GRANTS LITHIUM PROJECT

Environmental Impact Statement

Appendix J

Water balance report

Prepared by EcOz

October 2018

Core Exploration Ltd,
Cox Peninsula

Grants Lithium Project
Preliminary Mine Site Water Balance Report

Report 01000405 - Final report

Core Exploration Limited

Grants Lithium Project

Preliminary Mine Site Water Balance Report

Report 01000405 - Final report

Table of Contents

List of Figures

List of Tables

1 Introduction

EnviroConsult Australia Pty Ltd was engaged by EcOz Environmental Consulting on behalf of Core Exploration Limited to conduct a preliminary mine site water balance study for the proposed Grants Lithium project. The Mine Lease Area is located near Berry Springs, approximately 25 km southwest of Darwin City, Northern Territory (Figure 1). EnviroConsult Australia has conducted a surface water assessment and EcOz has undertaken a groundwater assessment as part of the preparation of the Environmental Impact Statement (EIS). Results from these assessments have been used in developing a preliminary monthly water balance model in Microsoft Excel. This report outlines details of the water balance modelling approach and results.

2 Objectives and Scope

This preliminary water balance has been developed to support the EIS for the Project. The objectives and scope of work are:

- Development of a preliminary monthly water balance model providing estimates of expected water volumes on site and from external sources to support site water management;
- Produce deliveries complying with the Minerals Council of Australia Water Accounting Framework[1] (MCA WAF).

3 Methodology

3.1 Water balance model development

The monthly water balance model was developed using Microsoft Excel for a 25-month operational life of the mine. Ore processing will not be conducted in the first 4 months. The model was simulated using 50th percentile rainfall and evaporation data to reflect the water balance under a median climate condition.

Prior to developing the water balance model, the schematic of the water balance system was established based on available drawings and design information. The schematic is illustrated by the flow chart in Figure 2.

In the Microsoft Excel spreadsheet, inputs, outputs and flow between components were entered in columns and relationships described by built-in equations. Storages were modelled in separate tables for inputs, outputs and changing inventories.

The detailed water balance modelling results are in Appendix.

[1] Minerals Council of Australia 2014. Water Accounting Framework for the Minerals Industry, User guide, Version1.3, January 2014.

3.2 Deliverables in accordance with the MCA WAF

The Terms of Reference for the Preparation of an Environmental Impact Statement[2] for this project indicates that the water balance should be based on the MCA WAF. Therefore, the following deliverables were prepared based on the MCA WAF guidelines and the Microsoft Excel water balance model:

- Input-Output Statement which lists flows for all input and output categories for the reporting period, along with the change in storage;
- Accuracy Statement which lists the percentage of flows that were measured, simulated and estimated;
- Statement of Operational Efficiencies which lists the total flows into the tasks, volume of reused water, reuse efficiency, the volume of recycled water and recycling efficiency.

[2] NTEPA 2018. Terms of Reference for the Preparation of an Environmental Impact Statement, Grants Lithium Project, Core Exploration Limited.

4 0 4 8 12 km

Data source:
Base Map - ESRI Satellite (ArcGIS/World Imagery)

Legend

Mine Lease Area

N

Figure 1. Location of Mine Lease Area

Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)
Grid: Map Grid of Australia (MGA) zone 52

CORE EXPLORATION LTD

ECAust
EnviroConsult Australia Pty Ltd

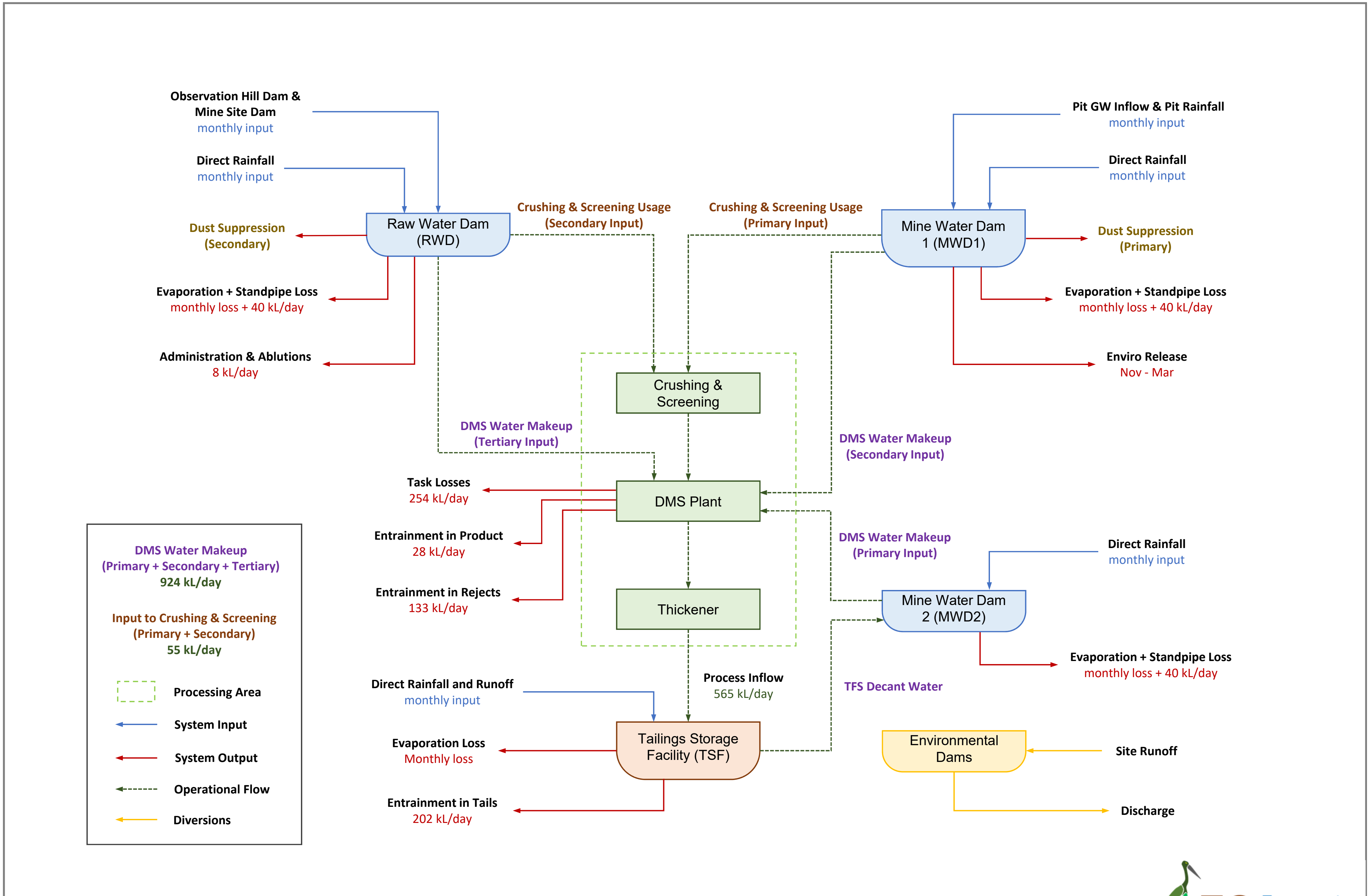


Figure 2. Preliminary Water Balance Schematic

4 Climate Data

Climate data used for the water balance were collected from the Bureau of Meteorology (BOM). The station numbers and general data information are in Table 1. The Darwin Airport climate station was selected as it has the longest high-quality continuous rainfall record and it is relatively close to the mine site in the region. Darwin airport is also the closet station having complete evaporation data for the last decade, so its pan evaporation data was adopted for the water balance.

