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Kogan Creek - Pit closure water balance

September 2020

For AARC Environmental Solutions



Document history & status

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1.0	28 September 2020	Tania Kennedy, SBE	Stuart Ritchie, AARC	Draft

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1 Introduction

1.1 Kogan Creek mine operation

Kogan Creek mine is an open cut mine located in the Surat river basin in southern Queensland, 15km south of Brigalow, & 40km south east of Chinchilla.

The mine is operated to supply the adjacent Kogan Creek Power Station with approximately 2.5Mt of coal each year, a single turbine station which provides 750MW baseload power into the Eastern Australian power network.

Kogan Creek mine was opened in 2006: the mine is owned by CS Energy & operated by Golding.

1.2 Study purpose & objectives

A water balance for the final open pit void is required as part of Progressive Rehabilitation & Closure Plan (PRCP) works & evaluation of final pit fate for water quality, quantity & landform closure. Planned mine closure is expected around 2042.

AARC Environmental Services commissioned SeeBuiltEarth develop an analytical water balance for the pit domain to assess & inform pit closure options.



2 Water systems of Kogan Creek pit void

2.1 Climate – rainfall & evaporation

Kogan Creek mine lays in a climate zone characterised by hot, dry summers & cold winters (BoM), near the town of Chinchilla. Two nearby weather stations provide indicative rainfall & evaporation rates, Chinchilla WTP & Ehlma Park:

- Chinchilla WTP (water treatment plant) is located 30km to the northwest of the site & provides data from prior to 1900, providing a record of >100 years of rainfall data.
- Ehlma Park is nearer, approximately 10km to the north east of the site, & with records commencing in the mid 1950's.

Comparative annual rainfall (Figure 1) indicates both sites average between 350mm to 800mm rainfall per year, but may be as low as 200mm in drier years, & regularly up to 1,000mm in wetter years. Rainfall is comparable between the two sites from year to year, & together provide a continuous record of indicative rainfall for the site. Average regional rainfall appears in decline since 1990.

Evaporation records are also available from Chinchilla WTP site since pre-1900. Monthly evaporation rates are shown in Figure 2, & average daily to monthly evaporation in Table 1. A rolling 12 month average evaporation trends show evaporation starting to vary more widely since 1960, & appears to be increasing since 1990.

For longer-term indicators, residual rainfall trends (Figure 3) shows the seasons of the area, with periods of continual average rainfall over several years, but with a strongly wet period from 1930 - 1950, & forming into a severe drier period since 1999. Residual rainfall charts the deviation of rainfall from the average: when conditions are wetter, trends increase – when conditions are drier, trends decline.

Table 1 - Daily & average evaporation rates

	1	2	3	4	5	6	7	8	9	10	11	12
Station	J	F	M	A	M	J	J	A	S	O	N	D
Average daily (mm)	7.7	6.8	6.1	4.6	3.2	2.4	2.5	3.5	4.9	6.3	7.4	7.8
Monthly (mm)	239.4	191.0	188.5	137.1	99.0	71.8	78.2	109.3	148.0	195.8	220.7	240.4
Annual – 1919.1mm												

2.2 General water balance state

As a simple water balance from year to year, the Kogan Creek site from year to year is generally strongly water balance negative. Annual rainfall averages 644.4mm, whilst annual evaporation rates (on the condition water was present) can range up to 1,919mm in a year, a deficit of 1,250mm per year.





