolled release of mine affected water (see Section 2.3).

We trust the above assists in clarifying the items as requests by New South Wales EPA, and that the EPA official would contact the undersigned if additional clarification discussions would be required.

Yours sincerely,

Henning Boshoff
Principal Engineer
ATC Williams Pty Ltd