Table 1. Selected climate data.

Station number	Description	Period of record
BOM 014015	Monthly Rainfall – Darwin Airport	1941 - 2018
BOM 014015	Monthly Pan Evaporation – Darwin Airport	2009 - 2018

The 50th percentile monthly rainfall and pan evaporation depths adopted for this study are in Table 2.

Table 2. 50th percentile monthly rainfall and pan evaporation depths.

Month	50th percentile rainfall depth (mm)	50th percentile pan evaporation rate (mm)
Jan	425.7	170.9
Feb	361.4	159.7
Mar	283.9	175.7
Apr	74.1	172.9
May	4.8	188.8
Jun	0.0	194.5
Jul	0.0	195.5
Aug	0.0	212.2
Sep	5.8	214.4
Oct	53.7	215.2
Nov	142.8	188.6
Dec	225.8	170.8
Total	**1578**	**2259**

5 Water Balance Model Setup

The water balance model was developed in a Microsoft Excel spreadsheet based on the water balance flow chart in Figure 2. As the modelling results would be used to generate deliverables in accordance with the MCA WAF guidelines, the water balance model was established as the combination of an Inputs-Outputs model which describes the flows between the environment and the boundary of the operational facility (i.e. Inputs, outputs and diversions) and an operational model which describes the flows internal to the operational facility (i.e. the flows between the stores, tasks and treatment plants).

According to the guidelines, a water quality category is assigned to each input, output and diversion. The water quality categories are described in the guidelines as follows:

- Category 1: Water is of a high quality and may require no or minimal inexpensive treatment (for example disinfection and pond settlement of solids) to raise the quality to appropriate drinking water standards;
- Category 2: Water is of a medium quality with individual constituents encompassing a wide range of values. It would require a moderate level of treatment such as disinfection, neutralisation, removal of solids and chemicals to meet appropriate drinking water standards;
- Category 3: Water is of a low quality with individual constituents encompassing high values of total dissolved solids, elevated levels of dissolved metals or extreme levels of pH. It would require significant treatment to remove dissolved solids and metals through neutralisation and/or disinfection to meet appropriate drinking water standards.

5.1 Inputs

Inputs are volumes of water received by the operational facility for use in the water balance system. The inputs to the water balance are indicated by blue line arrows in Figure 2. Details of data and equations used to calculate inputs are described below.

5.1.1 Groundwater inflow and pit rainfall

Groundwater inflow to the mine pit was estimated via ground water modelling conducted by EcOz Environmental Consulting. The monthly groundwater inflows for a 26-month design mine life are shown in Table 3.

Table 3. Groundwater inflow.

Month		Inflow (kL/day)	Inflow (kL/month)
1	July	178	5353
2	August	808	25051
3	September	1125	34871
4	October	1412	42361
5	November	1467	45478
6	December	1744	52323
7	January	1768	54815
8	February	1936	60029
9	March	2030	56827
10	April	1561	48392
11	May	1763	52891

12	June	1615	50057
13	July	1687	50618
14	August	1534	47544
15	September	1547	47952
16	October	1599	47982
17	November	1484	45993
18	December	1593	47782
19	January	1522	47195
20	February	1616	50098
21	March	1737	50382
22	April	1497	46396
23	May	1639	49155
24	June	1504	46609
25	July	1494	44835

Direct pit rainfall run-off volume $V_{Pit\text{-}runoff}$ (ML) is determined as:

$$V_{Pit\text{-}runoff} = 0.01 \times R \times A$$

Where *R* (mm) is the rainfall depth, *A* is the pit area (12.6 ha).

The pit groundwater inflow and pit rainfall runoff water will be directly pumped into MWD1 (Figure 2).

These flows are assigned to Category 2 water quality.

5.1.2 External Surface Water Storages

Water will be extracted from Observation Hill Dam and the mine site dam to make up the shortfall during mining operations. This volume will be calculated by balancing other inputs and outputs and storage changes of the system. This water is assigned Category 1.

5.1.3 Storage aggregation

To calculate operational efficiency, the MCA WAF guidelines require the storages to be grouped into a Raw Water Store and a Mixed Water Store. As the storages were modelled separately in the Excel water balance model, the modelling results were grouped as follows:

- The Raw Water Dam (RWD) only receives inflows form external water storages (Observation Hill Dam and Mine Site Dam) and direct rainfall so it is grouped into the Raw Water Store.
- The Mine Water Dam 1 (MWD1) receives direct rainfall, pit rainfall runoff and ground water inflow, so it is grouped into the Raw Water Store.
- The Mine Water Dam 2 (MWD2) receives direct rainfall and decant water from the TSF which is worked water, so it is a Mixed Water Store.

The TSF acts as both a task and a storage. The TSF stores raw water from direct rainfall and runoff from disturbed areas and worked inflow. The water in the TSF needs to be separated into raw and worked water before calculating the reuse efficiency.

The Environmental Dams are used to receive runoff from disturbed land. Their inputs are rainfall and runoff from the disturbed mine site area which is not involved in mining operations. Therefore, the Environmental Dams are not considered as stores.

The mine site storages and grouped stores are summarised in Table 4.

Table 4. Mine site stores and grouped stores.

Storage name	Raw or Mixed Store	Surface Area (m^2)	Disturbed Catchment area (m^2)
RWD	Raw	16000	0
MWD1	Raw	46000	0
Raw water store	**Total**	**62000**	**0**
MWD2	Mixed	12000	0
Mixed water store	**Total**	**12000**	**0**
TSF	N/A	20000	95000

To calculate the volume of rainfall incident on the stores $V_{Rainfall}$ (ML):

$$V_{Rainfall} = 10^{-6} \times R \times SA$$

Where *R* (mm) is the rainfall depth, and SA (m^2) is the storage surface areas.

As rainfall is directly incident on the stores, to the contained water is of good quality so it is assigned to Category 1.

The runoff volume to the TSF ($V_{Runoff)}$ is:

$$V_{Runoff} = 10^{-6} \times R \times A$$

Where *R* (mm) is the rainfall depth, A (m^2) is the disturbed catchment area and V_{Runoff} is in ML.

The runoff from the disturbed catchment will usually be of a poorer quality therefore it can be assigned to Category 2.

5.2 Outputs

Outputs are volumes of water removed from the operational facility after it has been through a task, treated or stored for use. The outputs are indicated by dark red line arrows in Figure 2. Details of data and equations used to calculate outputs are described below.

5.2.1 Entrained water in the product and waste material

According to the information provided by the design team, the volume of entrained water in the product was estimated as 27.5 kL/day. The water entrained in tailings was estimated as 202 kL/day. The water entrained in rejects was estimated as 133 kL/day.

It is assumed that entrained water will be of very poor quality, so it is assigned to Category 3.

5.2.2 Evaporation

Evaporation V_{Evap} from storage surfaces was calculated by:

$$V_{Evap} = 10^{-6} \times SEvap \times PanEvap \times f$$

Where SEvap is the average water surface area (m^2) in the storage. PanEvap is the value of measured rates of pan evaporation. f is a correction factor to convert pan evaporation rate into evaporation losses from open storages. An estimate of 0.75 recommended by the MCA WAF guidelines was used.

A constant extra evaporation loss of 40 kL/day was applied to each storage to cover standpipe losses.

There will also be evaporation of the water used for dust suppression and Administration/Ablutions. The dust suppression losses were calculated based on a varying rate for each mining stage (Table 5). The Administration/Ablutions losses were calculated at a rate of 8 kL/day.