Annual rainfall - Chincilla WTP & Ehlma Park

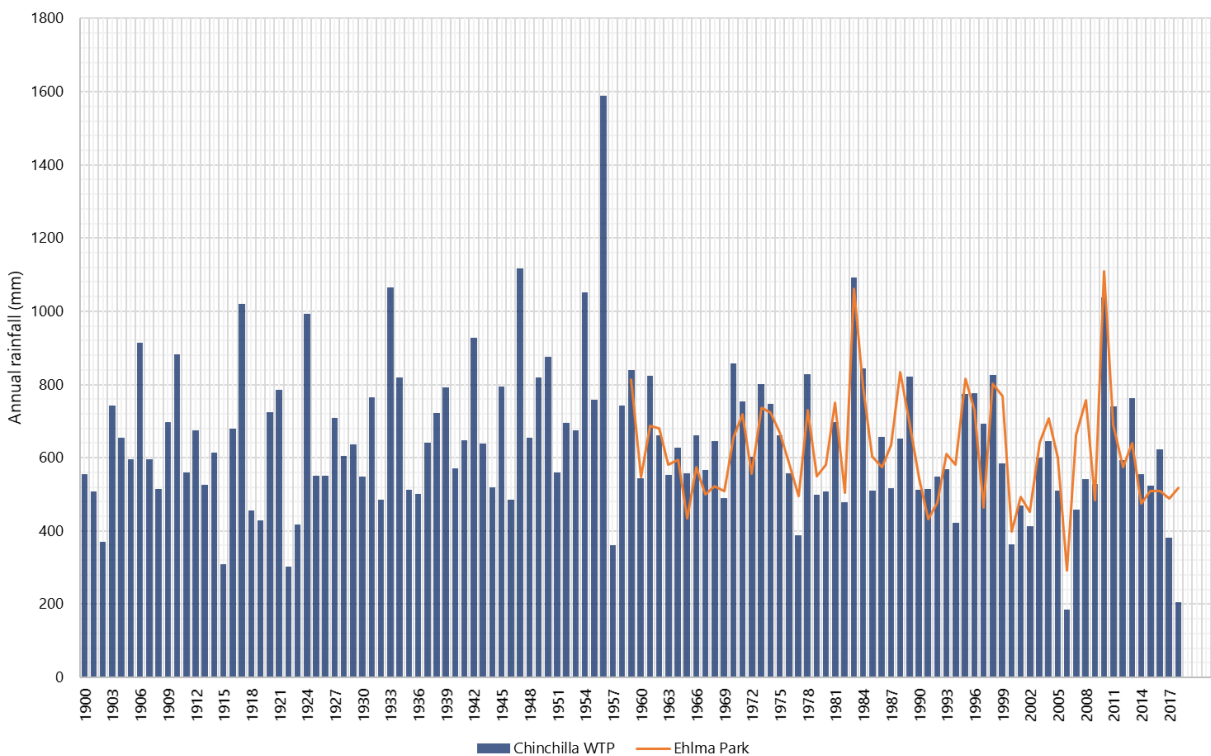


Figure 1 - Annual rainfall Chincilla WTP & Ehlma Park

Chincilla monthly evaporation

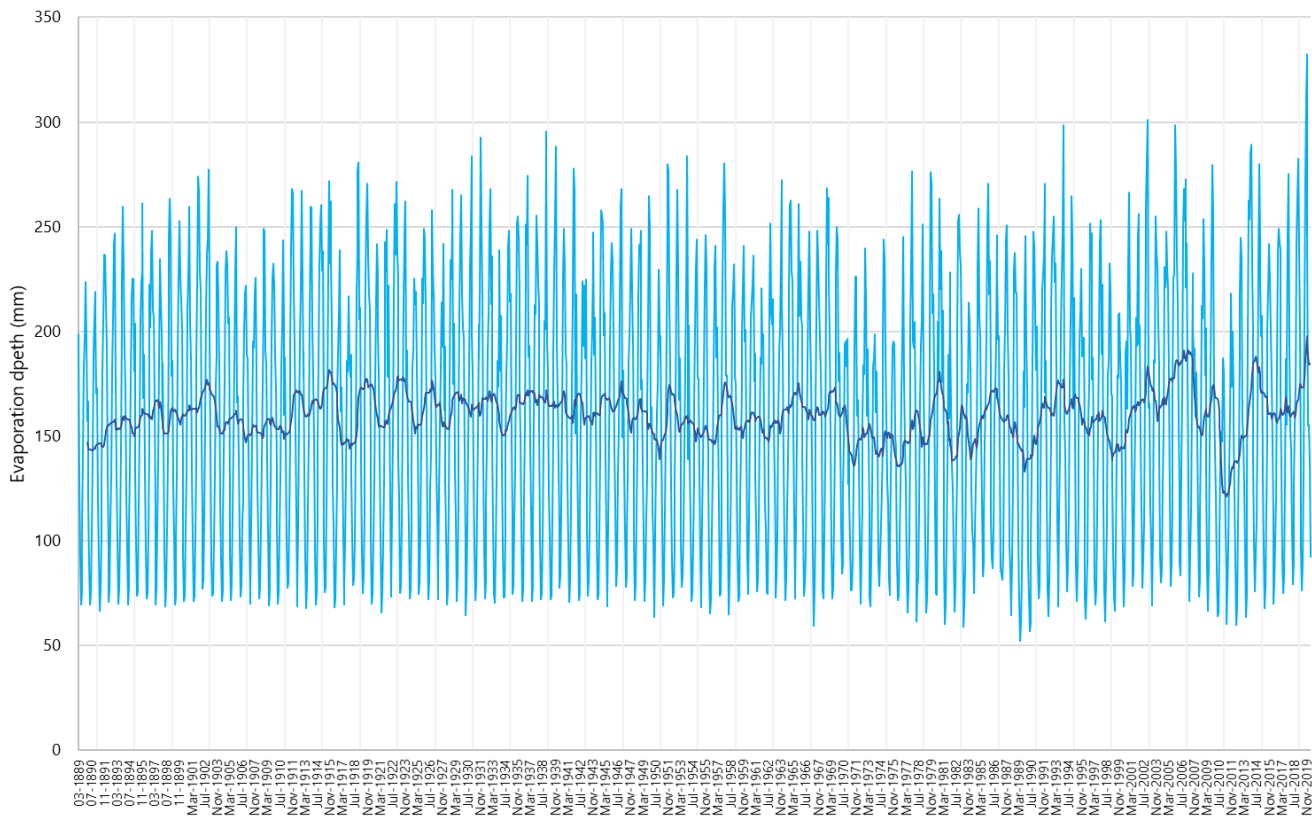


Figure 2 - Monthly evaporation & rolling annual average evaporation - Chincilla



Residual rainfall patterns since 1900

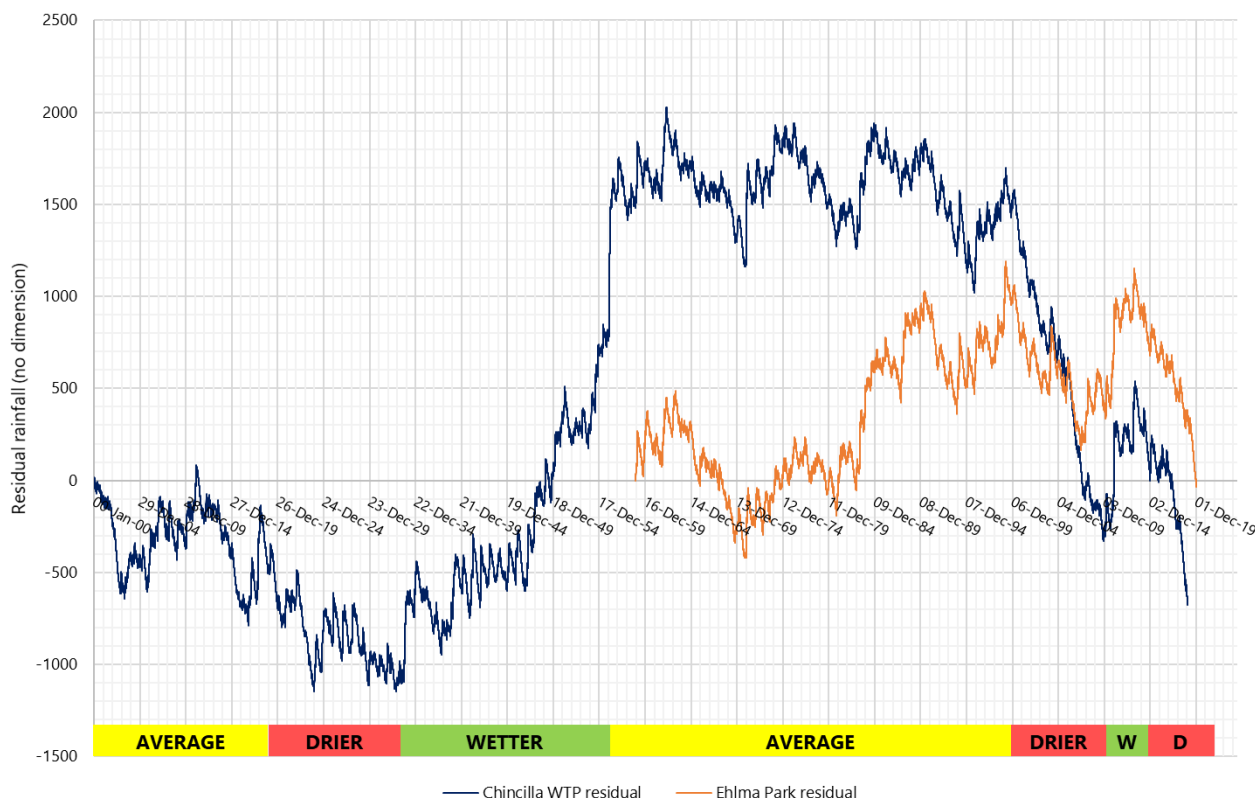


Figure 3 - Residual rainfall of Kogan Creek region

2.3 Surface water & catchments

Landscape of the site is predominantly low gradient, with dark grey sandy loamy soils: high sodicity & low strength & nutrients.

Figure 4 lays out the catchments of the site: with pit catchment shown as #38, with a total catchment currently reporting to the pit of 1,468,071m², & in the event of a pit crest bund being installed, the pit itself has a catchment surface area of 620,000m².

2.4 Groundwater

No groundwater inflow is recorded into the pit of Kogan Creek mine: the pit is essentially dry unless rain falls.

2.5 Final pit dimensions & storage curve

Pit storage volumes are determined by slicing a pit void at 1 metre intervals, & using unit height by surface area to calculate volume. Storage curves & volumes are shown in in Figure 5.

Final pit void runs from an elevation of 253mAHD (deepest) to 325mAHD (pit crest), with a total void space of 625,000m³. There is a noticeable change in elevation to storage ratio from base of pit to ~267mAHD, & again at 267-275mAHD as pit wall angles change.

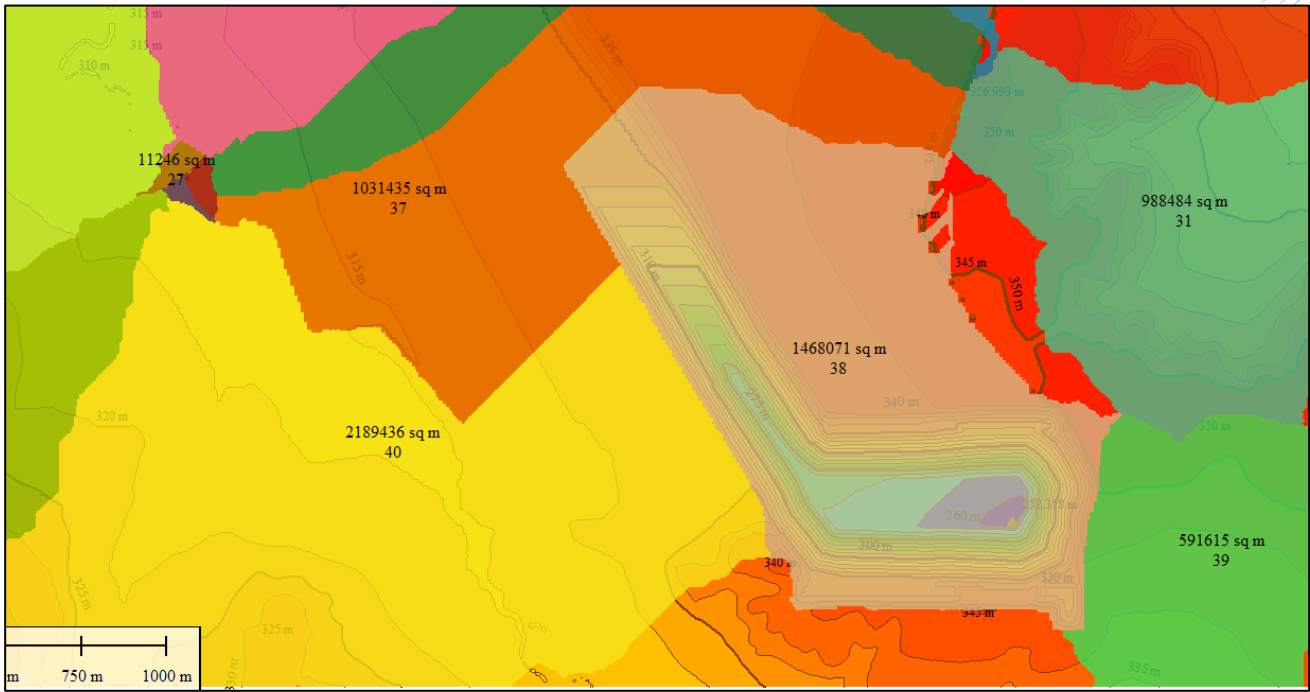


Figure 4 - Catchments of Kogan Creek mine: note pit catchment area (#38)



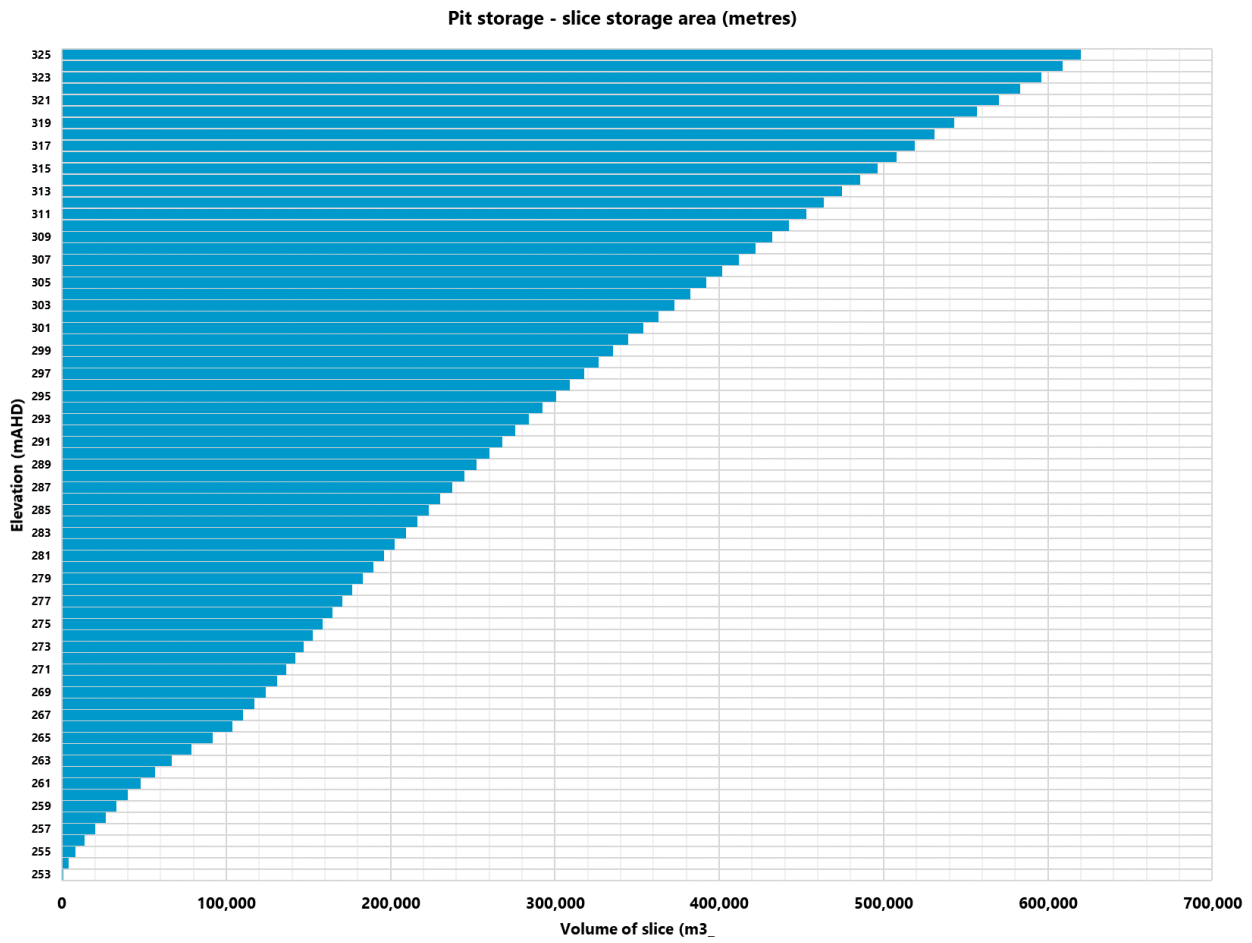
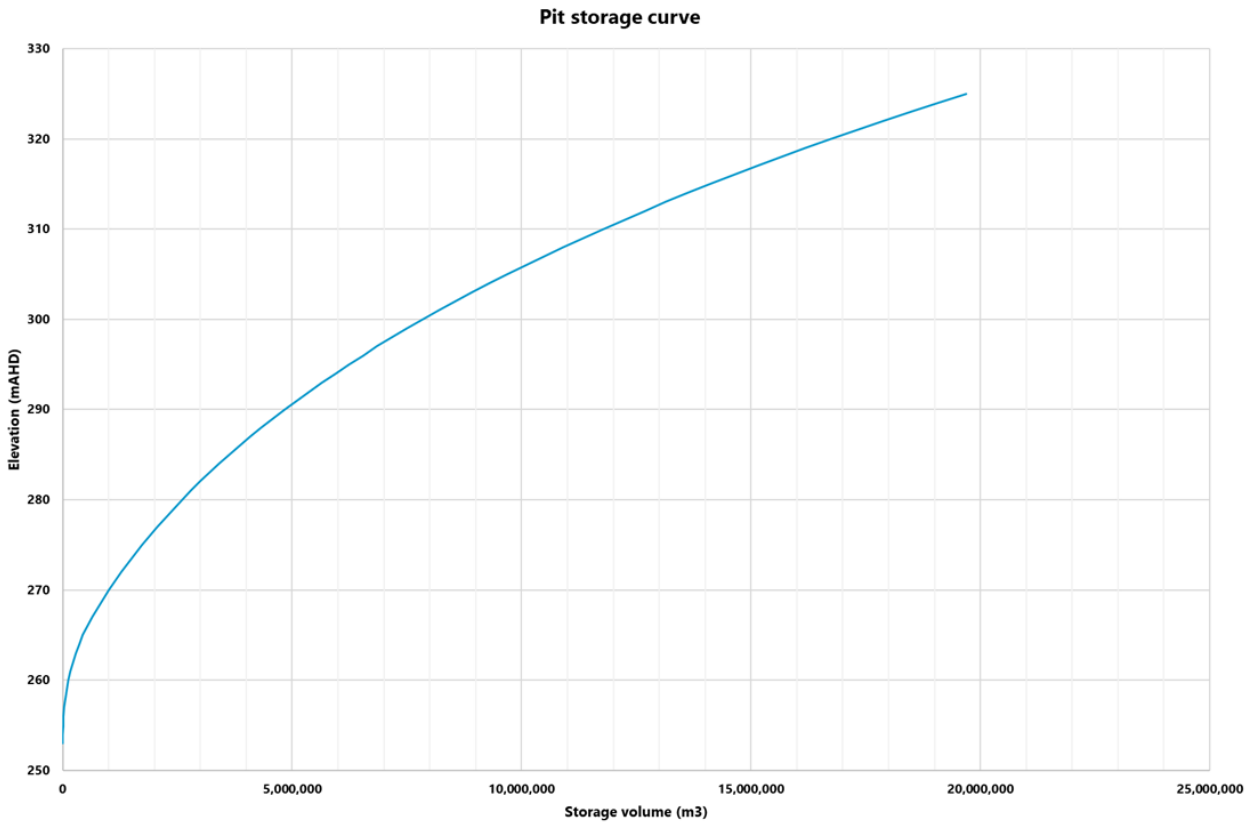


