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NOZALA COAL

GRUISFONTEIN WATER BALANCE

FINAL REPORT
REVISION 01

SEPTEMBER 2019

Prepared by:
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1.1 GENERAL INFORMATION

The planning and presentation of predicted water usage and stormwater management are of utmost importance in South Africa when designing mining infrastructure. This is due to the scarcity of the resource and the present misuse thereof at various mines across the country.

The management of water revolves around the following aspects:

- Water supply
- Dirty and clean stormwater management
- Process water management.

The formulated water balance will enable the mine to report on predicted water requirements from various sources and the responsible management and usage thereof.

The objective of this water balance can be summarised as follows:

- Determining the water requirements throughout the proposed mine and for the duration of the life of mine
- Assessing water supply strategies to identify minimal pollution options and the required changes during the various phases of the mine (construction, mining, closure)
- Providing the environmentalist with the required water usage to determine the impact on the surrounding environment and possible prevention thereof
- Allocation of funds for the purchasing of water for the mining operations.

For the objectives above, a high-level water balance will be adequate. This balance will not include the internal water networks within elements like the mining plant, but rather the source of water which makes provision for the plant and the infrastructure allocated for the collection of the process water resulting from the plant's processes. However, the flow values used for the larger elements, like the plant, will be calculated in detail.

1.2 DESIGN GUIDELINES AND STANDARDS

The design and formulation of the water balance are guided by the adherence to the following documentation and standards:

- Best Practice Guidelines (BPG) G2: Water and Salt Balances
- National Water Act (Act 36 1998)
- Regulation GN 704
- Other relevant manuals from the BPG series.

1.3 DESIGN PHILOSOPHY

For the formulation of a water balance of a proposed mine, the following will have to be kept in mind:

- No testing of accuracy will be possible since no actual demand measurements can be taken. The values used in the balance are calculated using recognised standards and will have to be adjusted once the mine is operational
- Values will be used in cubic meters per annum and will be provided for both the wet season and the dry season to accommodate the impact of stormwater attenuation
- Water balances will be separated for the following areas:
  - Mining Pit
  - Plant Area
  - Environmental System
  - Domestic.

1.4 SIMULATION PERIOD

Various simulations were done to ensure that the different possible water balances can all be accounted for. This will ensure that the required amount is budgeted for in the water demands.

All the various water balances can be seen in Appendix A.

Ideally, three different time-steps are indicated on the model. The type and use can be summarised as follows:

- Annual time-step: Used to indicate the volumes of water required from the possible sources. Also shows the difference in water usage between the various operational stages of the mine's life.
- Monthly time-step: Indicates the seasonal changes and impacts on operations.
- Daily time-step: Used for the sizing of storage facilities and pumping requirements.

For the purposes of this report, only the monthly and annual time-step has been modelled.

1.5 WATER BOUNDARIES

The Gruisfontein Project consists of independent infrastructure zones. The groups can be categorised/labelled as follows:

- Mining Pit
- Plant Area
- Environmental Systems
- Domestic (Office Area).

Each of the groups above can then be subdivided into clean water areas and dirty water areas. These infrastructure zones form the primary water boundaries of the mine, which ensure and alleviate the task of separating contaminated and unpolluted water, as required in Regulation GN 704.

The following elements were used to determine the exact route of the boundaries and were taken into consideration during the planning of the mining layout:

- Natural elements
- Topography
- Catchments
- Geology
- Man-made features
- Roads
- Stormwater berms
- Stormwater channels
- Building Platforms
- Railway lines
- Bunds
- Embankments.

1.6 USER INTERFACE

The water balance model has been generated using Microsoft Excel. The utilisation of Excel for this purpose has various pros and cons with the essential con being that the interface is not user-friendly and hard to modify once completed. Delta BEC would, therefore, recommend that a water balance be formalised on specialised software (Goldsim) once the mine is constructed and operational, and the monitoring of the system becomes a priority.

1.7 MODEL DESCRIPTION

As described in the previous sections, a water balance has been formalised for each water boundary and has subsequently been linked to each other to form the holistic water balance. Each water balance follows a top-down approach and is illustrated similar to the normal flow of water in a facility, flowing from the source to the user and then to the disposal point.

The mine will use a system of dams, channels, pumps, diversions and various water utilising management options to control the water within the mining complex. These elements are therefore used within each water balance to accurately represent the mines water management. The items can be listed as follows:

- Sources
  - Surface runoff
  - Borehole
  - Pit groundwater
  - On-site STP
- Storage elements
  - Dams
  - Reservoirs
- Usage
  - Domestic

  - Plant (Operations)
  - Dust suppression
- Loss
  - Evaporation
  - Seepage
  - Spillage.

The elements above were used to generate the water balance, as indicated in Figure 1-2

Some of the items listed above have various influences and complex integrated relationships. These items will have short descriptions in the following sections.

1.7.1 DAM ELEMENT

There are several types of dams required for effective water usage in the mine, and each dam will operate in a specific manner to achieve the objective it was designed for.

Dirty and Clean Stormwater Dams– These dams are used to attenuate stormwater during a storm event. They will be kept at minimum supply level to ensure capacity required to attenuate the 1 in 50-year flash flood as required in regulation GN 704.

The water collected in the dirty stormwater dam (pollution control dam) will be pumped to the water balancing dam and used as plant process water. The water gathered in the clean stormwater dam during a storm will be pumped to the Raw Water Dam to be treated and used as domestic water. Once the Raw Water Dam reaches capacity, the water will be diverted to the water balancing dam.

Raw Water Dam– This dam will act as a storage reservoir for the water that will be treated through the water treatment works and will provide four days demand as required by the MIA in case a water supply emergency arises.

Water Balancing Dam– Water pumped from the clean and dirty water dams after a significant storm event will be stored in this dam to optimise the usage of collected stormwater. Once the capacity of the dam is exceeded, the excess water will be discharged into the environment with the quality ranges indicated in Table 1-1.

Table 1-1: Quality of water discharged into the environment

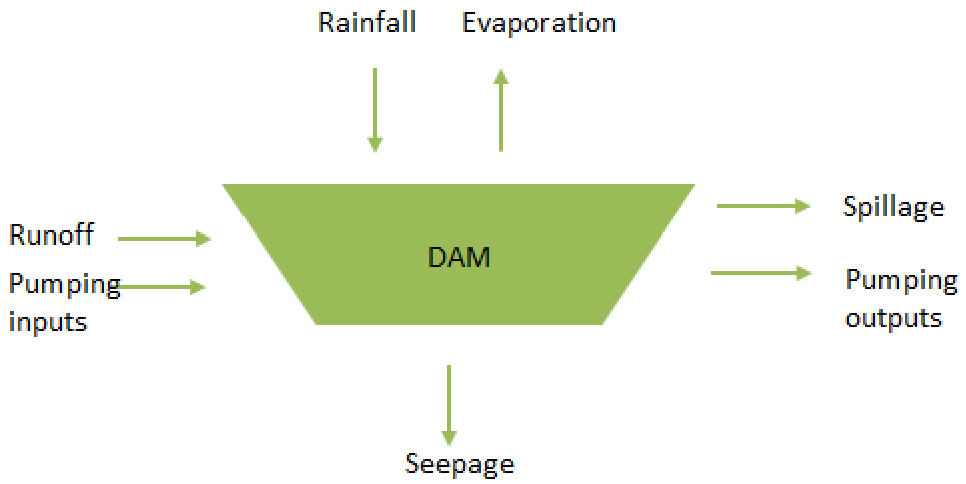
VARIABLE	LIMITS
Aluminium	0 - 5.0 mg/ℓ
Arsenic	0 - 0.1 mg/ℓ
Beryllium	0 - 0.1 mg/ℓ
Boron	0 - 0.5 mg/ℓ
Cadmium	0 - 10 mg/ℓ
Chemical Oxygen Demand	≤75 mg/ℓ