Table 5. Dust suppression at each mining stage.

Month of operation	Rate (kL/day)
1-4	900
5-21	1020
22-25	420

The water quality of evaporated water is assigned to Category 1.

5.2.3 Seepage

Losses due to seepage was not considered in this water balance, as the volume of seepage losses are minor compared to other outputs. The fines are expected to settle to the bottom of the storage to from an impermeable layer.

5.2.4 Task losses

Processing losses were estimated to be 254 kL/day. This daily rate was calculated from balancing the DMS plant.

5.2.5 Discharge to environment

The excess inventory in MWD1 is discharged to the environment during the wet season (November - March). The maximum discharge rate is 50 L/s. A minimum inventory of 60 ML is kept in MWD1 to ensure water supply in the dry season.

5.3 Diversions

Diversions are flows from an input to an output without being utilised by the operational facility. The flow is not stored with the intention of being used in a task or treated. The diversions are indicated by yellow line arrows in Figure 2. Details of data and equations used to calculate diversions are described below.

5.3.1 Mine site runoff

It was assumed that the runoff from the mine site only flows into the Environmental Dams (sedimentation ponds). This water will not be involved in mining operation, so it is treated as diverted flow.

The mine site has a hydrological model, but the model was developed in an earlier stage of the project. As the mine site design had been updated during the preparation of this water balance, the site runoff was calculated manually based on the latest mine site design available.

To calculate the site run-off volume V_{Runoff} (ML) use:

$$V_{Runoff} = 0.01 \times R \times A \times \beta$$

where R (mm) is the rainfall depth, A is the disturbed catchment area (ha) and β is a rainfall/runoff factor.

The total disturbed catchment area bounded by topsoil and inundation bund, which does not include the area of storages, pit and TSF, is 113 ha. An estimate for β is 0.15 for disturbed area.

As this water is runoff from disturbed area, it is assigned to Category 2.

5.4 Operational flows

Operation flows are internal to the operational facility, such as the flows between the stores and tasks and treatment plants.

Tasks are operational activities that use water. The water received as an input and has not been used in a task is regarded as raw water. The raw water will become worked water after it has been through a task.

The operational flows are indicated by dark green dash line arrows in Figure 2. The volumes of operational flows are estimated based on the information provided by design team.

The total crushing and screening water use is estimated as 55 kL/day.

The total DMS makeup water is estimated as 924 kL/day

The process flow from the Thickener to TSF is estimated to be 565 kL/day

The TSF Decant flow to MWD2 will be calculated by balancing the TSF.

As the ore processing will not be conducted in the first 4 months, there will be no operational flows during this course.

6 MCA WAF Deliverables

6.1 Input-Output Statement

The Input-Output statement is prepared in accordance with the MCA WAF guidelines and the water balance modelling results in Appendix. The reporting period is form 01/07/2019 to 31/07/2021 which is the design life of the mine. The statement is in Table 6.

Table 6. Input-Output statement

Inputs and Outputs for the reporting period (1st July 2019 to 31st July 2021)							
Input/ Output	**Source/ Destination**	**Inputs/ Outputs**	**Water quality**			**Note**	**How were the flows obtained and what is the confidence level of them?**
			Cat1 (ML)	**Cat2 (ML)**	**Cat3 (ML)**		
Input	Surface Water	Precipitation and Runoff	297	698	0	1	Estimated/Low
		External Storages	82	0	0	2	Estimated/Low
	Groundwater	Aquifer interception	0	1151	0	3	Simulated/Medium
	Total Inputs		**379**	**1849**	**0**		
Output	Surface Water	Discharge	476	0	0	4	Estimated/Low
	Other	Evaporation	1090	0	0	5	Estimated/Medium
		Entrainment	0	0	231	6	Estimated/Medium
		Task losses	0	162	0	7	Estimated/Medium
	Total Outputs		**1566**	**162**	**231**		

Diversions							
Input	Surface Water	Precipitation and Runoff		537		8	Estimated/Low
	Total Inputs			**537**			
Output	Surface Water	Discharge	537				Estimated/Low
	Total Outputs		**537**				

Notes for Input-Output statement:

1. The precipitation and runoff were estimated using the equations in section 5.1.1 and 5.1.3 and BOM rainfall data from Table 2.
2. The water extracted from external storages was estimated by balancing the whole water balance system.
3. The pit groundwater inflows (Table 3) are from the result of groundwater modelling conducted by EcOz.

4. The water released form MWD1 was estimated by balancing the storage.
5. The evaporation from storage was estimated using the equation in Section 5.2.2 and BOM evaporation data from Table 2.
6. The entrainment was estimated based on the entrainment rates in Section 5.2.1.
7. The task loss was estimated by balancing the DMS plant.
8. The site runoff was estimated by the equation in Section 5.3.1. A runoff/rainfall coefficient of 0.15 from the MCA WAF guidelines was adopted for the disturbed area.

The volumes of water in storages at the beginning and end of the reporting period is in

Table 7. volumes of water in storages

	RWD	MWD1	MWD2	TSF	Total
1st July 2019	0	0	0	0	0
31st July 2021	0	169	0	100	269
Changes in storage	0	169	0	100	269

Total Inputs – Total Outputs = (379+1849) – (1566+162+231) = 269 ML = Change in storage

The system is in balance

6.2 Accuracy Statement

The Accuracy Statement shows the proportions of flows by volume which are measured, estimated or simulated along with the level of confidence with which that number is known. The proportions of flows are calculated based on the flow volumes in Table 6.

The Accuracy Statement is in Table 8.

Table 8. Accuracy statement.

Types	% of all Flows	Confidence (%)		
		High	Medium	Low
Measured	0%	0%	0%	0%
Estimated	78%	0%	28%	50%
Simulated	22%	0%	22%	0%
Total		0%	50%	50%

6.3 Statement of Operational Efficiencies

The stores have been grouped into a Raw Water Store and a Mixed Water Store in Section 5.1.3. An operational flow chart with grouped stores and tasks is then developed based on the modelling results and the water balance schematic in Figure 2. The operational flow chart is in Figure 3. The Statement of Operational Efficiencies is then calculated based on this operational flow chart.

Total inflow into tasks (grey boxes) during the reporting period =

35+35+176+414+360+360+300+63+688+6 = 2437 ML

As the TSF acting as a water store, the flow coming out of it is not 100% worked water but a mix of raw and worked. The proportion in the TSF is calculated as flowing:

Raw water (flows from green boxes) to TSF = 363 ML

Worked water (flows from grey boxes) to TSF = 360 ML

Assume the proportion of worked water in the TSF is the same as the proportion of worked water that enters the TSF. The proportion of worked water in the TSF = 50%

The worked water flow from the TSF to the Mixed Water Store is 50% of 436 = 218 ML

Raw water (flows from green boxes) to Mixed Water Store = 218+38 = 256 ML

Worked water (flows from grey tasks) to Mixed Water Store = 218 ML

Assume the proportion of worked water in the Mixed Water Store is the same as the proportion of worked water that enters the Mixed Water Store. So, the proportion of worked water in the Mixed Water Store = 46%

Worked water to tasks = flows from tasks to tasks + proportion of worked water in Mixed Water Store × flow from Mixed Water Store to tasks = 35+360+360+46% × (414) = 945 ML

Reuse Efficiency = Worked water flows to tasks as a proportion of the total flows to tasks