Figure 5 - Pit storage curves for Kogan pit





3 Water balance structure & outcomes

3.1 Overview

The Kogan Creek pit domain water balance is an analytical balance running from January 1900 through to December 2019 by daily time steps. The actual 120-year rainfall record is applied as it provides an appropriate range to assess variation of the types of events & sequences to be expected in the region. Notably, if a drying climate occurs in the future, the condition is likely to increase the severity of negative water balance for the site.

The model works through applying rainfall each day from the record onto catchment areas & building a rainfall runoff model with initial loss & runoff coefficient suitable for landscape. Any water volume which is water balance positive is stored within the pit as a volume with a surface area, with evaporation on any water surface (based on the storage curve). The balance executes as a running storage to see changes in water storage both as a total system & as a budget change.

Figure 6 provides a view of the balance configuration & setup for Kogan Creek mine pit domain.

Kogan Creek pit domain water balance																					
Parameters	DataArrangements			PitMetrics		Rain&EvapTracking		CatchmentsReporting			WaterInputs		WaterOutputs			CHANGE					
	Date	Month	FY	RunningStorage	SurfaceAreaCalc	RLCalc	EvapRate	Rainfall	C38A - Direct pit	C38 - Surrounding	TotalCatchment	GroundwaterGain	Other	TOTAL-IN	Evaporation		Pump	GroundwaterLoss	TOTAL-OUT		
				m2			mm	mm	m3	m3	m3	l/s to m3/d	m3/d	m3	m3	m3/d	l/s to m3/d	m3	m3		
Area m2				8,211					620,000	843,071					8,211						
RunoffDepth(mm)									10	15					10						
RunoffFactor OR PanFactor									85%	65%					0.95						
l/s OR m3/d												0.0	0.0			0.0	0.0				
RL or mAHd						255															
Pit water volume m3 (starting)				8,440																	
BALANCE																					
01-Jan-00	1	1900	1900	8,440	8,211	255	7.7	2	0	0	0	0.0	0.0	0	60.2	0.0	0.0	60.2	0.0	-60	
02-Jan-00	1	1900	1900	8,380	8,211	254	7.7	0	0	0	0	0.0	0.0	0	28.6	0.0	0.0	28.6	0.0	-29	
03-Jan-00	1	1900	1900	8,351	8,211	254	7.7	0	0	0	0	0.0	0.0	0	28.6	0.0	0.0	28.6	0.0	-29	
04-Jan-00	1	1900	1900	8,323	8,211	254	7.7	0	0	0	0	0.0	0.0	0	28.6	0.0	0.0	28.6	0.0	-29	
05-Jan-00	1	1900	1900	8,294	8,211	254	7.7	0	0	0	0	0.0	0.0	0	28.6	0.0	0.0	28.6	0.0	-29	
06-Jan-00	1	1900	1900	8,265	8,211	254	7.7	0	0	0	0	0.0	0.0	0	28.6	0.0	0.0	28.6	0.0	-29	
07-Jan-00	1	1900	1900	8,237	8,211	254	7.7	0	0	0	0	0.0	0.0	0	28.6	0.0	0.0	28.6	0.0	-29	
08-Jan-00	1	1900	1900	8,208	8,211	254	7.7	5	0	0	0	0.0	0.0	0	28.6	0.0	0.0	28.6	0.0	-29	
09-Jan-00	1	1900	1900	8,180	8,211	254	7.7	1	0	0	0	0.0	0.0	0	28.6	0.0	0.0	28.6	0.0	-29	
10-Jan-00	1	1900	1900	8,151	8,211	254	7.7	26	8,274	5,898	14,172	0.0	0.0	14,172	0.0	0.0	0.0	0.0	14,172	0.0	14,172
11-Jan-00	1	1900	1900	22,323	13,591	256	7.7	3	0	0	0	0.0	0.0	0	99.7	0.0	0.0	99.7	0.0	-100	
12-Jan-00	1	1900	1900	22,224	13,591	256	7.7	0	0	0	0	0.0	0.0	0	99.7	0.0	0.0	99.7	0.0	-100	
13-Jan-00	1	1900	1900	22,124	13,591	256	7.7	0	0	0	0	0.0	0.0	0	99.7	0.0	0.0	99.7	0.0	-100	

Figure 6 - View of water balance configuration & step

3.2 Balance calibration settings

The balance is established through application of reasonable, conservative factors of rainfall, runoff & evaporation relative to the geology & water system of the site. Fine-tuning of parameters is achieved through trial & error & observing if the system provides a practical response given what is already known about the system from empirical knowledge.

Table 2 presents the summary of water balance settings applied throughout all scenarios.

Table 2 - Water balance settings

Component	Details & settings of balance	
Dates	January 1900 through to 31 December 2019 (120 years), daily time steps	
Rainfall sites	Chinchilla WTP	
Catchment areas	Pit area - 620,000m ²	Adjacent catchment - 843,071m ²
Initial loss	10mm (slope of pit)	15mm (low gradient catchment)
Runoff factor	0.85 (reporting direct to pit)	0.65
Evaporation	Average monthly evaporation by day, only applied if there is storage in pit & no rain. Factor applied to pan factor of 0.95	
Groundwater inflow	None	
Pumping/extraction or loss	None	





3.3 Scenarios

Two main catchment scenarios are run:

1. No pit bund at pit crest (adjacent catchment).
2. Pit bund at pit crest

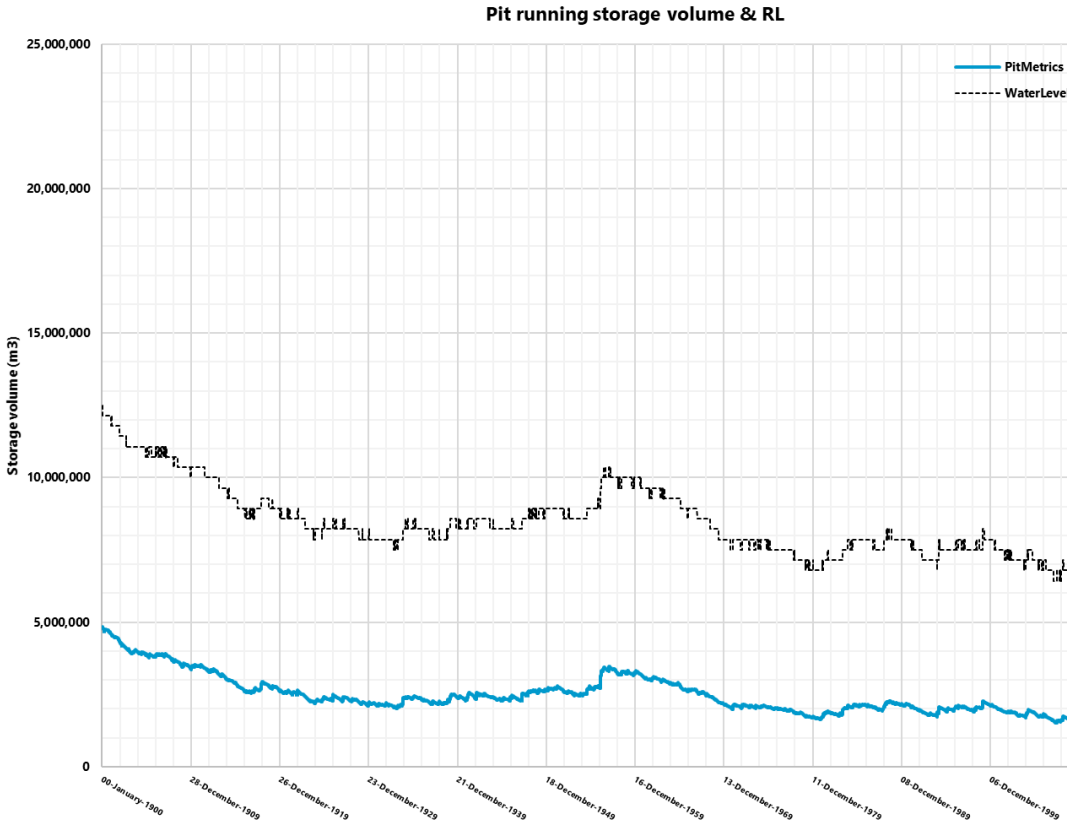
Three starting storage states to assess the full range of states of water budget & understand dynamics of the water balance:

1. Start at full storage (325mAHD) – to assess behaviour with a large body of water (limitless supply to assess negative water balance potential).
2. Start at mid-storage (290mAHD) – to assess behaviour during wetter periods.
3. Start at low storage (255mAHD) – to assess likely starting point at closure.



4 Outcomes & findings

4.1 Scenario 1 – full catchment reporting (no pit crest bund)

Starting value	% years negative rainfall	Comment
Full storage Figure 7	78% years water negative	Strong continuous drying stages until ~1970, then forms into slow decline of levels.
Mid-storage 	69% years water negative	Strong continuous drying stages until ~1970, then forms into slow decline of levels.