VARIABLE	LIMITS
Chloride	0 - 1.0 mg/ℓ
Chromium(VI)	0 - 0.1 mg/ℓ
Cobalt	0 - 0.05 mg/ℓ
Electrical Conductivity EC	70 - 150 mS/m
Faecal Coliforms	≤ 1 count/100mℓ
Free and Saline Ammonia (as Nat pH 8)	0 - 2.0 mg/ℓ
Copper	0 - 0.2 mg/ℓ
Fluoride	0 - 1.0 mg/ℓ
Iron	0 - 5.0 mg/ℓ
Lead	0 - 0.2 mg/ℓ
Lithium	0 - 2.5 mg/ℓ
Manganese	0 - 0.02 mg/ℓ
Molybdenum	0 - 0.01 mg/ℓ
Nickel	0 - 0.2 mg/ℓ
Nitrate	0 - 6.0 mg/ℓ
Orthophosphate (as P)	0 - 1.0 mg/ℓ
pH	6.5 - 8.4 pH units
Residual Chlorine	≤ 0.1 mg/ℓ
Selenium	0 - 0.02 mg/ℓ
Sodium	≤70 mg/ℓ
Sodium Absorption Rate	0 - 1.5
Soap, grease or oil	0 - 2.5 mg/ℓ
Total Dissolved Solids	≤40 mg/ℓ
Total Hardness	+0.2 mg $CaCO_3$/ℓ
Uranium	0 - 0.01 mg/ℓ
Vanadium	0 - 0.1 mg/ℓ
Zinc	0 - 1.0 mg/ℓ

Plant Process Water Storage Dam– This dam will serve to supply water to the plant for operational purposes. The dam will be filled with water from the balancing dam and will provide 4 days' worth of water for the plant in case of water shortage.

The dams used in the water balance model take cognisance of the following factors illustrated in Figure 1-1.

Figure 1-1: Dam water source and draw-off schematic



The dam water source and draw-off schematic can be summarised as follows:

- Contributions to the storage
  - Runoff generated by a storm event as indicated in the stormwater master plan
  - Direct rainfall onto the dam surface. This is calculated as the rainfall depth multiplied with the dam surface area
  - Any water being pumped from another facility within the mine to the storage dam. This could be from the sewerage treatment plant or the boreholes
- Extractions:
  - Evaporation of the dam water can be calculated as the evaporation depth multiplied with the dam surface area
  - The seepage of the dam water should be close to zero for any water storage dam containing contaminated water since these dams will be lined according to legislation. Unlined clean water dam seepage will be calculated according to the Schaffernak method published in the Journal of Geoengineering Vol 8. The seepage can also be seen as groundwater recharge
  - Pumping of water from the dam will be used to balance the system, by providing water where needed across the mine for operational or maintenance purposes
  - Spillage of the dam might occur during significant storm events, which will not be used for the purpose of this water balance diagram.

1.7.2 COAL PLANT ELEMENT

At this stage, very little information is available for the calculations of the plant water requirements and production. The plant will, therefore, be treated as a black box with the following elements being the primary inputs and outputs:

- Contributing
  - Recycle from plant
  - Pumped water from pollution control dams
  - Moisture within the ROM

- Extractions
  - General losses and spillages
  - Water within the coal product
  - Water within the discard.

The values used for the elements above have been estimated based on similar plant installations.

1.7.3 PIT GROUNDWATER INFLOW

The envisaged phasing of the mining operations indicates that strategic sections of the overburden of the pit will be excavated at a time to allow mining of the coal reserves within that particular section. After the section has been exhausted, the next section will be excavated while the preceding section may be backfilled. This phasing has a significant impact on the groundwater ingress into the pit and the volume of direct rainfall that can be accumulated for reuse.

However, for the purposes of this study, the worst-case scenario has been utilised in which no in-pit backfilling occur during the life-of-mine.

1.8 MODEL INPUT DATA

Since the Gruisfontein Project is in the design phase, various factors are unknown. Therefore, assumptions have been made to provide a complete model. The premises can be listed as follows:

- Plant
  - The plant will require a demand of 2 049.17 m³/day
  - 55% of the water used in the plant can be recycled
  - 29% of the water used in the plant will be lost in the product
  - 1% of the water used in the plant will be lost to dust suppression
- Construction
  - Two water bowsers will be used per day at 800 ℓ/min
  - For the construction of the mine, it will be assumed that a total of 546 construction workers will be active on the mine and require an average of 25 litres per worker per day
- Stormwater calculations
  - Stormwater infiltration will remain constant and uniform for the catchment area and the duration of the storm
  - Evaporation is consistent and uniform throughout the year and the site (no variation data was obtained for the evaporation during the months of the year)
  - Rainfall variation is assumed to be the same as the average variation of rainfall for the past 30 years
- No seepage or spillage will occur at the lined stormwater storage dams
- The water balance will only be analysed for 16 years, with five years allowed for construction
- Only borehole and clean stormwater runoff can be used for potable water consumption and therefore for office purposes

- Boreholes within the development will have an adequate yield to meet demands.

1.8.1 WATER DEMAND

- Plant water demand – 747 942 m³/annum
- Office water demand – 104 875 m³/annum
- Dust suppression – 482 130 m³/annum.

1.8.2 WATER SOURCES

The available water sources, as calculated with the available information, can be summarised as follows:

- Average annual rainfall – 4 644 m³/annum
- Recyclable plant water – It is estimated at this stage that 45% of the water used within the plant will be recycled for reuse and can, therefore, be seen as another source of water. This will amount to 568 631 m³/annum. This estimate was based on data received from similar coal mines within the region
- On-site STP – 182 625 m³/annum (estimated at a sewage treatment rate of 0.5 Mℓ/day).

1.8.3 DAM CAPACITIES AND AREAS

Since the various dams have different functions, the sizing will differ in design and size. The storage capacities of the multiple dams are provide in Table 1-2.

Table 1-2: Dam capacities and areas

	Volume (m³)	Top Length (m)	Top Width (m)	Bottom Length (m)	Bottom Width (m)	Depth (m)
PCD 1	117 450	150	90	140	90	9
PCD 2	176 400	200	98	200	98	9
Clean water pond	120 143	200	90	190	86	7
Plant water dam	25 600	200	100	80	80	2
Balancing dam	417 600	400	200	200	98	9
Raw water dam	17 100	200	90	80	70	1.5

The stormwater dams were sized to contain the runoff generated during a 1: 50-year storm.

The balancing dam was sized to receive all stormwater pumped from the stormwater dams. The pumping of the stormwater volumes will last for 7 days, during which the plant water demand will reduce the amount of water in the balancing dam.