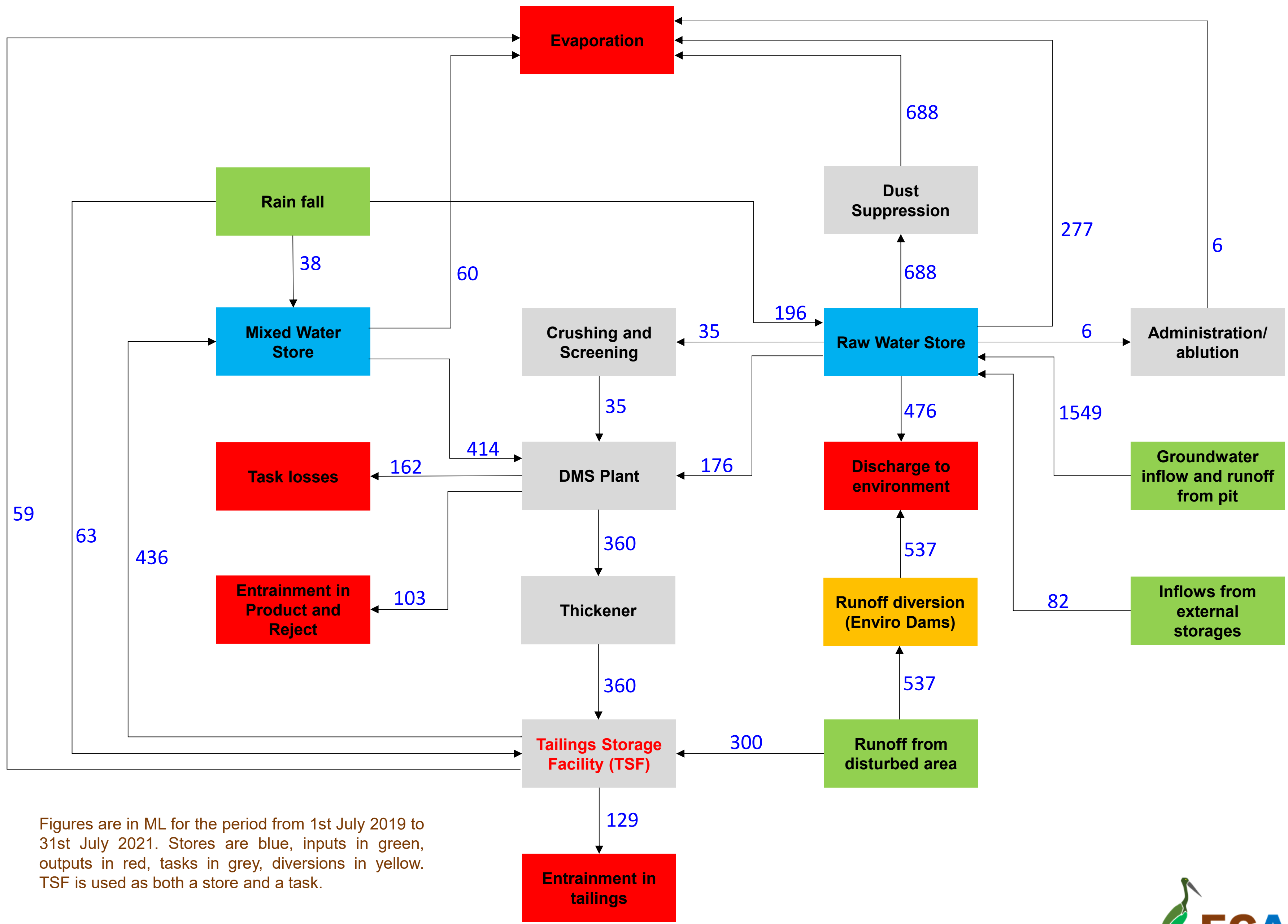
= 945/2437 = 39%

There is no treatment plant on-site so there is no recycled water.

The Statement of Operational Efficiencies for this project is in Table 9.

Table 9. Statement of Operational Efficiencies.

Operational efficiencies	
Total volume to tasks (ML)	2437
Total volume of reused water (ML)	945
Reuse efficiency (%)	39
Total volume of recycled water (ML)	0
Recycling efficiency (%)	0



Figures are in ML for the period from 1st July 2019 to 31st July 2021. Stores are blue, inputs in green, outputs in red, tasks in grey, diversions in yellow. TSF is used as both a store and a task.

Figure 3. Operational flow chart

7 MCA WAF Deliverables for the scenario when no dust suppression in January and February

7.1 Input-Output Statement

Table 10. Input-Output statement for the scenario when no dust suppression in Jan and Feb.

Inputs and Outputs for the reporting period (1st July 2019 to 31st July 2021)							
Input/ Output	Source/ Destination	Inputs/ Outputs	Water quality			Note	How were the flows obtained and what is the confidence level of them?
			Cat1 (ML)	Cat2 (ML)	Cat3 (ML)		
Input	Surface Water	Precipitation and Runoff	297	698	0	1	Estimated/Low
		External Storages	82	0	0	2	Estimated/Low
	Groundwater	Aquifer interception	0	1151	0	3	Simulated/Medium
	Total Inputs		**379**	**1849**	**0**		
Output	Surface Water	Discharge	597	0	0	4	Estimated/Low
	Other	Evaporation	969	0	0	5	Estimated/Medium
		Entrainment	0	0	231	6	Estimated/Medium
		Task losses	0	162	0	7	Estimated/Medium
	Total Outputs		**1566**	**162**	**231**		

Diversions							
Input	Surface Water	Precipitation and Runoff		537		8	Estimated/Low
	Total Inputs			**537**			
Output	Surface Water	Discharge	537				Estimated/Low
	Total Outputs		**537**				

Notes for Input-Output statement:

9. The precipitation and runoff were estimated using the equations in section 5.1.1 and 5.1.3 and BOM rainfall data from Table 2.
10. The water extracted from external storages was estimated by balancing the whole water balance system.
11. The pit groundwater inflows (Table 3) are from the result of groundwater modelling conducted by EcOz.
12. The water released form MWD1 was estimated by balancing the storage.

13. The evaporation from storage was estimated using the equation in Section 5.2.2 and BOM evaporation data from Table 2.
14. The entrainment was estimated based on the entrainment rates in Section 5.2.1.
15. The task loss was estimated by balancing the DMS plant.
16. The site runoff was estimated by the equation in Section 5.3.1. A runoff/rainfall coefficient of 0.15 from the MCA WAF guidelines was adopted for the disturbed area.

The volumes of water in storages at the beginning and end of the reporting period is in Table 11.

Table 11. volumes of water in storages

	RWD	MWD1	MWD2	TSF	Total
1st July 2019	0	0	0	0	0
31st July 2021	0	169	0	100	269
Changes in storage	0	169	0	100	269

Total Inputs – Total Outputs = (379+1849) – (1566+162+231) = 269 ML = Change in storage

The system is in balance

7.2 Accuracy Statement

The Accuracy Statement shows the proportions of flows by volume which are measured, estimated or simulated along with the level of confidence with which that number is known. The proportions of flows are calculated based on the flow volumes in Table 10.

The Accuracy Statement is in Table 12.

Table 12. Accuracy statement.

Types	% of all Flows	Confidence (%)		
		High	Medium	Low
Measured	0%	0%	0%	0%
Estimated	78%	0%	26%	52%
Simulated	22%	0%	22%	0%
Total		0%	48%	52%

7.3 Statement of Operational Efficiencies

The operational flow chart for this scenario is in Figure 4. The Statement of Operational Efficiencies is then calculated based on this operational flow chart.