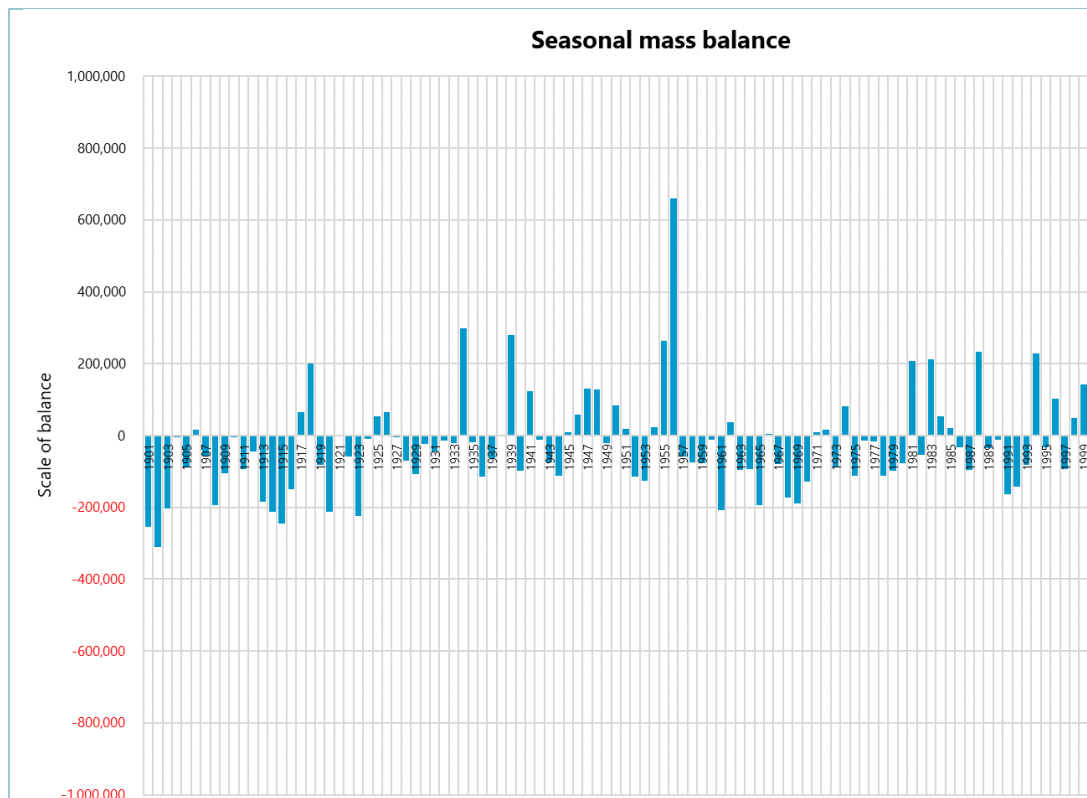


Figure 8

Low-storage
Figure 9

51%
years
water
negative

Shows
impact
of wetter
period in
early
century,
but
returns
to
similar
level of

Key learnings from Scenario 1 (pit & adjacent catchment):

1. Pit levels stabilise into slow declining rates, regardless of starting volume by end of the 120 year cycle in the drying to average rainfall periods.
2. Wetter periods may result in extra storage in the short term (low-storage starting volume), but will trend similarly over time as rainfall returns to near average.
3. Evaporation volumes highly dependent on size of pond area, with reduced evaporation as pond areas decline near base of pit.

4.2 Scenario 2 – pit only catchment (pit crest bund)

Starting value	% years negative rainfall	Comment
Full storage Figure 10	83% years water negative	Strong continuous drying stages until ~1980, when changes to slow decline.
Mid-storage Figure 11	73% years water negative	Impact of wetter & drier years shown, stabilises ~1980, when changes to slow decline.





Low-storage Figure 12	55% years water negative	Increases during wetter cycles, but imitates greater storage options from 1980 in slow decline.
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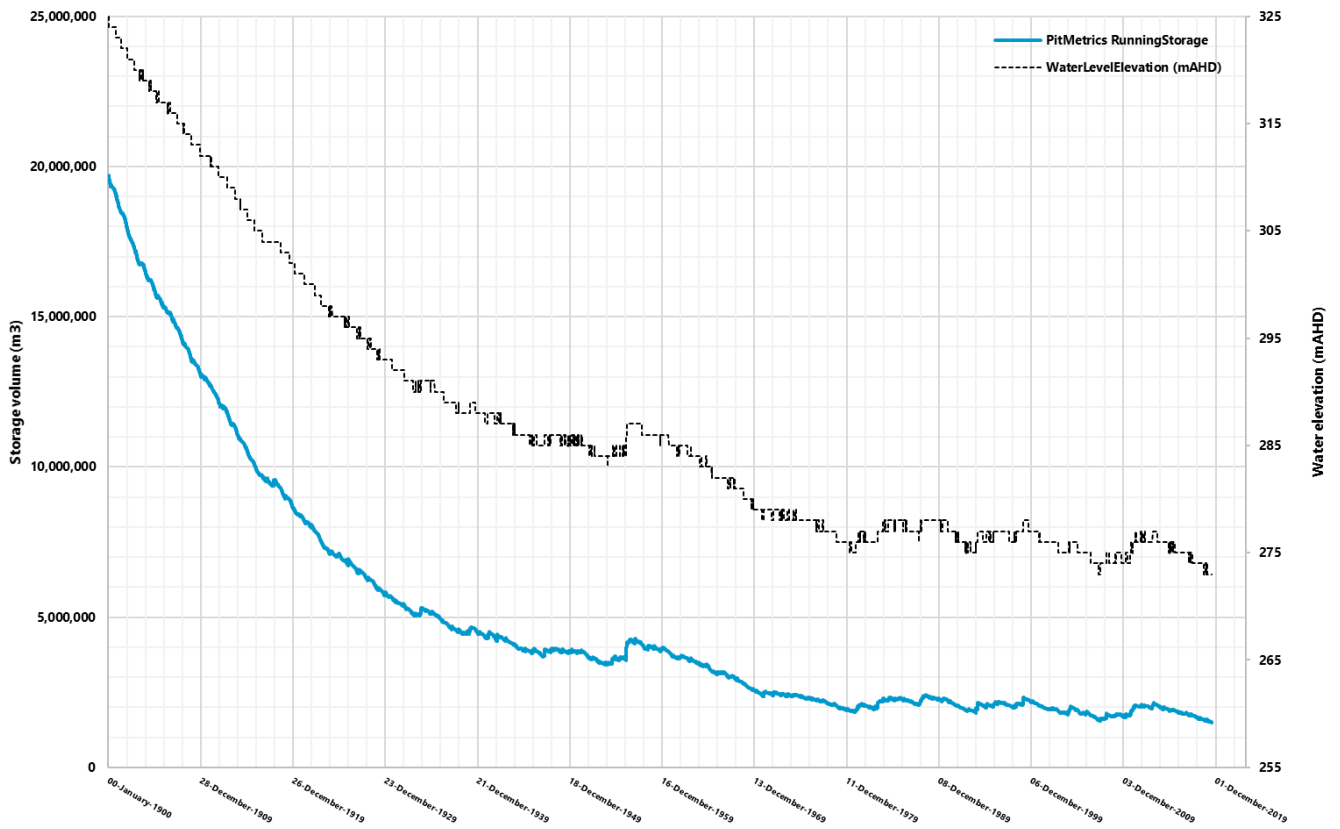
Key learnings from Scenario 2 (pit only catchment):

1. Diversion of adjacent catchment via a pit crest bund or similar:
 - a. Reduces potential storage
 - b. The water balance stabilises & reaches steady state, with seasonal variation.
2. All scenarios return to a low storage outcome with seasonal volumes, even with a large starting volume & across wet seasons.
3. Stabilisation is based on freshening rainfall to manage pit water quality. In the event of a drying climate, size of pit storage will be further reduced.





Pit running storage volume & RL



Seasonal mass balance

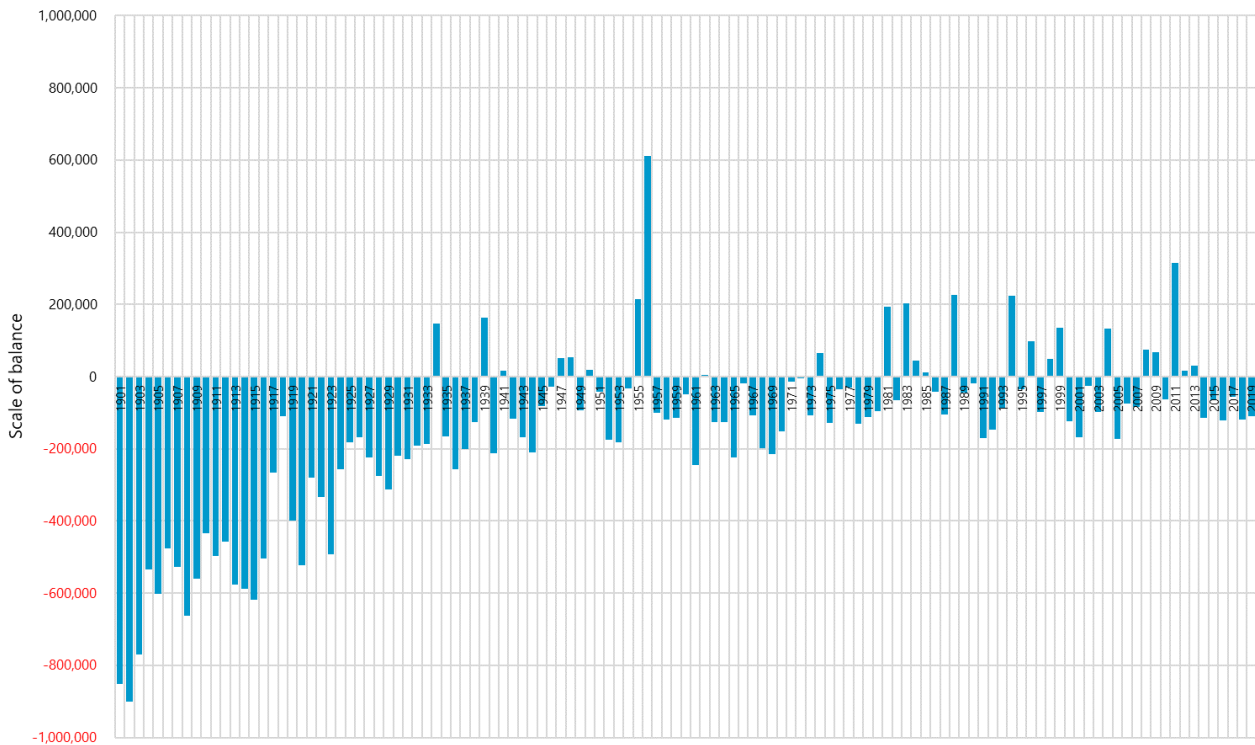
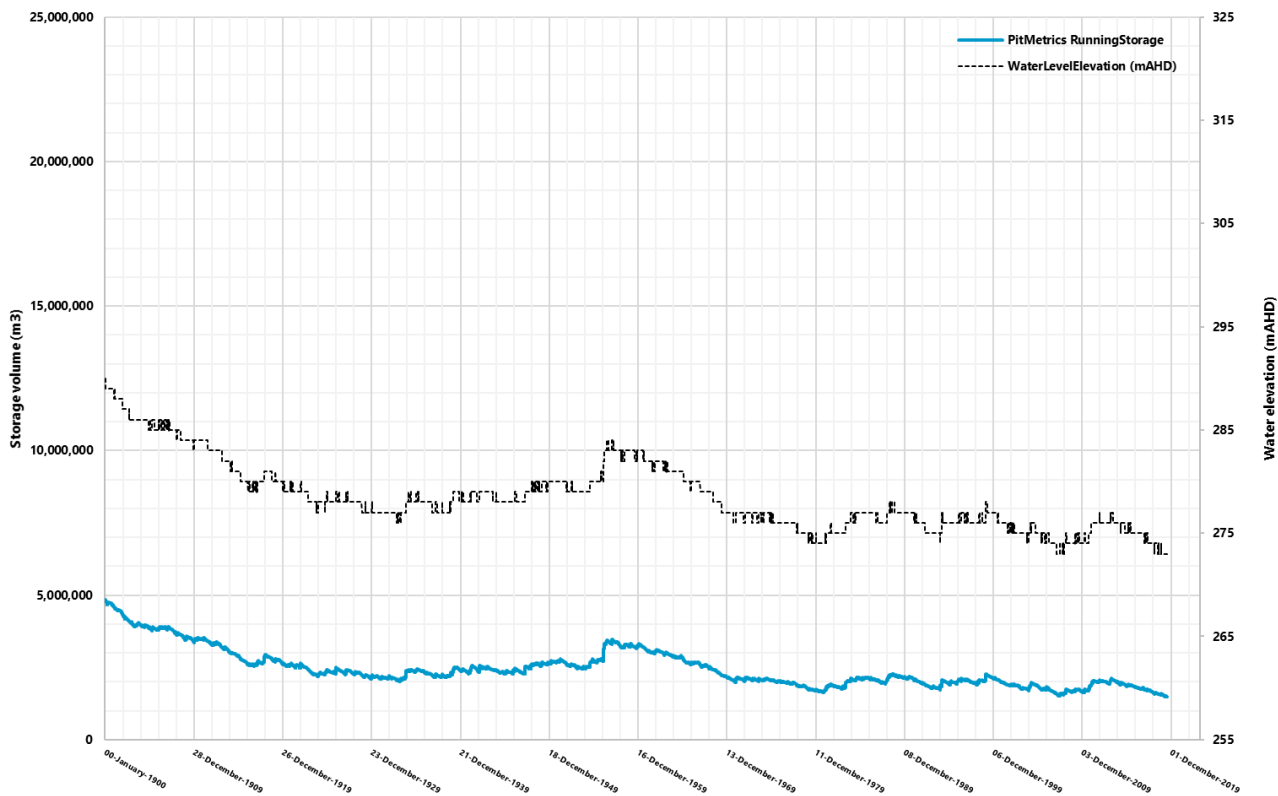