1.8.4 PUMPING CAPACITIES

During a 1:50-year storm event, the stormwater dams will reach full capacity. Subsequently, these dams will have to be emptied to restore the available capacity for the next storm. However, since the probability of another 1:50-year storm occurring within the following week is minuscule, the emptying of these dams is designed to last for a week. This was decided to reduce the cost required for the pumping equipment and to reduce the size of the necessary balancing dam. Table 1-3 provides the pumping values for the stormwater dams.

Table 1-3: stormwater dam pumping requirements

	Volume (m^3)	Flow (m^3/s)	Volume pumped per day (m^3)
PCD 1	117 450	0.192	90
PCD 2	176 400	0.291	98
Clean water pond	120 143	0.198	90

1.8.5 WATER SUPPLY DAMS

The water supply dams' pumping requirements are based on the demands they have to cater for. Since the pumps pump the water to a storage element within the plant and the office, these pumps only have to pump one day's demand over the day. Table 1-4 provides the pumping values for these dams.

Table 1-4: Water supply dams pumping requirements

	Volume (m^3)	Flow (m^3/s)	Volume pumped per day (m^3)
Plant water dam	25 600	0.040	100
Balancing dam	417 600	0.040	200
Raw water dam	17 100	0.003	90

For the calculations on the pumping requirements, please refer to Appendix A.

1.9 ANNUAL WATER BALANCE MODEL

Four annual water balance models are provided in this report. This is to display the difference in water usage across the various phases of the mine as well as in low rainfall and high rainfall months under normal operating conditions.

The first model provides the water balance for the period during which the mine is fully operational in a high rainfall month. Please refer to Figure 1-2 for this information.

The second model provides the water balance for the period during which the mine is fully operational in a low rainfall month. Please refer to Figure 1-3 for this information.

The third model indicates the period during which the mine is being constructed. The plant is not yet operational, but water is still required for the construction processes. Please refer to Figure 1-4 for this model.

The fourth model provides information on the phase during which construction is nearing its end, and the plant has started with its operation, though not yet at full capacity. Please refer to Figure 1-5 for this model.

1.10 OBSERVATIONS AND RECOMMENDATIONS

1.10.1 FULLY OPERATIONAL PHASE

From the water balance, it can be seen that theoretically, no municipal supply of water would be required for the operation of the mine. The following sources provide adequate supply:

- Pit groundwater
- Boreholes
- Rainwater
- Recycled water from the on-site STP.

This would imply that stormwater dams should be adequately sized to accommodate a year’s worth of stormwater attenuation and excess water originating from the pit and recycled water sources. The boreholes will then be used to make up the balance of the required water within the mine when the sources above are depleted.

Figure 1-2: Monthly water balance during fully operational mining phase in high rainfall month (m³ per month)

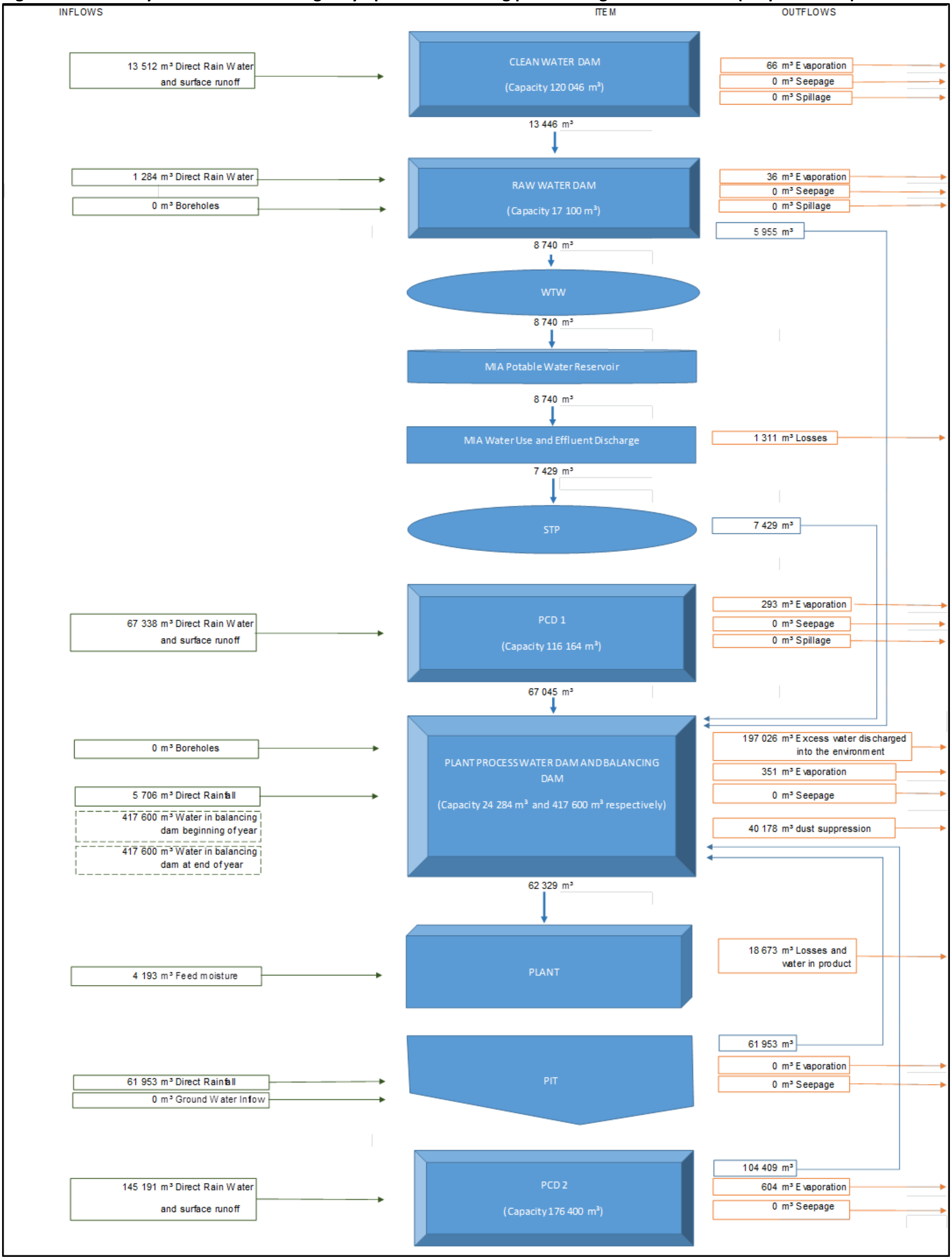


Figure 1-3: Monthly water balance during fully operational mining phase in low rainfall month (m³ per month)