Total inflow into tasks (grey boxes) during the reporting period =

35+35+176+414+360+360+300+63+567+6 = 2316 ML

As the TSF acting as a water store, the flow coming out of it is not 100% worked water but a mix of raw and worked. The proportion in the TSF is calculated as flowing:

Raw water (flows from green boxes) to TSF = 363 ML

Worked water (flows from grey boxes) to TSF = 360 ML

Assume the proportion of worked water in the TSF is the same as the proportion of worked water that enters the TSF. The proportion of worked water in the TSF = 50%

The worked water flow from the TSF to the Mixed Water Store is 50% of 436 = 218 ML

Raw water (flows from green boxes) to Mixed Water Store = 218+38 = 256 ML

Worked water (flows from grey tasks) to Mixed Water Store = 218 ML

Assume the proportion of worked water in the Mixed Water Store is the same as the proportion of worked water that enters the Mixed Water Store. So, the proportion of worked water in the Mixed Water Store = 46%

Worked water to tasks = flows from tasks to tasks + proportion of worked water in Mixed Water Store × flow from Mixed Water Store to tasks = 35+360+360+46% × (414) = 945 ML

Reuse Efficiency = Worked water flows to tasks as a proportion of the total flows to tasks

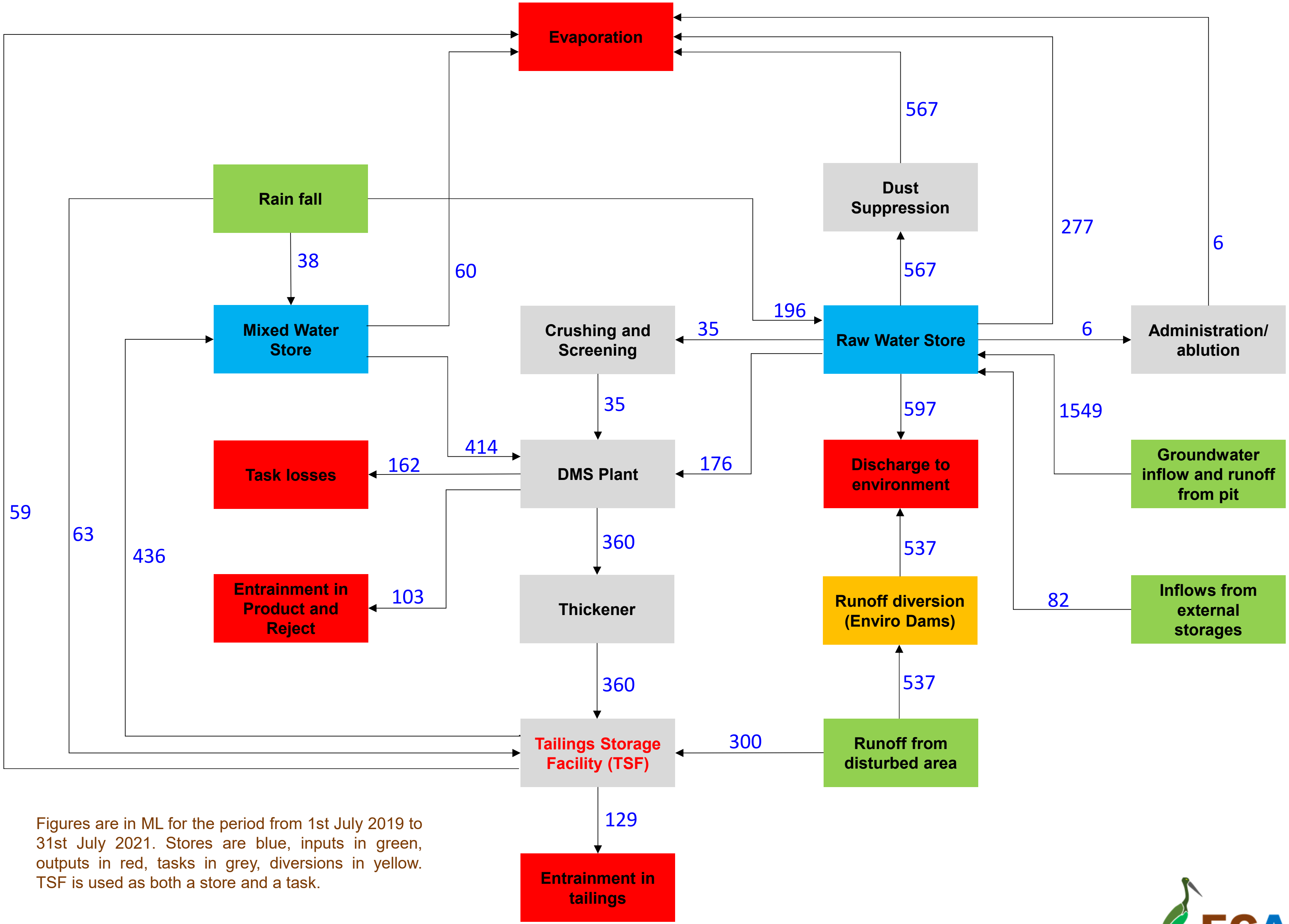
= 945/2316 = 41%

There is no treatment plant on-site so there is no recycled water.

The Statement of Operational Efficiencies for this project is in Table 13Table 9.

Table 13. Statement of Operational Efficiencies.

Operational efficiencies	
Total volume to tasks (ML)	2316
Total volume of reused water (ML)	945
Reuse efficiency (%)	41
Total volume of recycled water (ML)	0
Recycling efficiency (%)	0



Figures are in ML for the period from 1st July 2019 to 31st July 2021. Stores are blue, inputs in green, outputs in red, tasks in grey, diversions in yellow. TSF is used as both a store and a task.

Figure 4. Operational flow chart for the scenario when no dust suppression in January and February

ECAust EnviroConsult Australia Pty Ltd

Appendix A. Water balance modelling results

Mine Water Dam 1 balance (ML)

Months of operation	Ground water Inflow to pit	Rainfall to pit	Direct rainfall	Evaporation + Standpipe loss	Dust Suppression (Primary)	DMS water makeup (Secondary)	Crushing & Screening (Primary)	Enviro Release	Inventory
0									0.0
1	5.4	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0
2	25.1	0.0	0.0	8.6	16.5	0.0	0.0	0.0	0.0
3	34.9	0.7	0.3	8.6	27.0	0.0	0.0	0.0	0.3
4	42.4	6.8	2.5	8.7	27.9	0.0	0.0	0.0	15.3
5	45.5	18.0	6.6	7.7	30.6	27.7	1.7	0.0	17.7
6	52.3	28.5	10.4	7.1	31.6	28.6	1.7	0.0	39.8
7	54.8	53.7	19.6	7.1	31.6	5.7	1.7	61.7	60.0
8	60.0	45.6	16.6	6.6	28.6	0.0	1.5	85.5	60.0
9	56.8	35.8	13.1	7.3	30.6	0.0	1.7	66.2	60.0
10	48.4	9.3	3.4	7.2	30.6	0.0	1.7	0.0	81.7
11	52.9	0.6	0.2	7.8	31.6	0.0	1.7	0.0	94.4
12	50.1	0.0	0.0	7.9	30.6	19.6	1.7	0.0	84.7
13	50.6	0.0	0.0	8.0	31.6	23.6	1.7	0.0	70.4
14	47.5	0.0	0.0	8.6	31.6	23.8	1.7	0.0	52.3
15	48.0	0.7	0.3	8.6	30.6	22.5	1.7	0.0	38.0
16	48.0	6.8	2.5	8.7	31.6	16.6	1.7	0.0	36.6
17	46.0	18.0	6.6	7.7	30.6	4.2	1.7	3.1	60.0
18	47.8	28.5	10.4	7.1	31.6	0.0	1.7	46.2	60.0
19	47.2	53.7	19.6	7.1	31.6	0.0	1.7	80.0	60.0
20	50.1	45.6	16.6	6.7	29.6	0.0	1.6	74.5	60.0
21	50.4	35.8	13.1	7.3	31.6	0.0	1.7	58.6	60.0
22	46.4	9.3	3.4	7.2	12.6	0.0	1.7	0.0	97.7
23	49.2	0.6	0.2	7.8	13.0	0.0	1.7	0.0	125.2
24	46.6	0.0	0.0	7.9	12.6	0.0	1.7	0.0	149.7
25	44.8	0.0	0.0	8.0	13.0	3.7	1.7	0.0	168.1
Total	**1151.0**	**398.0**	**145.2**	**190.4**	**649.0**	**175.9**	**35.1**	**475.7**	