Figure 7 - Pit & catchment - full supply level water balance



Pit running storage volume & RL



Seasonal mass balance

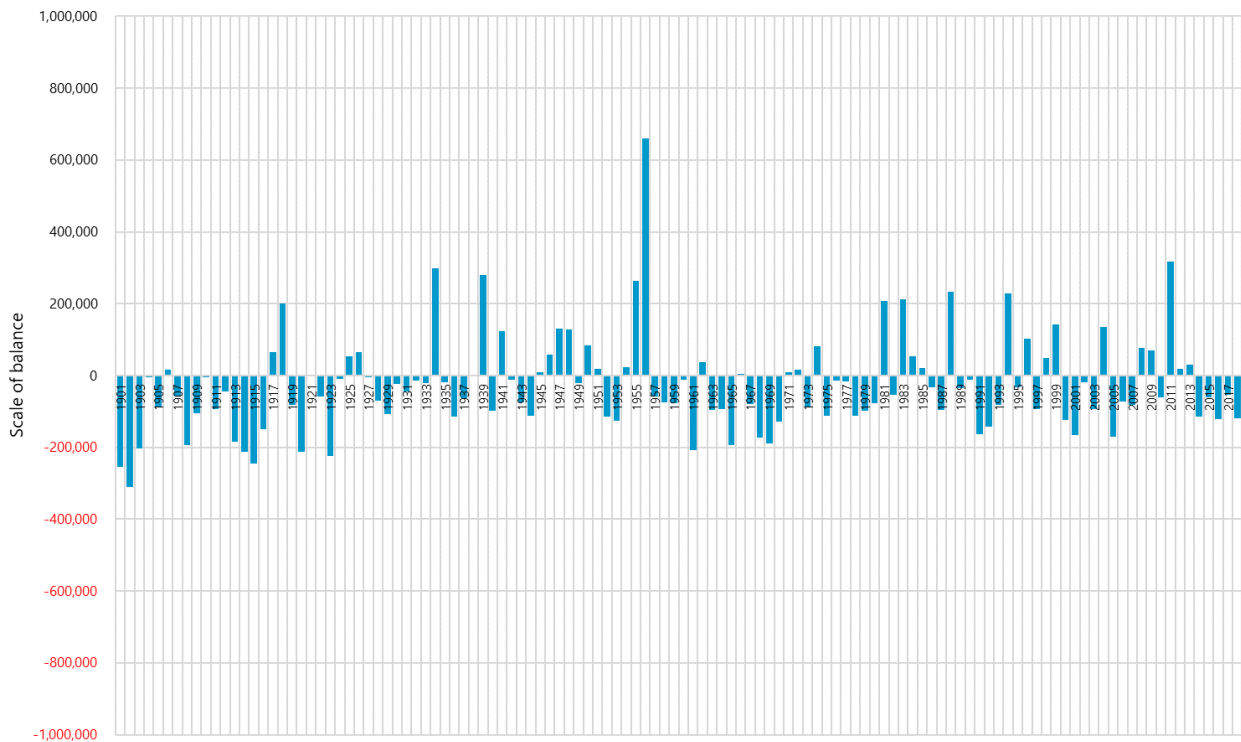
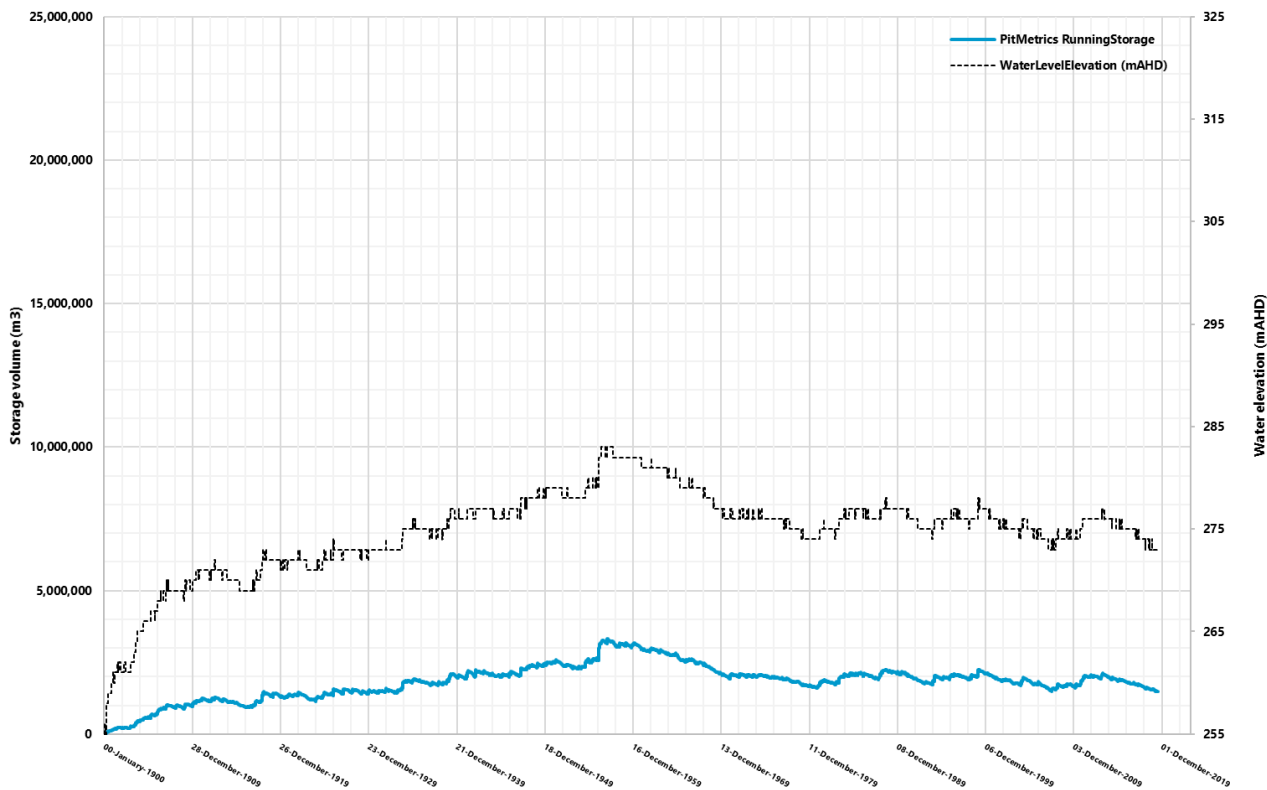