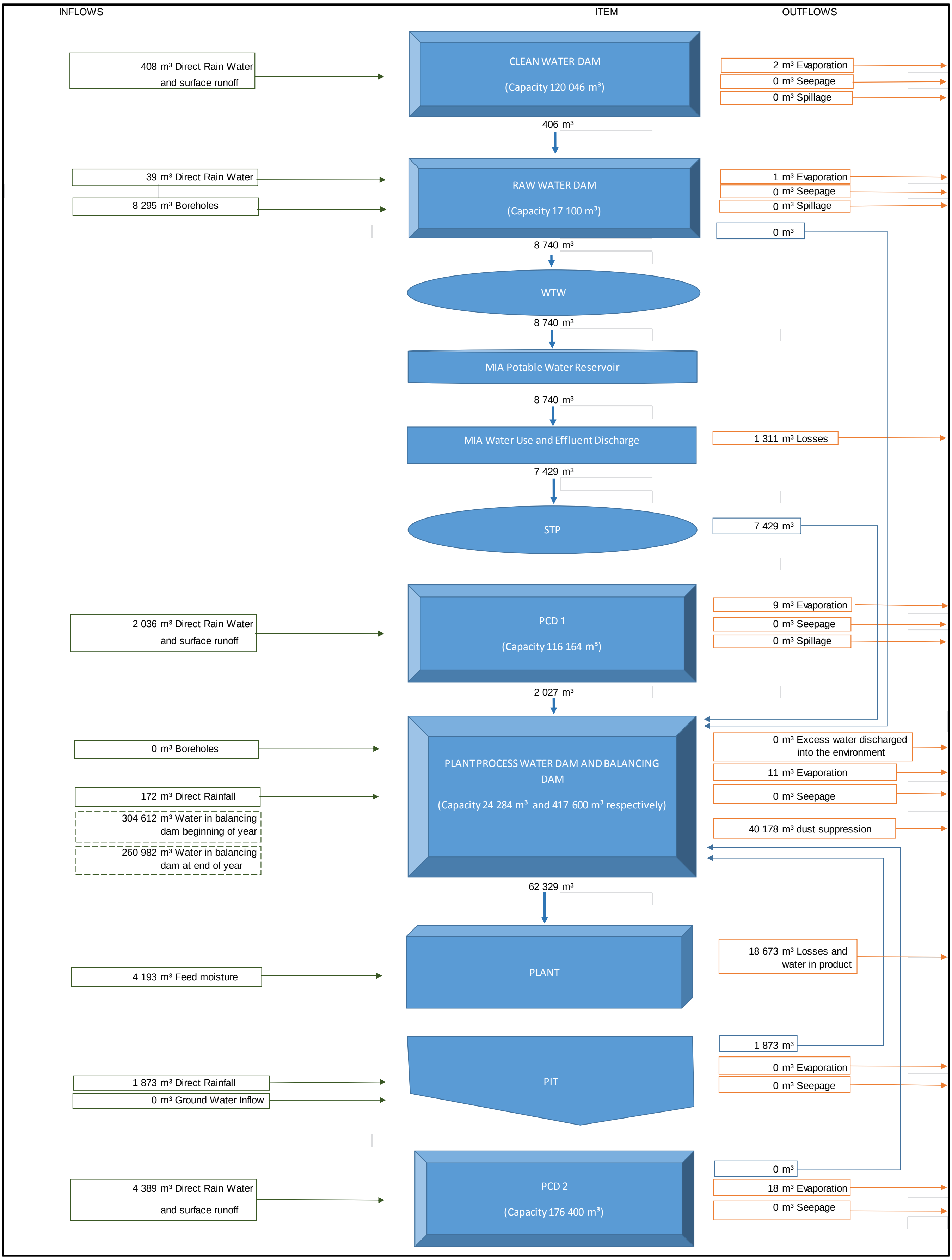


Figure 1-4: Water balance in year 1 of construction (m³ per annum)

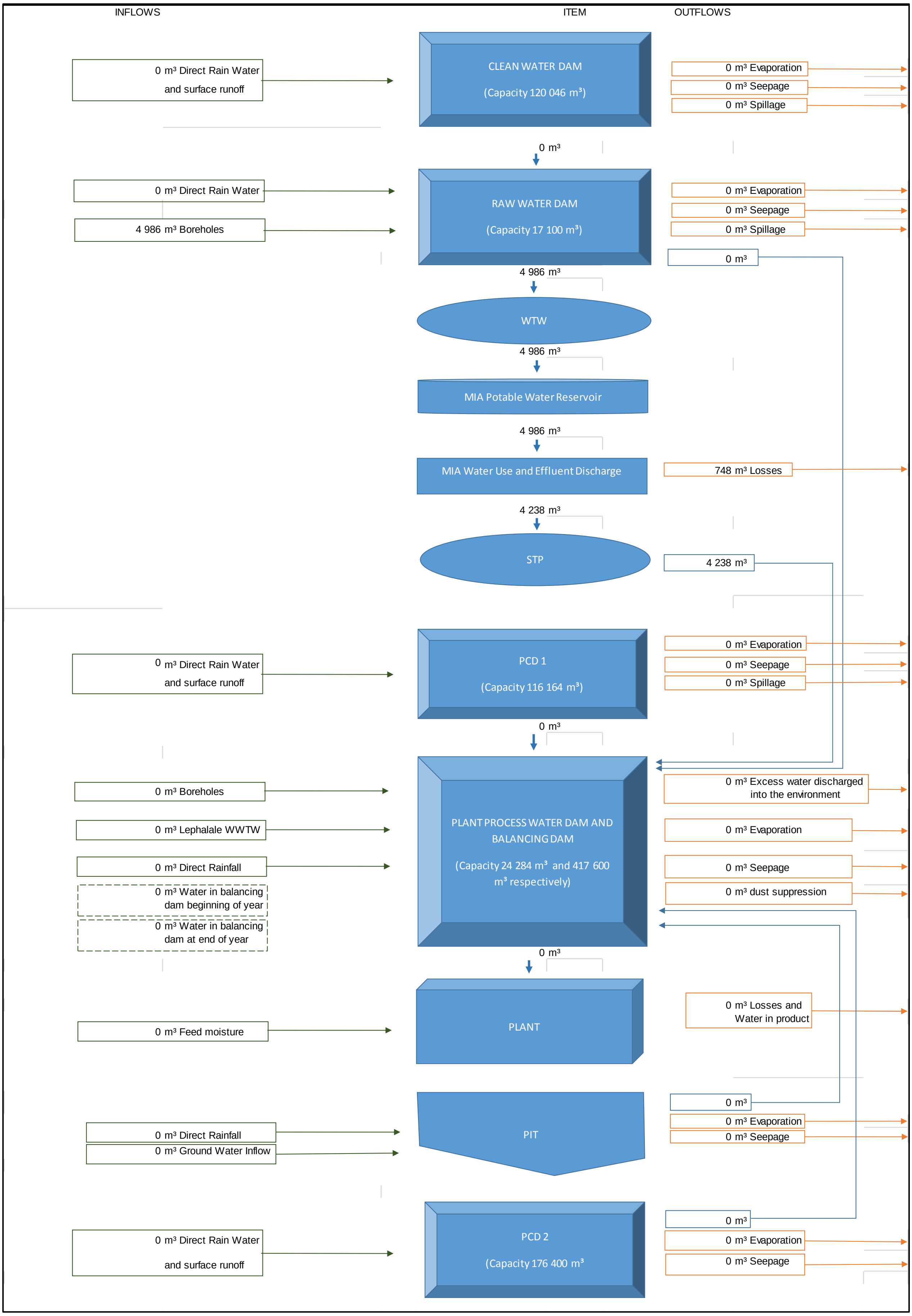
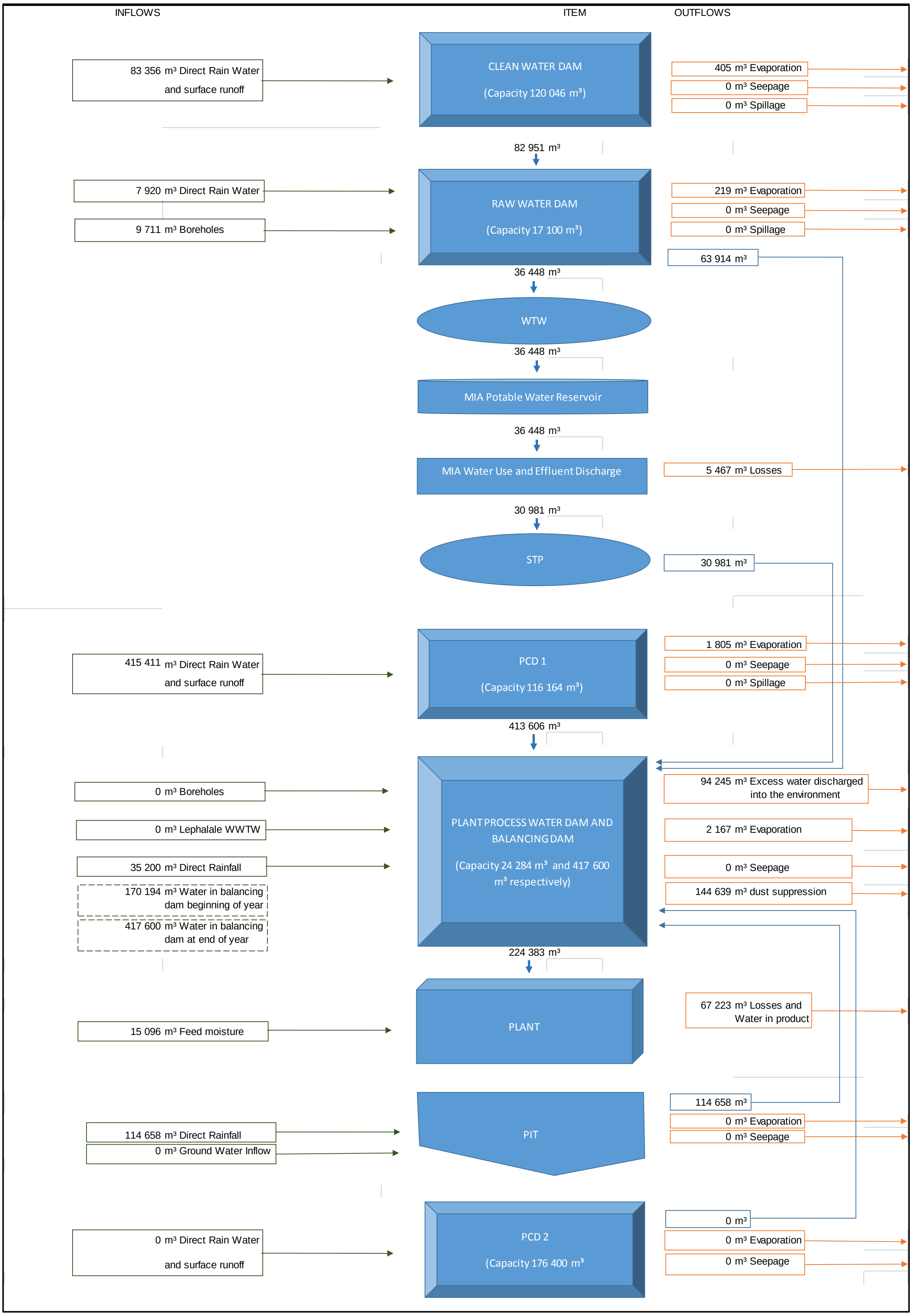