Mine Water Dam 2 balance (in ML)

Months of operation	Direct rainfall	Evaporation + Standpipe loss	TSF decant water inflow	DMS water makeup (Primary)	Inventory
0					**0.0**
1	0.0	0.0	0.0	0.0	**0.0**
2	0.0	0.0	0.0	0.0	**0.0**
3	0.1	0.1	0.0	0.0	**0.0**
4	0.6	0.6	0.0	0.0	**0.0**
5	1.7	1.7	0.0	0.0	**0.0**
6	2.7	2.7	0.0	0.0	**0.0**
7	5.1	2.8	20.7	23.0	**0.0**
8	4.3	2.6	24.1	25.9	**0.0**
9	3.4	2.8	27.1	27.7	**0.0**
10	0.9	2.8	29.6	27.7	**0.0**
11	0.1	2.9	31.5	28.6	**0.0**
12	0.0	3.0	11.1	8.2	**0.0**
13	0.0	3.0	8.1	5.1	**0.0**
14	0.0	3.1	8.0	4.9	**0.0**
15	0.1	3.1	8.3	5.3	**0.0**
16	0.6	3.2	14.6	12.1	**0.0**
17	1.7	2.9	24.7	23.6	**0.0**
18	2.7	2.8	28.7	28.6	**0.0**
19	5.1	2.8	26.3	28.6	**0.0**
20	4.3	2.6	25.1	26.8	**0.0**
21	3.4	2.8	28.1	28.6	**0.0**
22	0.9	2.8	29.6	27.7	**0.0**
23	0.1	2.9	31.5	28.6	**0.0**
24	0.0	3.0	30.7	27.7	**0.0**
25	0.0	3.0	27.9	24.9	**0.0**
Total	**37.9**	**59.9**	**435.6**	**413.6**	

Raw Water Dam balance (in ML)

Months of operation	Direct rainfall	Inflow from OHD & Mine Site Dam	Evaporation + Standpipe loss	Administration & ablution	Dust suppression (Secondary)	DMS water makeup (Tertiary)	Crushing & Screening (Secondary)	Inventory
0								0.0
1	0.0	31.7	3.6	0.2	27.9	0.0	0.0	0.0
2	0.0	15.4	3.8	0.2	11.4	0.0	0.0	0.0
3	0.1	3.9	3.8	0.2	0.0	0.0	0.0	0.0
4	0.9	3.2	3.8	0.2	0.0	0.0	0.0	0.0
5	2.3	1.4	3.5	0.2	0.0	0.0	0.0	0.0
6	3.6	0.0	3.3	0.2	0.0	0.0	0.0	0.1
7	6.8	0.0	3.3	0.2	0.0	0.0	0.0	3.3
8	5.8	0.0	3.0	0.2	0.0	0.0	0.0	5.9
9	4.5	0.0	3.3	0.2	0.0	0.0	0.0	6.9
10	1.2	0.0	3.3	0.2	0.0	0.0	0.0	4.5
11	0.1	0.0	3.5	0.2	0.0	0.0	0.0	0.9
12	0.0	2.9	3.5	0.2	0.0	0.0	0.0	0.0
13	0.0	3.8	3.6	0.2	0.0	0.0	0.0	0.0
14	0.0	4.0	3.8	0.2	0.0	0.0	0.0	0.0
15	0.1	3.9	3.8	0.2	0.0	0.0	0.0	0.0
16	0.9	3.2	3.8	0.2	0.0	0.0	0.0	0.0
17	2.3	1.4	3.5	0.2	0.0	0.0	0.0	0.0
18	3.6	0.0	3.3	0.2	0.0	0.0	0.0	0.1
19	6.8	0.0	3.3	0.2	0.0	0.0	0.0	3.3
20	5.8	0.0	3.1	0.2	0.0	0.0	0.0	5.8
21	4.5	0.0	3.3	0.2	0.0	0.0	0.0	6.8
22	1.2	0.0	3.3	0.2	0.0	0.0	0.0	4.4
23	0.1	0.0	3.5	0.2	0.0	0.0	0.0	0.8
24	0.0	3.0	3.5	0.2	0.0	0.0	0.0	0.0
25	0.0	3.8	3.6	0.2	0.0	0.0	0.0	0.0
Total	**50.5**	**81.9**	**87.0**	**6.1**	**39.3**	**0.0**	**0.0**	

TSF balance (in ML)

Months of operation	Direct rainfall	TSF runoff water	Evaporation	Entrainment in tails	Process inflow	TSF decant water	Inventory	Tails production	TSF storage availability	Contingency water storage if required
0							**0.0**		515.0	515.0
1	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	515.0	515.0
2	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	515.0	515.0
3	0.1	0.6	0.6	0.0	0.0	0.0	**0.1**	0.0	515.0	514.9
4	1.1	5.1	2.8	0.0	0.0	0.0	**3.5**	0.0	515.0	511.5
5	2.9	13.6	2.6	6.1	16.9	0.0	**28.2**	12.6	502.4	474.2
6	4.5	21.5	2.6	6.3	17.5	0.0	**62.9**	13.0	489.4	426.5
7	8.5	40.4	2.4	6.3	17.5	20.7	**100.0**	13.0	476.4	376.4
8	7.2	34.3	2.6	5.7	15.8	24.1	**125.0**	11.8	464.6	339.6
9	5.7	27.0	2.6	6.1	16.9	27.1	**138.8**	12.6	452.0	313.2
10	1.5	7.0	2.8	6.1	16.9	29.6	**125.8**	12.6	439.4	313.6
11	0.1	0.5	2.9	6.3	17.5	31.5	**103.2**	13.0	426.4	323.2
12	0.0	0.0	2.9	6.1	16.9	11.1	**100.0**	12.6	413.8	313.8
13	0.0	0.0	3.2	6.3	17.5	8.1	**100.0**	13.0	400.8	300.8
14	0.0	0.0	3.2	6.3	17.5	8.0	**100.0**	13.0	387.7	287.7
15	0.1	0.6	3.2	6.1	16.9	8.3	**100.0**	12.6	375.1	275.1
16	1.1	5.1	2.8	6.3	17.5	14.6	**100.0**	13.0	362.1	262.1
17	2.9	13.6	2.6	6.1	16.9	24.7	**100.0**	12.6	349.5	249.5
18	4.5	21.5	2.6	6.3	17.5	28.7	**105.9**	13.0	336.5	230.6
19	8.5	40.4	2.4	6.3	17.5	26.3	**137.4**	13.0	323.5	186.1
20	7.2	34.3	2.6	5.9	16.4	25.1	**161.8**	12.2	311.3	149.5
21	5.7	27.0	2.6	6.3	17.5	28.1	**175.1**	13.0	298.3	123.2
22	1.5	7.0	2.8	6.1	16.9	29.6	**162.0**	12.6	285.7	123.6
23	0.1	0.5	2.9	6.3	17.5	31.5	**139.4**	13.0	272.7	133.3
24	0.0	0.0	2.9	6.1	16.9	30.7	**116.7**	12.6	260.1	143.4
25	0.0	0.0	0.0	6.3	17.5	27.9	**100.0**	13.0	247.0	147.0
Total	**63.1**	**299.8**	**58.7**	**129.0**	**360.4**	**435.6**		**268.0**		