Figure 8 - Pit & catchment - mid supply level water balance





Pit running storage volume & RL



Seasonal mass balance

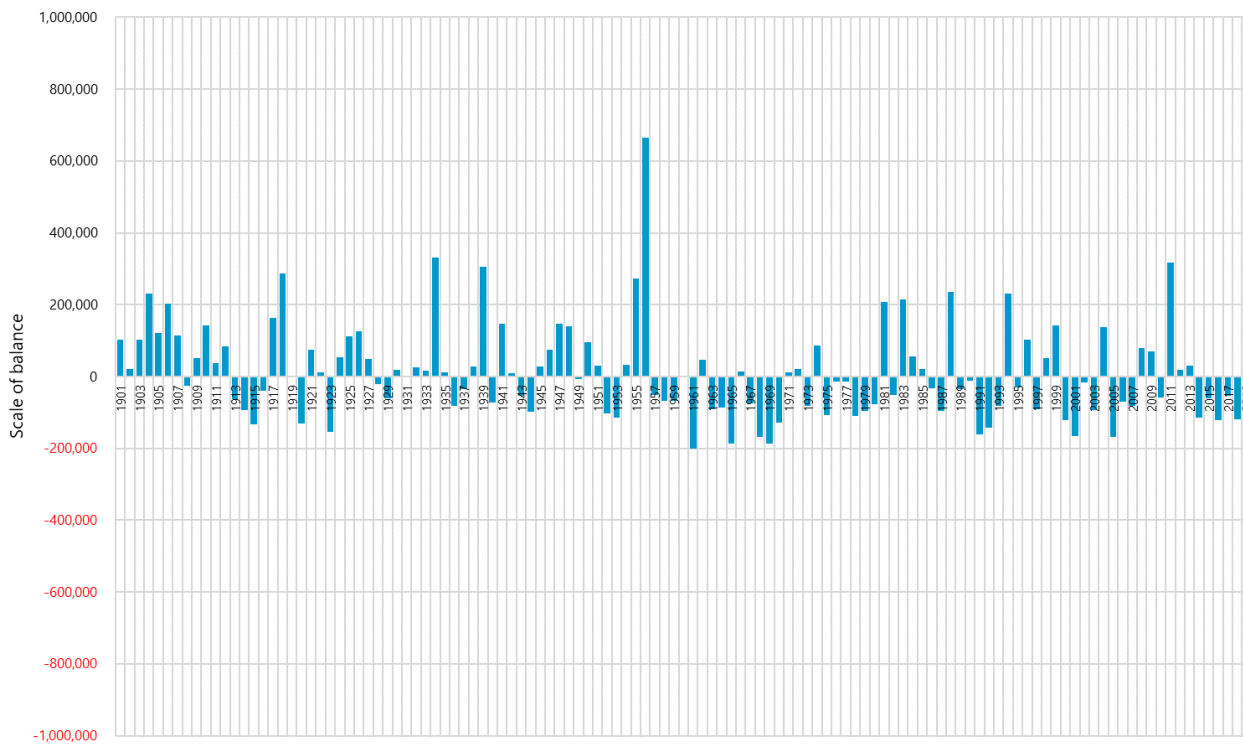
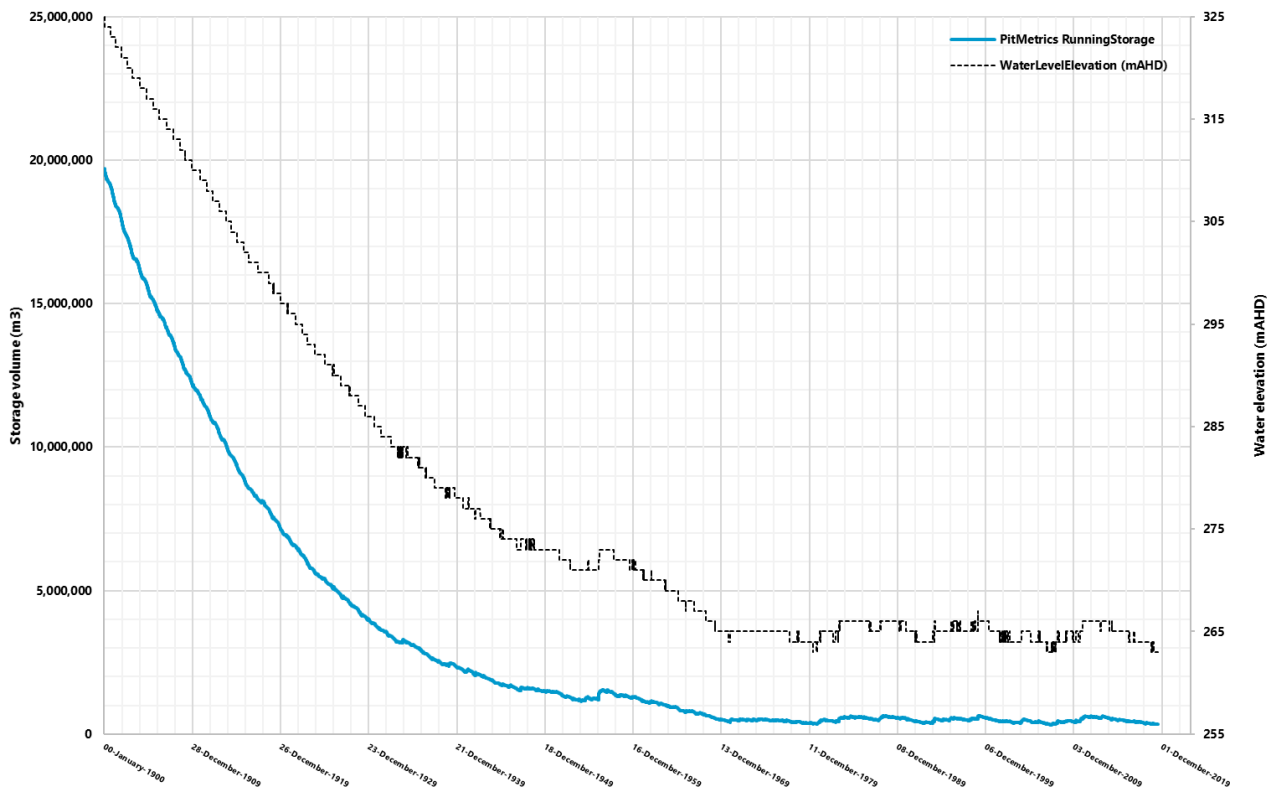


Figure 9 - Pit & catchment - low supply level water balance





Pit running storage volume & RL



Seasonal mass balance

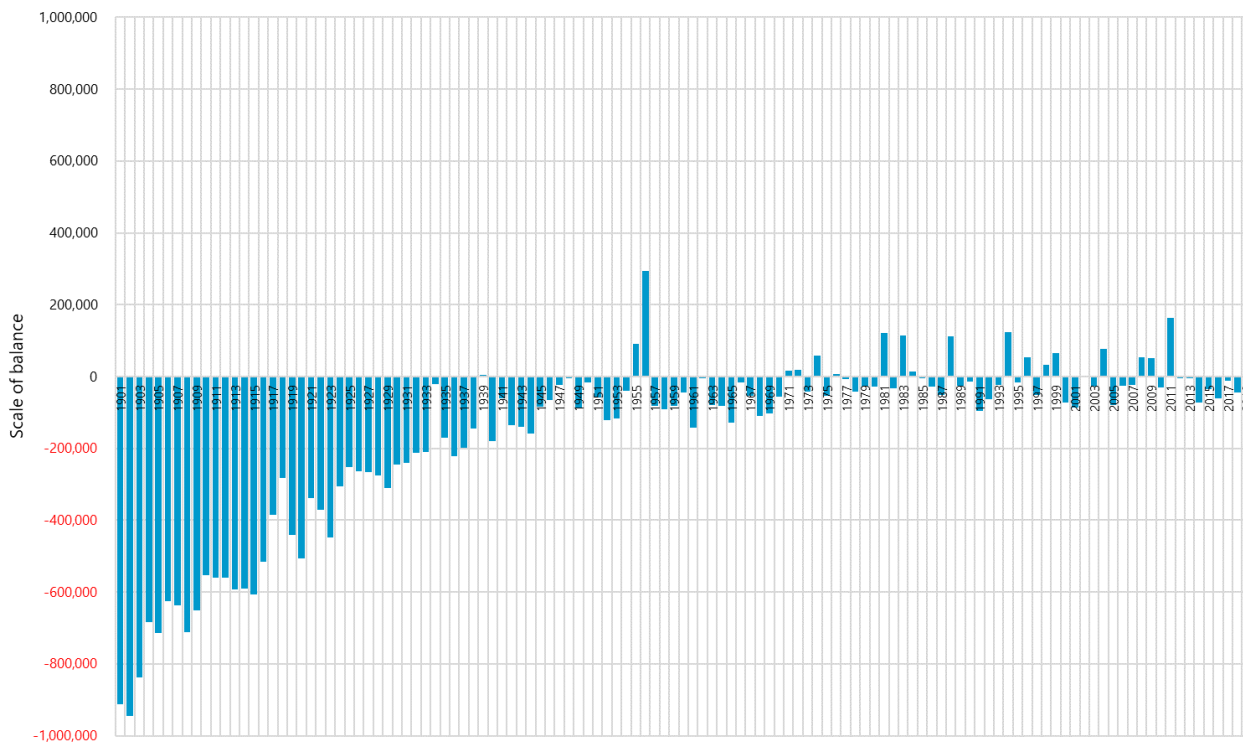
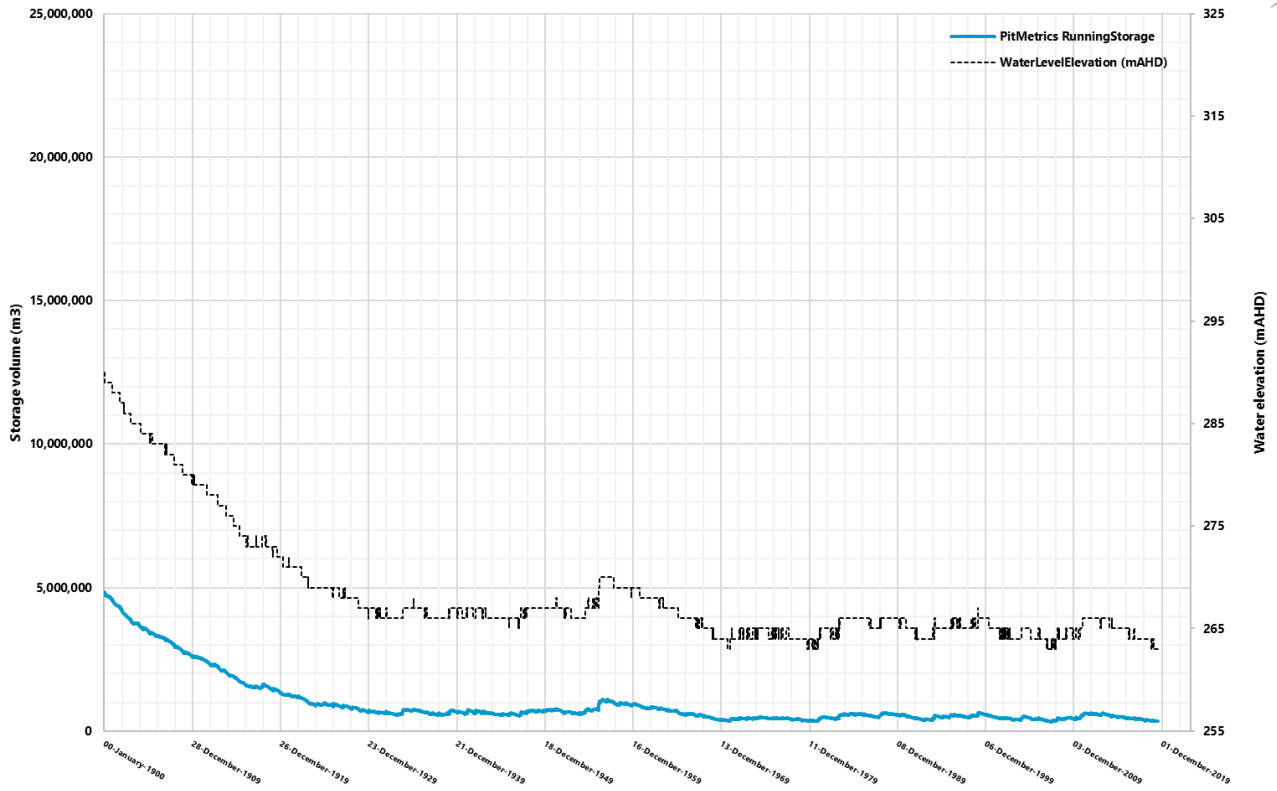