Figure 1-5: Water balance in year 3 of construction (m^3 per annum)



APPENDIX A: WATER BALANCE CALCULATIONS

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0102

Project number: P18054
Date: 2019/08/26
Description: Water supply

Calculated by: DJ. Borges
Checked by: B. Matshazi

Mine stormwater runoff

Average Annual Rainfall 440 mm
Average Annual Evaportaion 1 950 mm

MONTH	PERCENTAGE RAINFALL
January	20%
February	16%
March	13%
April	7%
May	2%
June	1%
July	0%
August	0%
September	2%
October	7%
November	14%
December	18%

CATCHMENT DESCRIPTION	AREA (km²)	COMBINED RUNOFF COEFFICIENT	VOLUME OF STORMWATER (m³/annum)	COLLECTING DAM
CA1d	0.4123	0.396	71 814	PCD West
CA2d	0.3266	0.930	133 653	PCD West
CA3d	0.2706	0.700	83 356	Clean water pond
CA4d	0.0783	0.900	31 012	PCD West
CA5d	0.4518	0.900	178 932	PCD West
CA6d	0.0913	0.220	8 834	PCD East
CA7d	2.4087	0.837	886 854	PCD East

	POND TOP WIDTH (m)	POND TOP LENGTH (m)	STORMWATER COLLECTED (m³/annum)	EVAPORATION LOSSES (m³/day)	DAM CAPACITY (m³)	PUMP RATE (m³/day)
Clean water pond	82	190	83 356	83	120 043	17 107
PCD 1	90	150	415 411	72	117 450	16 589
PCD 2	98	200	895 688	105	176 400	25 142
Plant water dam	100	200	8 800	107	24 284	3 469
Balancing Dam	200	400	35 200	427	417 600	3 469
Raw Water Dam	90	200	7 920	96	17 100	287

Pit dewatering (with backfill)

YEAR	NOZALA COAL ONLY	
	m³/d	m³/annum
1	180	65 745
2	430	157 058
3	440	160 710
4	450	164 363
5	440	160 710
6	420	153 405
7	410	149 753
8	410	149 753
9	420	153 405
10	440	160 710
11	455	166 189
12	470	171 668
13	490	178 973
14	510	186 278
15	530	193 583
16	550	200 888

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Project number: P18054
Date: 2019/08/26
Description: Water supply

Calculated by: DJ. Borges
Checked by: B. Matshazi

Recycled plant process water

Plant capacity:	6 000 000	mtpa
Plant operating hours:	18.6288232	hours
Plant operating days:	30.4178378	days

Water out		m³/hour	
Primary Cyclone waste		59.85	recover
Fine coal waste		7.95	recover
Coarse Export product		31.725	loss
Coarse Domestic product		28.125	loss
Fine coal Export product		6.975	loss
Ultra fine Filtercake to waste		15.45	recover
Floc make up		0.375	recover
Dust supression		1.5	loss
Total water out		151.95	
Water in			
Feed moisture		7.4	
Total water in		0	
Make up water required		**144.55**	

	m³/annum
Feed moisture	50 318
Primary Cyclone waste	406 967
Fine coal waste	54 058
Ultra fine Filtercake to waste	105 057
Floc make up	2 550
Total	**568 632**

Treated effluent from onsite Waste Water Treatment Works

	TREATED EFFLUENT (m³/annum)
Onsite Waste Water Treatment Works	182 625

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Project number: P18054
Date: 2019/08/26 **Calculated by:** DJ. BORGES
Description: Water demand **Checked by:** B. Matshazi

Potable water

BUILDING NAME	DAILY WATER DEMAND (m^3/day)	ANNUAL WATER DEMAND (m^3/annum)
VMI Offices	1.03	375
Management Change Houses	28	10 147
Clinic	5	1 700
Fire Control Facilities	3	914
Coal labotory	20	7 223
Instrumentation workshop	1	540
Electrical workshop	1	438
Security house	7	2 656
Visitors Access control and induction office female toilet	2	808
Visitors Access control and induction office male toilet	2	808
Visitors Access control and induction Disabled toilet	1	381
Canteen	5	1 918
Female Staff Change House	23	8 532
Maitenance office, Tech and Ops	3	1 104
Management Offices	13	4 770
General Workshop	0	135
LDV Wash Bays	9	3 287
LDV Workshop	5	1 914
HDV Wash Bays	18	6 575
Waste Water Treatment Works	24	8 766
Water Treatment Works	24	8 766
Male Changing room 1	42	15 341
Male Changing room 2	42	15 341