Operational Flows (in ML)

Tasks	Crushing & Screening Input		DMS Water Makeup			Thickener Outflow to TSF	TSF to DMS
Months of operation	From MWD1 (Primary Input)	From RWD (Secondary Input)	From MWD2 (Primary)	From MWD1 (Secondary Input)	From RWD (Tertiary Input)	Process inflow to TSF	TSF Decant water
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1.7	0.0	0.0	27.7	0.0	16.9	0.0
6	1.7	0.0	0.0	28.6	0.0	17.5	0.0
7	1.7	0.0	23.0	5.7	0.0	17.5	20.7
8	1.5	0.0	25.9	0.0	0.0	15.8	24.1
9	1.7	0.0	27.7	0.0	0.0	16.9	27.1
10	1.7	0.0	27.7	0.0	0.0	16.9	29.6
11	1.7	0.0	28.6	0.0	0.0	17.5	31.5
12	1.7	0.0	8.2	19.6	0.0	16.9	11.1
13	1.7	0.0	5.1	23.6	0.0	17.5	8.1
14	1.7	0.0	4.9	23.8	0.0	17.5	8.0
15	1.7	0.0	5.3	22.5	0.0	16.9	8.3
16	1.7	0.0	12.1	16.6	0.0	17.5	14.6
17	1.7	0.0	23.6	4.2	0.0	16.9	24.7
18	1.7	0.0	28.6	0.0	0.0	17.5	28.7
19	1.7	0.0	28.6	0.0	0.0	17.5	26.3
20	1.6	0.0	26.8	0.0	0.0	16.4	25.1
21	1.7	0.0	28.6	0.0	0.0	17.5	28.1
22	1.7	0.0	27.7	0.0	0.0	16.9	29.6
23	1.7	0.0	28.6	0.0	0.0	17.5	31.5
24	1.7	0.0	27.7	0.0	0.0	16.9	30.7
25	1.7	0.0	24.9	3.7	0.0	17.5	27.9
Total	**35.1**	**0.0**	**413.6**	**175.9**	**0.0**	**360.4**	**435.6**

Appendix B. Water balance modelling results for the scenario when no dust suppression in January and February

Mine Water Dam 1 balance (ML)

Months of operation	Ground water Inflow to pit	Rainfall to pit	Direct rainfall	Evaporation + Standpipe loss	Dust Suppression (Primary)	DMS water makeup (Secondary)	Crushing & Screening (Primary)	Enviro Release	Inventory
0									0.0
1	5.4	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0
2	25.1	0.0	0.0	8.6	16.5	0.0	0.0	0.0	0.0
3	34.9	0.7	0.3	8.6	27.0	0.0	0.0	0.0	0.3
4	42.4	6.8	2.5	8.7	27.9	0.0	0.0	0.0	15.3
5	45.5	18.0	6.6	7.7	30.6	27.7	1.7	0.0	17.7
6	52.3	28.5	10.4	7.1	31.6	28.6	1.7	0.0	39.8
7	54.8	53.7	19.6	7.1	0.0	5.7	1.7	93.3	60.0
8	60.0	45.6	16.6	6.6	0.0	0.0	1.5	114.1	60.0
9	56.8	35.8	13.1	7.3	30.6	0.0	1.7	66.2	60.0
10	48.4	9.3	3.4	7.2	30.6	0.0	1.7	0.0	81.7
11	52.9	0.6	0.2	7.8	31.6	0.0	1.7	0.0	94.4
12	50.1	0.0	0.0	7.9	30.6	19.6	1.7	0.0	84.7
13	50.6	0.0	0.0	8.0	31.6	23.6	1.7	0.0	70.4
14	47.5	0.0	0.0	8.6	31.6	23.8	1.7	0.0	52.3
15	48.0	0.7	0.3	8.6	30.6	22.5	1.7	0.0	38.0
16	48.0	6.8	2.5	8.7	31.6	16.6	1.7	0.0	36.6
17	46.0	18.0	6.6	7.7	30.6	4.2	1.7	3.1	60.0
18	47.8	28.5	10.4	7.1	31.6	0.0	1.7	46.2	60.0
19	47.2	53.7	19.6	7.1	0.0	0.0	1.7	111.6	60.0
20	50.1	45.6	16.6	6.7	0.0	0.0	1.6	104.0	60.0
21	50.4	35.8	13.1	7.3	31.6	0.0	1.7	58.6	60.0
22	46.4	9.3	3.4	7.2	12.6	0.0	1.7	0.0	97.7
23	49.2	0.6	0.2	7.8	13.0	0.0	1.7	0.0	125.2
24	46.6	0.0	0.0	7.9	12.6	0.0	1.7	0.0	149.7
25	44.8	0.0	0.0	8.0	13.0	3.7	1.7	0.0	168.1
Total	**1151.0**	**398.0**	**145.2**	**190.4**	**527.6**	**175.9**	**35.1**	**597.1**	

Mine Water Dam 2 balance (in ML)

Months of operation	Direct rainfall	Evaporation + Standpipe loss	TSF decant water inflow	DMS water makeup (Primary)	Inventory
0					0.0
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.1	0.1	0.0	0.0	0.0
4	0.6	0.6	0.0	0.0	0.0
5	1.7	1.7	0.0	0.0	0.0
6	2.7	2.7	0.0	0.0	0.0
7	5.1	2.8	20.7	23.0	0.0
8	4.3	2.6	24.1	25.9	0.0
9	3.4	2.8	27.1	27.7	0.0
10	0.9	2.8	29.6	27.7	0.0
11	0.1	2.9	31.5	28.6	0.0
12	0.0	3.0	11.1	8.2	0.0
13	0.0	3.0	8.1	5.1	0.0
14	0.0	3.1	8.0	4.9	0.0
15	0.1	3.1	8.3	5.3	0.0
16	0.6	3.2	14.6	12.1	0.0
17	1.7	2.9	24.7	23.6	0.0
18	2.7	2.8	28.7	28.6	0.0
19	5.1	2.8	26.3	28.6	0.0
20	4.3	2.6	25.1	26.8	0.0
21	3.4	2.8	28.1	28.6	0.0
22	0.9	2.8	29.6	27.7	0.0
23	0.1	2.9	31.5	28.6	0.0
24	0.0	3.0	30.7	27.7	0.0
25	0.0	3.0	27.9	24.9	0.0
Total	**37.9**	**59.9**	**435.6**	**413.6**	

Raw Water Dam balance (in ML)