Figure 10 - Pit only catchment - high supply level water balance





Pit running storage volume & RL



Seasonal mass balance

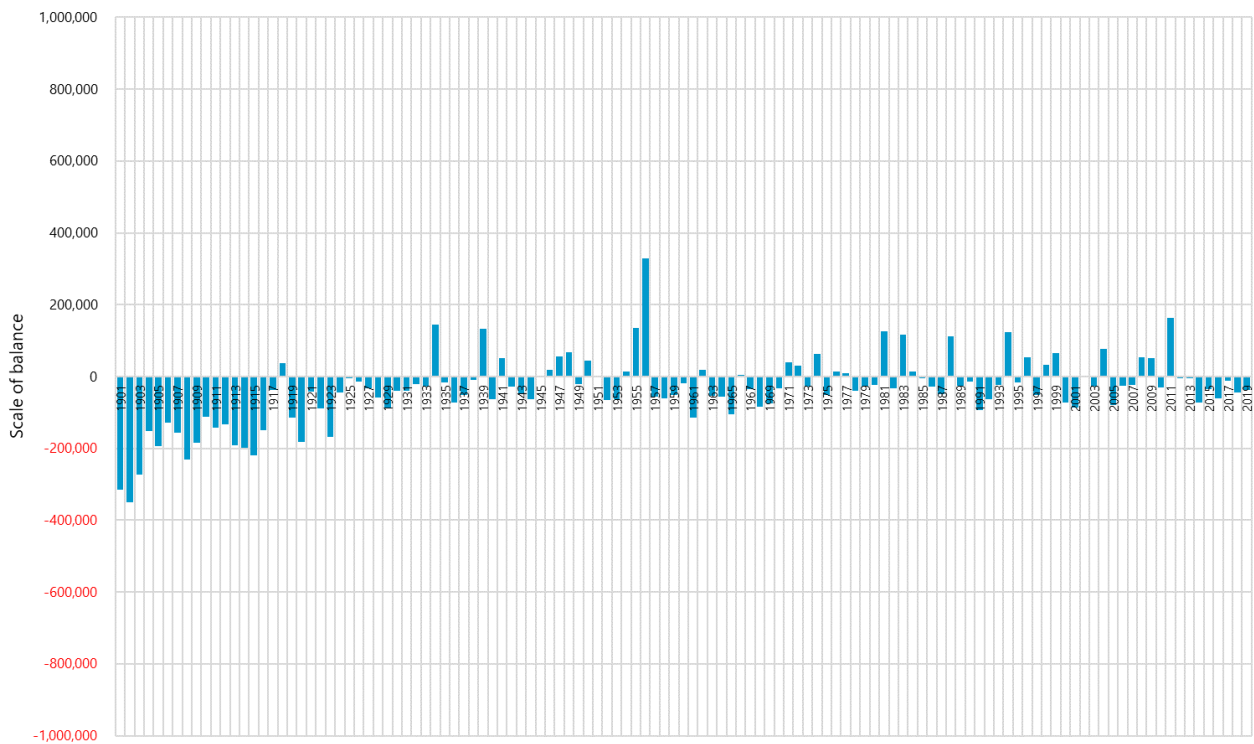
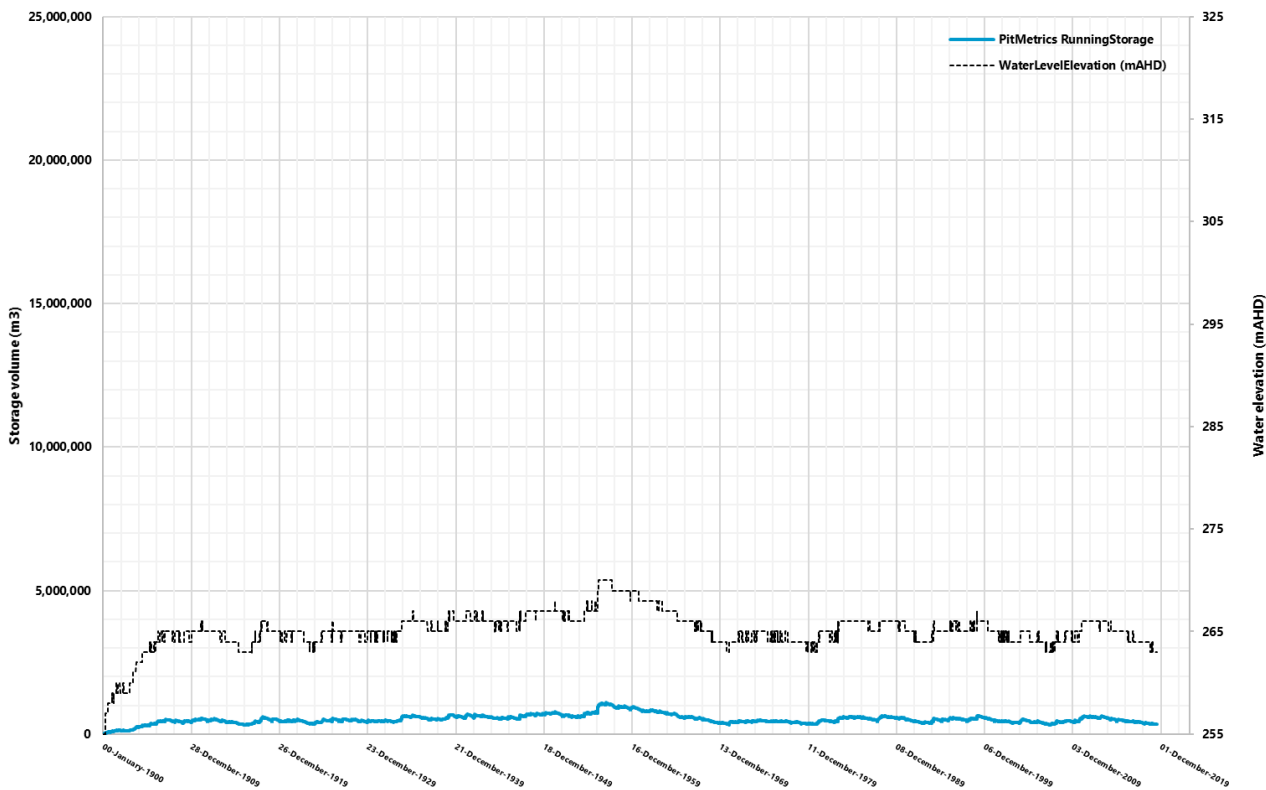