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0102

Project number:	P18054		
Date:	2019/08/26	**Calculated by:**	DJ. BORGES
Description:	Water demand	**Checked by:**	B. Matshazi

Heavy Vehicle Service Bays	7	2 435
Total demand	**287**	**104 875**
Storage duration (days)	1	
Storeage size	287.13	

Fire water

Fire Risk Category	High Risk
Design Fire Flow	200 ℓ/s
Duration	4 hrs
Fire Hydrant min. Flow	25 ℓ/s
Max number of hydrants	4
Fire Storage Required	**1.44 Mℓ**

Fire Water Summary

	ℓ/s	m³/s	m³/annum
Firefighting	100.0	0.100	1 440.0
Total	100.0	0.1	**1 440.0**

Assumption: Fire water tank will be flushed and cleaned once a year.

Plant process water

Plant capacity:	6 000 000	mtpa
Plant operating hours:	18.62882322	hours
Plant operating days:	30.41783776	days

WATER OUT	m³/h	
Primary Cyclone waste	40	recover
Fine coal waste	6.95	recover
Coarse Export product	21	loss
Coarse Domestic product	27.2	loss
Fine coal Export product	5.92	loss
Ultra fine Filtercake to waste	14.45	recover
Floc make up	0.375	recover
Dust supression	1.5	loss
Total water out	117.395	
WATER IN		
Feed moisture	7.4	
Total water in	0	
Make up water required	**109.995**	
Make up water required (m³/annum)	**747 942**	

Losses	
Coarse Export product	142 795
Coarse Domestic product	30 826
Fine coal Export product	40 255
Dust supression	10 200
Total losses (m³/annum)	**224 075**

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Project number:	P18054		
Date:	2019/08/26	**Calculated by:**	DJ. BORGES
Description:	Water demand	**Checked by:**	B. Matshazi

Dust suppression water

Number of bowsers		2
Spray rate (m^3/min)		0.590
Operating time (hours)		18.629
Daily dust suppression water (m^3/day)		1 320
Annual dust suppression (m^3/annum)		**482 130**

Construction

Total working hours - entrance gate	3 264 138
Entrance Gate Area	536 000
Nozala Coal Area	1 634 342
Total working hours - GG Entrance Gate	9 952 832
Workers for 5 year construction	546
Construction Workers	546
Water demand per day (m^3/capita.day)	0.025
Total (m^3/day)	14
Total (m^3/annum)	**4 986**

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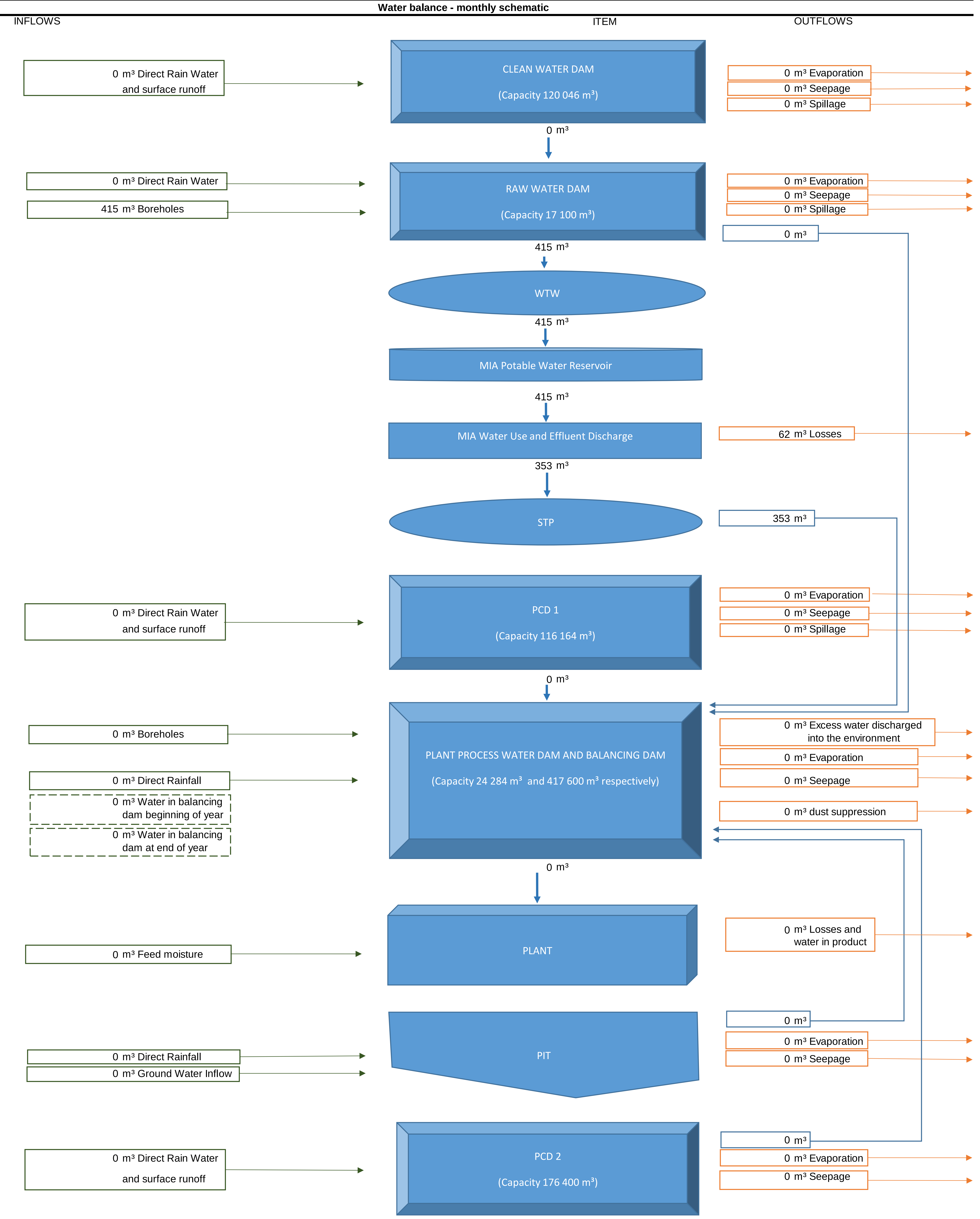
Project number: P18054
Date: 2019/08/26
Description: Monthly water balance schematic for year 1 February
Calculated by: DJ. Borges
Checked by: B. Matshazi