Months of operation	Direct rainfall	Inflow from OHD & Mine Site Dam	Evaporation + Standpipe loss	Administration & ablution	Dust suppression (Secondary)	DMS water makeup (Tertiary)	Crushing & Screening (Secondary)	Inventory
0								0.0
1	0.0	31.7	3.6	0.2	27.9	0.0	0.0	0.0
2	0.0	15.4	3.8	0.2	11.4	0.0	0.0	0.0
3	0.1	3.9	3.8	0.2	0.0	0.0	0.0	0.0
4	0.9	3.2	3.8	0.2	0.0	0.0	0.0	0.0
5	2.3	1.4	3.5	0.2	0.0	0.0	0.0	0.0
6	3.6	0.0	3.3	0.2	0.0	0.0	0.0	0.1
7	6.8	0.0	3.3	0.2	0.0	0.0	0.0	3.3
8	5.8	0.0	3.0	0.2	0.0	0.0	0.0	5.9
9	4.5	0.0	3.3	0.2	0.0	0.0	0.0	6.9
10	1.2	0.0	3.3	0.2	0.0	0.0	0.0	4.5
11	0.1	0.0	3.5	0.2	0.0	0.0	0.0	0.9
12	0.0	2.9	3.5	0.2	0.0	0.0	0.0	0.0
13	0.0	3.8	3.6	0.2	0.0	0.0	0.0	0.0
14	0.0	4.0	3.8	0.2	0.0	0.0	0.0	0.0
15	0.1	3.9	3.8	0.2	0.0	0.0	0.0	0.0
16	0.9	3.2	3.8	0.2	0.0	0.0	0.0	0.0
17	2.3	1.4	3.5	0.2	0.0	0.0	0.0	0.0
18	3.6	0.0	3.3	0.2	0.0	0.0	0.0	0.1
19	6.8	0.0	3.3	0.2	0.0	0.0	0.0	3.3
20	5.8	0.0	3.1	0.2	0.0	0.0	0.0	5.8
21	4.5	0.0	3.3	0.2	0.0	0.0	0.0	6.8
22	1.2	0.0	3.3	0.2	0.0	0.0	0.0	4.4
23	0.1	0.0	3.5	0.2	0.0	0.0	0.0	0.8
24	0.0	3.0	3.5	0.2	0.0	0.0	0.0	0.0
25	0.0	3.8	3.6	0.2	0.0	0.0	0.0	0.0
Total	**50.5**	**81.9**	**87.0**	**6.1**	**39.3**	**0.0**	**0.0**	

TSF balance (in ML)

Months of operation	Direct rainfall	TSF runoff water	Evaporation	Entrainment in tails	Process inflow	TSF decant water	Inventory	Tails production	TSF storage availability	Contingency water storage if required
0							**0.0**		515.0	515.0
1	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	515.0	515.0
2	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0	515.0	515.0
3	0.1	0.6	0.6	0.0	0.0	0.1	**0.1**	0.0	515.0	514.9
4	1.1	5.1	2.8	0.0	0.0	1.1	**3.5**	0.0	515.0	511.5
5	2.9	13.6	2.6	6.1	16.9	2.9	**28.2**	12.6	502.4	474.2
6	4.5	21.5	2.6	6.3	17.5	4.5	**62.9**	13.0	489.4	426.5
7	8.5	40.4	2.4	6.3	17.5	8.5	**100.0**	13.0	476.4	376.4
8	7.2	34.3	2.6	5.7	15.8	7.2	**125.0**	11.8	464.6	339.6
9	5.7	27.0	2.6	6.1	16.9	5.7	**138.8**	12.6	452.0	313.2
10	1.5	7.0	2.8	6.1	16.9	1.5	**125.8**	12.6	439.4	313.6
11	0.1	0.5	2.9	6.3	17.5	0.1	**103.2**	13.0	426.4	323.2
12	0.0	0.0	2.9	6.1	16.9	0.0	**100.0**	12.6	413.8	313.8
13	0.0	0.0	3.2	6.3	17.5	0.0	**100.0**	13.0	400.8	300.8
14	0.0	0.0	3.2	6.3	17.5	0.0	**100.0**	13.0	387.7	287.7
15	0.1	0.6	3.2	6.1	16.9	0.1	**100.0**	12.6	375.1	275.1
16	1.1	5.1	2.8	6.3	17.5	1.1	**100.0**	13.0	362.1	262.1
17	2.9	13.6	2.6	6.1	16.9	2.9	**100.0**	12.6	349.5	249.5
18	4.5	21.5	2.6	6.3	17.5	4.5	**105.9**	13.0	336.5	230.6
19	8.5	40.4	2.4	6.3	17.5	8.5	**137.4**	13.0	323.5	186.1
20	7.2	34.3	2.6	5.9	16.4	7.2	**161.8**	12.2	311.3	149.5
21	5.7	27.0	2.6	6.3	17.5	5.7	**175.1**	13.0	298.3	123.2
22	1.5	7.0	2.8	6.1	16.9	1.5	**162.0**	12.6	285.7	123.6
23	0.1	0.5	2.9	6.3	17.5	0.1	**139.4**	13.0	272.7	133.3
24	0.0	0.0	2.9	6.1	16.9	0.0	**116.7**	12.6	260.1	143.4
25	0.0	0.0	0.0	6.3	17.5	0.0	**100.0**	13.0	247.0	147.0
Total	**63.1**	**299.8**	**58.7**	**129.0**	**360.4**	**63.1**		**268.0**		

ECAust
EnviroConsult Australia Pty Ltd

Operational Flows (in ML)

Tasks	Crushing & Screening Input		DMS Water Makeup			Thickener Outflow to TSF	TSF to DMS
Months of operation	From MWD1 (Primary Input)	From RWD (Secondary Input)	From MWD2 (Primary)	From MWD1 (Secondary Input)	From RWD (Tertiary Input)	Process inflow to TSF	TSF Decant water
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1.7	0.0	0.0	27.7	0.0	16.9	0.0
6	1.7	0.0	0.0	28.6	0.0	17.5	0.0
7	1.7	0.0	23.0	5.7	0.0	17.5	20.7
8	1.5	0.0	25.9	0.0	0.0	15.8	24.1
9	1.7	0.0	27.7	0.0	0.0	16.9	27.1
10	1.7	0.0	27.7	0.0	0.0	16.9	29.6
11	1.7	0.0	28.6	0.0	0.0	17.5	31.5
12	1.7	0.0	8.2	19.6	0.0	16.9	11.1
13	1.7	0.0	5.1	23.6	0.0	17.5	8.1
14	1.7	0.0	4.9	23.8	0.0	17.5	8.0
15	1.7	0.0	5.3	22.5	0.0	16.9	8.3
16	1.7	0.0	12.1	16.6	0.0	17.5	14.6
17	1.7	0.0	23.6	4.2	0.0	16.9	24.7
18	1.7	0.0	28.6	0.0	0.0	17.5	28.7
19	1.7	0.0	28.6	0.0	0.0	17.5	26.3
20	1.6	0.0	26.8	0.0	0.0	16.4	25.1
21	1.7	0.0	28.6	0.0	0.0	17.5	28.1
22	1.7	0.0	27.7	0.0	0.0	16.9	29.6
23	1.7	0.0	28.6	0.0	0.0	17.5	31.5
24	1.7	0.0	27.7	0.0	0.0	16.9	30.7
25	1.7	0.0	24.9	3.7	0.0	17.5	27.9
Total	**35.1**	**0.0**	**413.6**	**175.9**	**0.0**	**360.4**	**435.6**

EnviroConsult Australia Pty Ltd
45 Malak Crescent
Malak, NT, 0812
F: +61 (0)4 7519 8875
admin@ecaust.com.au

RELIANCE, USES, and LIMITATIONS

Description	Author	Checked by	Approved for Issue		
			Name	Signature	Date
Draft	Mike Liu	Ken Evans	Ken Evans		04/10/2018
Revision 1	Mike Liu		Ken Evans		17/10/2018
Final	Mike Liu		Ken Evans		25/10/2018

CORE
EXPLORATION LTD