Water balance - monthly schematic



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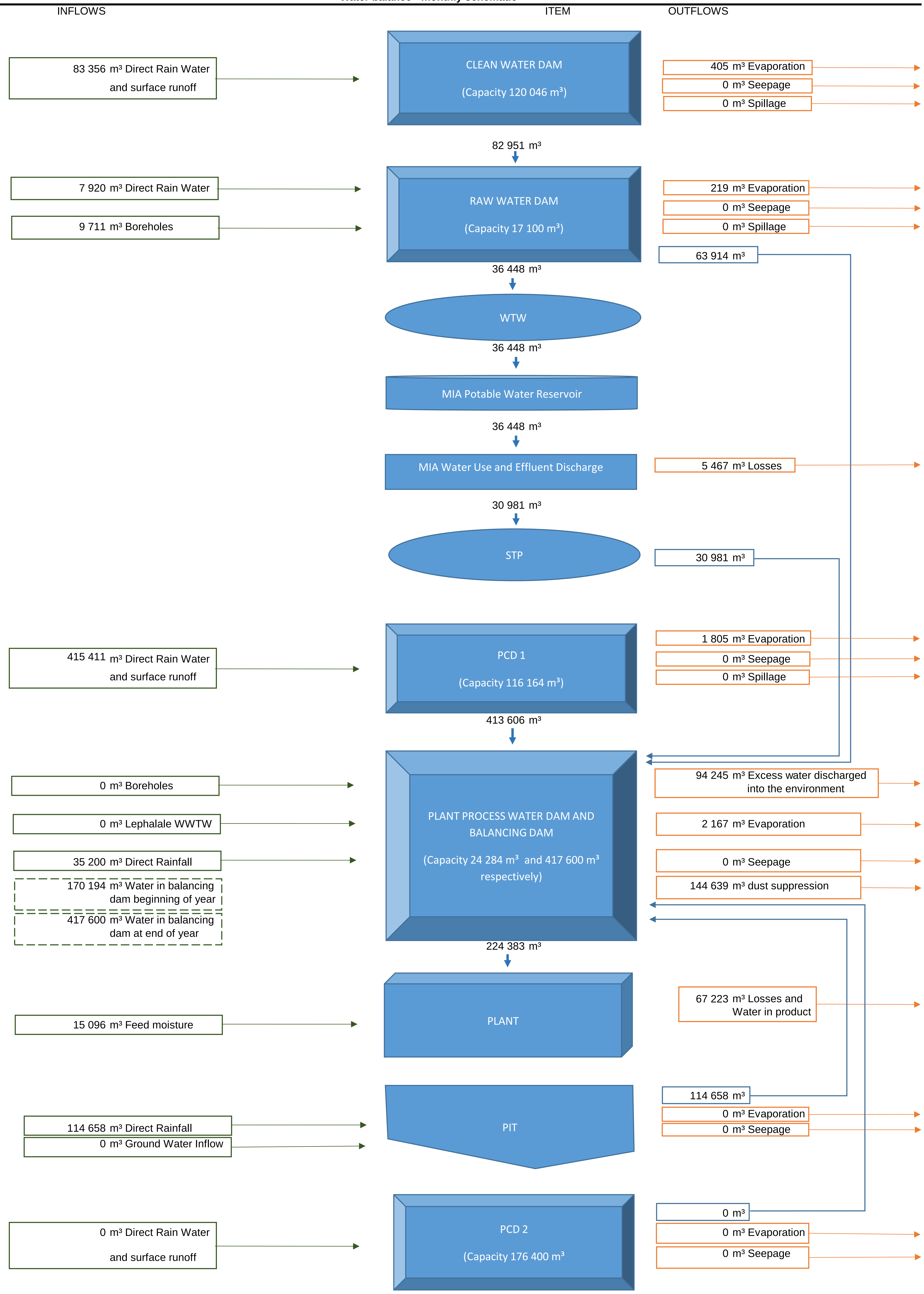
Project number: P18054
Date: 2019/08/26
Description: Monthly water balance schematic for year 3

Calculated by: DJ. Borges
Checked by: B. Matshazi

Water balance - monthly schematic



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Project number:	P18054	**Calculated by:**	DJ. Borges
Date:	2019/08/26	**Checked by:**	B. Matshazi
Description:	Monthly balance - Operation		

Monthly balance

YEAR 16

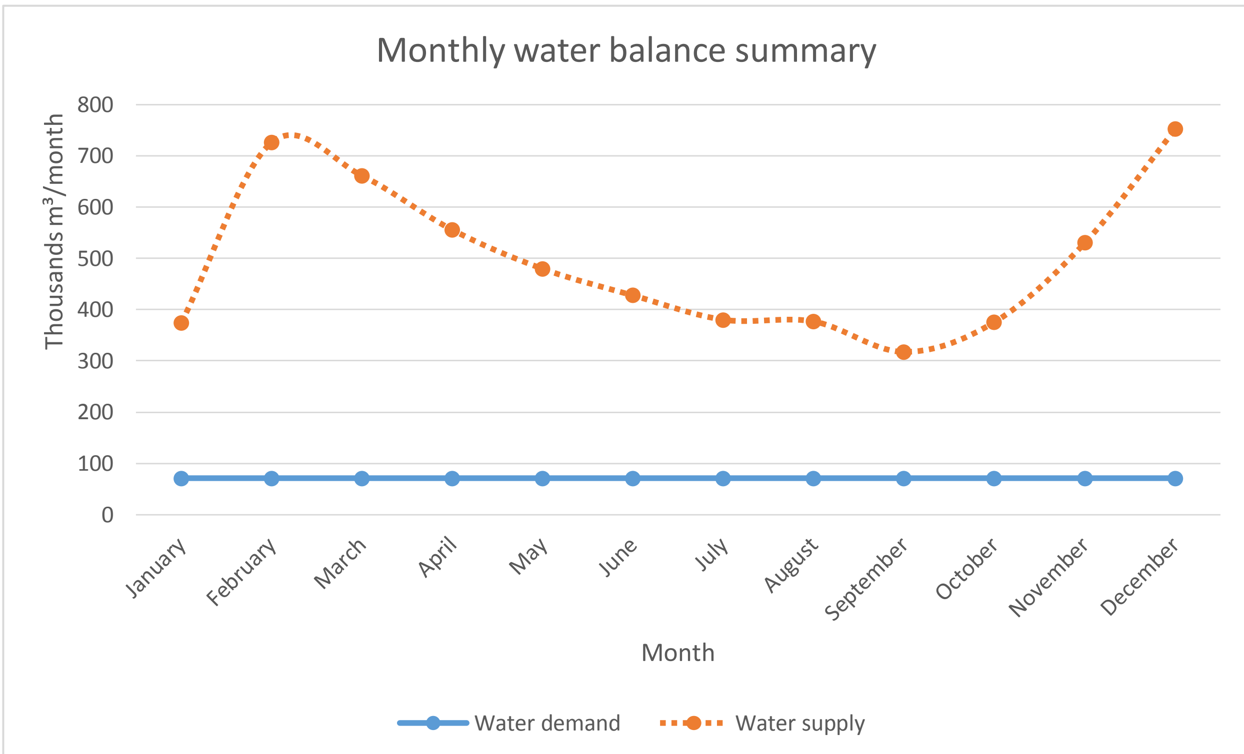
	WATER DEMAND						WATER SOURCES AVAILABLE									
YEAR	CONSTRUCTION		OFFICE		OPERATIONS		BOREHOLES		STW		RECYCLED PLANT		PIT		RAIN	
TOTAL	0		104 875		747 942		43 201		89 144		568 632		0		1 819 767	
January	0.0%	0	8.3%	8 740	8.3%	62 329	0.0%	0	8.3%	7 429	8.3%	47 386	19.8%	0	14.9%	318 850
February	0.0%	0	8.3%	8 740	8.3%	62 329	0.0%	0	8.3%	7 429	8.3%	47 386	16.2%	0	12.2%	671 057
March	0.0%	0	8.3%	8 740	8.3%	62 329	0.0%	0	8.3%	7 429	8.3%	47 386	12.6%	0	9.5%	606 208
April	0.0%	0	8.3%	8 740	8.3%	62 329	0.9%	2 720	8.3%	7 429	8.3%	47 386	6.6%	0	5.0%	497 702
May	0.0%	0	8.3%	8 740	8.3%	62 329	2.2%	6 718	8.3%	7 429	8.3%	47 386	2.2%	0	1.7%	417 818
June	0.0%	0	8.3%	8 740	8.3%	62 329	2.6%	7 915	8.3%	7 429	8.3%	47 386	0.9%	0	0.7%	364 698
July	0.0%	0	8.3%	8 740	8.3%	62 329	2.7%	8 295	8.3%	7 429	8.3%	47 386	0.5%	0	0.4%	316 941
August	0.0%	0	8.3%	8 740	8.3%	62 329	2.7%	8 295	8.3%	7 429	8.3%	47 386	0.5%	0	0.4%	313 529
September	0.0%	0	8.3%	8 740	8.3%	62 329	2.3%	6 999	8.3%	7 429	8.3%	47 386	1.9%	0	1.4%	255 585
October	0.0%	0	8.3%	8 740	8.3%	62 329	0.7%	2 258	8.3%	7 429	8.3%	47 386	7.2%	0	5.4%	318 545
November	0.0%	0	8.3%	8 740	8.3%	62 329	0.0%	0	8.3%	7 429	8.3%	47 386	13.9%	0	10.4%	475 442
December	0.0%	0	8.3%	8 740	8.3%	62 329	0.0%	0	8.3%	7 429	8.3%	47 386	17.6%	0	13.2%	696 961

Annual balance

	WATER DEMAND						WATER SOURCES AVAILABLE									
YEAR	CONSTRUCTION		OFFICE		OPERATIONS		BOREHOLES		STW		RECYCLED PLANT		PIT		RAIN	
TOTAL/YEAR	4 986		104 875		747 942		310 129		89 144		568 632		FROM DIGBY WELLS		1 819 767	
1	100%	4 986	0%	0	0%	0	2%	4 986	0%	0	0%	0	0%	0	0%	0
2	100%	4 986	10%	10 488	10%	74 794	1%	2 155	10%	8 914	10%	56 863	0%	0	7%	129 495
3	100%	4 986	30%	31 463	30%	224 383	3%	9 711	30%	26 743	30%	170 590	0%	0	36%	656 544
4	100%	4 986	50%	52 438	50%	373 971	6%	18 451	50%	44 572	50%	284 316	0%	0	40%	732 983
5	100%	4 986	70%	73 413	70%	523 559	9%	27 756	70%	62 401	70%	398 042	0%	0	94%	1 705 109
6	0%	0	90%	94 388	90%	673 148	12%	37 083	90%	80 229	90%	511 769	0%	0	98%	1 781 547
7	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767
8	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767
9	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767
10	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767
11	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767
12	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767
13	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767
14	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767
15	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767
16	0%	0	100%	104 875	100%	747 942	14%	43 201	100%	89 144	100%	568 632	0%	0	100%	1 819 767

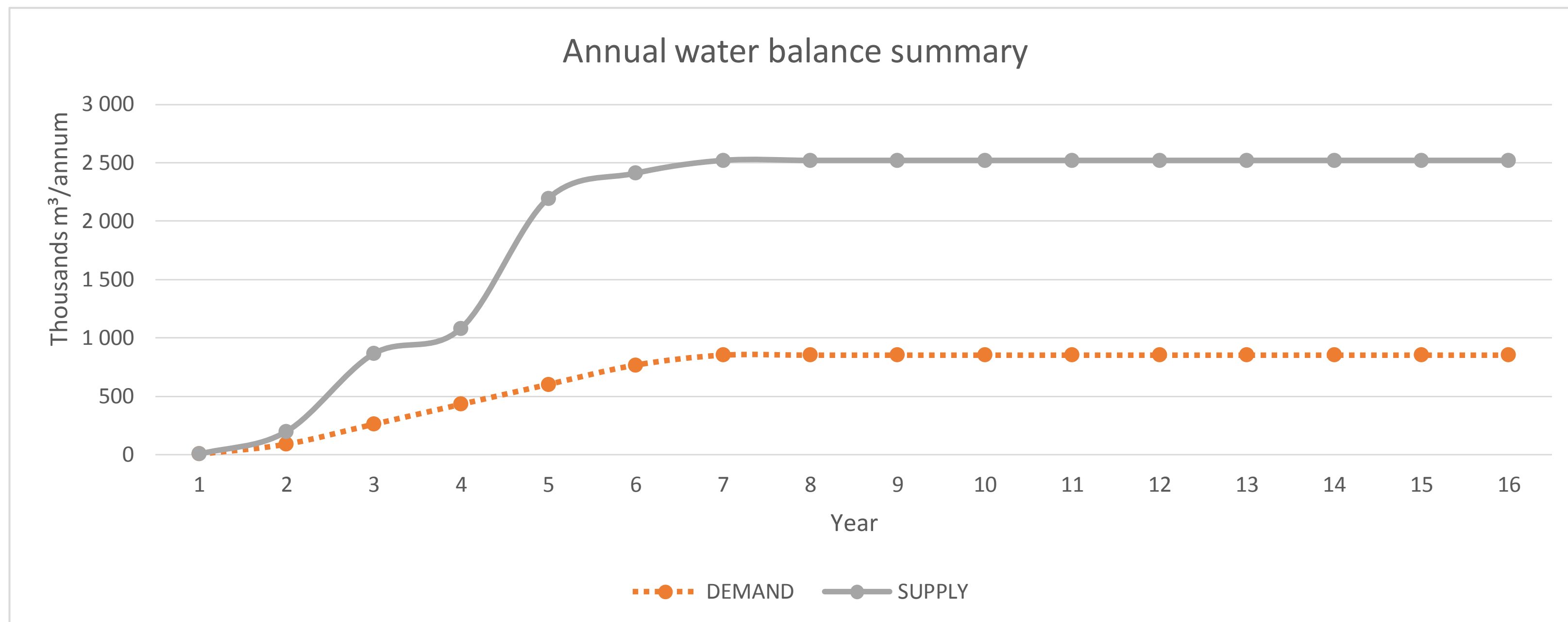
Monthly water balance summary for year 16

MONTH	DEMAND	SUPPLY
January	71 068	373 665
February	71 068	725 872
March	71 068	661 022
April	71 068	555 237
May	71 068	479 350
June	71 068	427 427
July	71 068	380 051
August	71 068	376 639
September	71 068	317 398
October	71 068	375 618
November	71 068	530 256
December	71 068	751 776



Annual water balance summary

YEAR	DEMAND	SUPPLY
1	4 986	4 986
2	90 267	197 428
3	260 831	863 588
4	431 394	1 080 321
5	601 958	2 193 308
6	767 535	2 410 629
7	852 817	2 520 743
8	852 817	2 520 743
9	852 817	2 520 743
10	852 817	2 520 743
11	852 817	2 520 743
12	852 817	2 520 743
13	852 817	2 520 743
14	852 817	2 520 743
15	852 817	2 520 743
16	852 817	2 520 743



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