Figure 11 - Pit only catchment – mid-supply level water balance





Pit running storage volume & RL



Seasonal mass balance

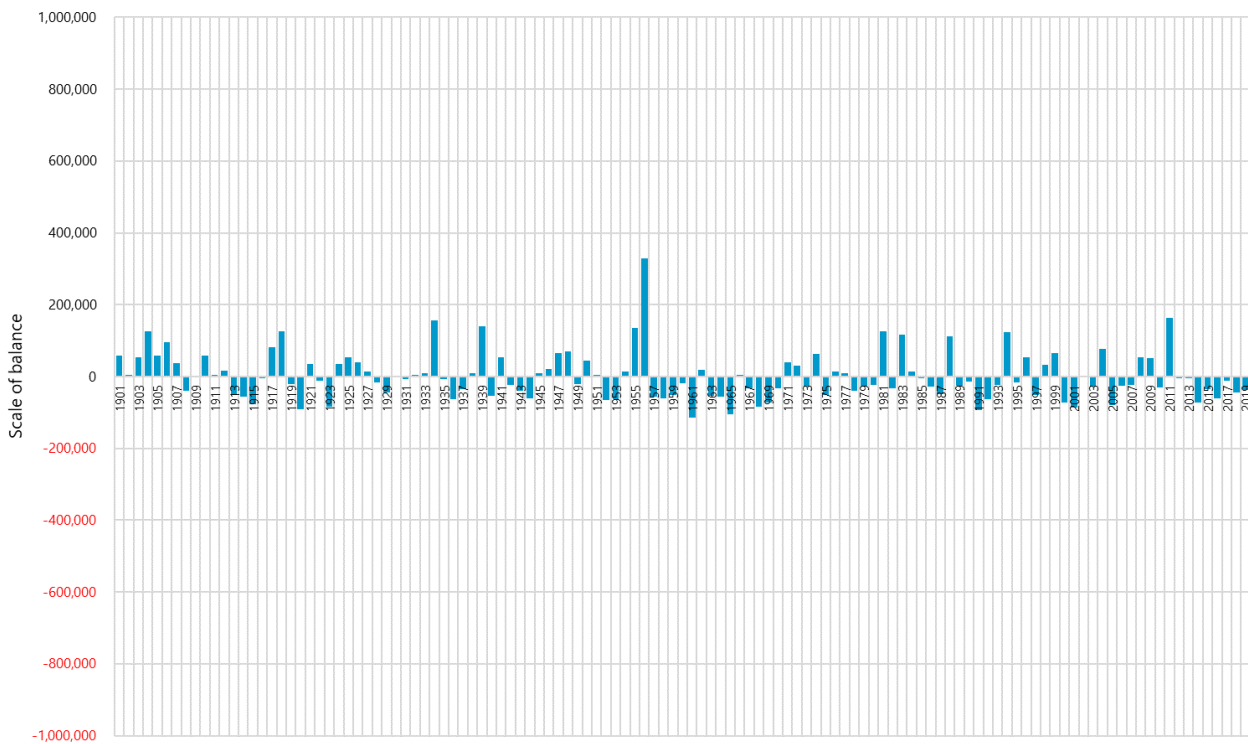


Figure 12 - Pit only catchment – low-supply level water balance





5 Appendix A – Balance tables





Scenario 1 - Pit & catchment – full supply volume

Mass water movement profiles

FY	StartDate	EndDate	Kogan						StartVolume	EndVolume	Change
			Rainfall	Groundwater	OtherWaterIn	Evaporation	GroundwaterOut	PumpingOut			
1901	30/06/1900	30/06/1901	171,984	-	-	1,023,595	-	-	19,292,704	18,431,035	-861,669
1902	30/06/1901	30/06/1902	113,051	-	-	1,031,983	-	-	18,431,035	17,530,073	-900,962
1903	30/06/1902	30/06/1903	194,490	-	-	963,367	-	-	17,530,073	16,761,166	-768,907
1904	30/06/1903	30/06/1904	381,011	-	-	914,823	-	-	16,761,166	16,227,322	-533,844
1905	30/06/1904	30/06/1905	299,554	-	-	901,901	-	-	16,227,322	15,624,921	-602,401
1906	30/06/1905	30/06/1906	393,314	-	-	868,345	-	-	15,624,921	15,149,890	-475,030
1907	30/06/1906	30/06/1907	322,466	-	-	850,405	-	-	15,149,890	14,621,926	-527,964
1908	30/06/1907	30/06/1908	188,817	-	-	851,051	-	-	14,621,926	13,959,641	-662,285
1909	30/06/1908	30/06/1909	267,509	-	-	827,373	-	-	13,959,641	13,399,752	-559,889
1910	30/06/1909	30/06/1910	359,458	-	-	792,461	-	-	13,399,752	12,966,724	-433,028
1911	30/06/1910	30/06/1911	263,219	-	-	760,955	-	-	12,966,724	12,468,965	-497,760
1912	30/06/1911	30/06/1912	321,417	-	-	779,063	-	-	12,468,965	12,011,295	-457,669
1913	30/06/1912	30/06/1913	170,457	-	-	746,506	-	-	12,011,295	11,435,223	-576,073
1914	30/06/1913	30/06/1914	133,319	-	-	722,374	-	-	11,435,223	10,846,121	-589,102
1915	30/06/1914	30/06/1915	97,092	-	-	715,418	-	-	10,846,121	10,227,772	-618,349
1916	30/06/1915	30/06/1916	172,046	-	-	675,741	-	-	10,227,772	9,724,054	-503,718
1917	30/06/1916	30/06/1917	380,667	-	-	646,441	-	-	9,724,054	9,457,657	-266,397
1918	30/06/1917	30/06/1918	518,835	-	-	628,627	-	-	9,457,657	9,347,866	-109,791
1919	30/06/1918	30/06/1919	250,153	-	-	649,762	-	-	9,347,866	8,948,235	-399,630
1920	30/06/1919	30/06/1920	121,849	-	-	644,520	-	-	8,948,235	8,425,522	-522,714
1921	30/06/1920	30/06/1921	314,288	-	-	594,053	-	-	8,425,522	8,145,736	-279,786
1922	30/06/1921	30/06/1922	268,997	-	-	587,903	-	-	8,145,736	7,813,061	-332,675
1923	30/06/1922	30/06/1923	75,720	-	-	581,315	-	-	7,813,061	7,321,194	-491,867
1924	30/06/1923	30/06/1924	284,663	-	-	541,710	-	-	7,321,194	7,064,127	-257,067
1925	30/06/1924	30/06/1925	348,002	-	-	529,344	-	-	7,064,127	6,882,785	-181,342
1926	30/06/1925	30/06/1926	380,160	-	-	548,971	-	-	6,882,785	6,713,954	-168,831
1927	30/06/1926	30/06/1927	297,658	-	-	520,975	-	-	6,713,954	6,490,618	-223,336
1928	30/06/1927	30/06/1928	224,936	-	-	500,348	-	-	6,490,618	6,215,188	-275,430
1929	30/06/1928	30/06/1929	195,565	-	-	508,634	-	-	6,215,188	5,902,100	-313,088
1930	30/06/1929	30/06/1930	269,717	-	-	488,697	-	-	5,902,100	5,683,119	-218,980
1931	30/06/1930	30/06/1931	251,172	-	-	478,682	-	-	5,683,119	5,455,591	-227,528
1932	30/06/1931	30/06/1932	279,922	-	-	470,535	-	-	5,455,591	5,264,959	-190,632
1933	30/06/1932	30/06/1933	269,848	-	-	457,304	-	-	5,264,959	5,077,485	-187,474
1934	30/06/1933	30/06/1934	589,343	-	-	442,481	-	-	5,077,485	5,224,366	146,881
1935	30/06/1934	30/06/1935	279,041	-	-	445,388	-	-	5,224,366	5,058,001	-166,365
1936	30/06/1935	30/06/1936	191,582	-	-	447,375	-	-	5,058,001	4,802,191	-255,810
1937	30/06/1936	30/06/1937	236,634	-	-	437,258	-	-	4,802,191	4,601,567	-200,624
1938	30/06/1937	30/06/1938	297,442	-	-	422,778	-	-	4,601,567	4,476,214	-125,353
1939	30/06/1938	30/06/1939	578,014	-	-	415,472	-	-	4,476,214	4,638,773	162,559
1940	30/06/1939	30/06/1940	210,440	-	-	421,753	-	-	4,638,773	4,427,443	-211,330
1941	30/06/1940	30/06/1941	427,532	-	-	411,277	-	-	4,427,443	4,443,697	16,254
1942	30/06/1941	30/06/1942	303,308	-	-	420,632	-	-	4,443,697	4,326,356	-117,341
1943	30/06/1942	30/06/1943	232,343	-	-	399,599	-	-	4,326,356	4,159,100	-167,257
1944	30/06/1943	30/06/1944	191,669	-	-	400,587	-	-	4,159,100	3,950,166	-208,934
1945	30/06/1944	30/06/1945	306,668	-	-	387,282	-	-	3,950,166	3,869,551	-80,615
1946	30/06/1945	30/06/1946	366,215	-	-	393,145	-	-	3,869,551	3,842,605	-26,946
1947	30/06/1946	30/06/1947	426,571	-	-	385,719	-	-	3,842,605	3,893,473	50,868
1948	30/06/1947	30/06/1948	430,618	-	-	377,183	-	-	3,893,473	3,946,909	53,436
1949	30/06/1948	30/06/1949	296,681	-	-	389,429	-	-	3,946,909	3,854,145	-92,764
1950	30/06/1949	30/06/1950	393,887	-	-	374,504	-	-	3,854,145	3,873,544	19,399
1951	30/06/1950	30/06/1951	338,410	-	-	381,340	-	-	3,873,544	3,830,598	-42,946
1952	30/06/1951	30/06/1952	204,177	-	-	380,346	-	-	3,830,598	3,654,428	-176,170
1953	30/06/1952	30/06/1953	181,175	-	-	363,206	-	-	3,654,428	3,472,382	-182,047
1954	30/06/1953	30/06/1954	330,077	-	-	362,733	-	-	3,472,382	3,439,726	-32,656
1955	30/06/1954	30/06/1955	580,346	-	-	366,118	-	-	3,439,726	3,653,969	214,243
1956	30/06/1955	30/06/1956	980,805	-	-	369,211	-	-	3,653,969	4,265,596	611,627
1957	30/06/1956	30/06/1957	303,171	-	-	404,479	-	-	4,265,596	4,164,287	-101,309
1958	30/06/1957	30/06/1958	284,550	-	-	402,463	-	-	4,164,287	4,046,358	-117,930
1959	30/06/1958	30/06/1959	276,016	-	-	389,626	-	-	4,046,358	3,932,748	-113,610
1960	30/06/1959	30/06/1960	340,231	-	-	388,921	-	-	3,932,748	3,884,058	-48,690
1961	30/06/1960	30/06/1961	141,362	-	-	385,385	-	-	3,884,058	3,640,019	-244,040
1962	30/06/1961	30/06/1962	373,739	-	-	369,826	-	-	3,640,019	3,643,931	3,913
1963	30/06/1962	30/06/1963	242,434	-	-	368,652	-	-	3,643,931	3,517,698	-126,234
1964	30/06/1963	30/06/1964	253,476	-	-	378,842	-	-	3,517,698	3,392,316	-125,382
1965	30/06/1964	30/06/1965	146,699	-	-	370,133	-	-	3,392,316	3,168,867	-223,449
1966	30/06/1965	30/06/1966	326,023	-	-	345,321	-	-	3,168,867	3,149,569	-19,298
1967	30/06/1966	30/06/1967	243,140	-	-	350,778	-	-	3,149,569	3,041,930	-107,639
1968	30/06/1967	30/06/1968	153,034	-	-	351,547	-	-	3,041,930	2,843,402	-198,528
1969	30/06/1968	30/06/1969	113,592	-	-	327,467	-	-	2,843,402	2,629,511	-213,890
1970	30/06/1969	30/06/1970	160,808	-	-	312,952	-	-	2,629,511	2,477,353	-152,159
1971	30/06/1970	30/06/1971	293,290	-	-	306,746	-	-	2,477,353	2,463,896	-13,457
1972	30/06/1971	30/06/1972	308,183	-	-	312,422	-	-	2,463,896	2,459,656	-4,240
1973	30/06/1972	30/06/1973	201,956	-	-	309,063	-	-	2,459,656	2,352,535	-107,121
1974	30/06/1973	30/06/1974	363,157	-	-	297,672	-	-	2,352,535	2,418,034	65,499
1975	30/06/1974	30/06/1975	168,364	-	-	297,217	-	-	2,418,034	2,289,167	-128,867
1976	30/06/1975	30/06/1976	258,682	-	-	293,478	-	-	2,289,167	2,254,371	-34,796
1977	30/06/1976	30/06/1977	266,390	-	-	296,678	-	-	2,254,371	2,224,070	-30,301
1978	30/06/1977	30/06/1978	168,629	-	-	298,679	-	-	2,224,070	2,094,019	-130,051
1979	30/06/1978	30/06/1979	174,319	-	-	287,347	-	-	2,094,019	1,980,977	-113,042
1980	30/06/1979	30/06/1980	187,614	-	-	283,770	-	-	1,980,977	1,884,807	-96,170
1981	30/06/1980	30/06/1981	468,206	-	-	273,777	-	-	1,884,807	2,079,263	194,457
1982	30/06/1981	30/06/1982	218,922	-	-	285,417	-	-	2,079,263	2,012,755	-66,509
1983	30/06/1982	30/06/1983	481,978	-	-	278,517	-	-	2,012,755	2,216,229	203,474
1984	30/06/1983	30/06/1984	336,740	-	-	291,956	-	-	2,216,229	2,261,027	44,798
1985	30/06/1984	30/06/1985	318,833	-	-	307,956	-	-	2,261,027	2,271,904	10,877
1986	30/06/1985	30/06/1986	259,035	-	-	300,934	-	-	2,271,904	2,229,991	-41,913
1987	30/06/1986	30/06/1987	188,393	-	-	293,066	-	-	2,229,991	2,125,318	-104,673
1988	30/06/1987	30/06/1988	518,872	-	-	293,551	-	-	2,125,318	2,350,653	225,335
1989	30/06/1988	30/06/1989	257,088	-	-	301,291	-	-	2,350,653	2,306,450	-44,202
1990	30/06/1989	30/06/1990	278,261	-	-	297,916	-	-	2,306,450	2,286,795	-19,655
1991	30/06/1990	30/06/1991	136,500	-	-	306,348	-	-	2,286,795	2,116,939	-169,856
1992	30/06/1991	30/06/1992	136,925	-	-	283,873	-	-	2,116,939	1,969,987	-146,952
1993	30/06/1992	30/06/1993	191,510	-	-	280,526	-	-	1,969,987	1,880,959	-89,028
1994	30/06/1993	30/06/1994	503,601	-	-	279,479	-	-	1,880,959	2,105,108	224,149
1995	30/06/1994										



Scenario 1 - Pit & catchment – mid supply volume

Mass water movement profiles											
FY	StartDate	EndDate	Rainfall	Groundwater	OtherWaterIn	Evaporation	Kogan			Change	
							GroundwaterOut	PumpingOut	StartVolume		
1901	30/06/1900	30/06/1901	171,984	-	-	426,519	-	-	4,723,531	4,468,979	-254,552
1902	30/06/1901	30/06/1902	113,051	-	-	422,809	-	-	4,468,979	4,159,205	-309,774
1903	30/06/1902	30/06/1903	194,490	-	-	398,583	-	-	4,159,205	3,955,095	-204,110
1904	30/06/1903	30/06/1904	381,011	-	-	386,731	-	-	3,955,095	3,949,374	-5,721
1905	30/06/1904	30/06/1905	299,554	-	-	387,590	-	-	3,949,374	3,861,338	-88,036
1906	30/06/1905	30/06/1906	393,314	-	-	377,396	-	-	3,861,338	3,877,256	15,918
1907	30/06/1906	30/06/1907	322,466	-	-	380,588	-	-	3,877,256	3,819,118	-58,138
1908	30/06/1907	30/06/1908	188,817	-	-	383,481	-	-	3,819,118	3,624,438	-194,680
1909	30/06/1908	30/06/1909	267,509	-	-	373,146	-	-	3,624,438	3,518,801	-105,637
1910	30/06/1909	30/06/1910	359,458	-	-	364,491	-	-	3,518,801	3,513,768	-5,033
1911	30/06/1910	30/06/1911	263,219	-	-	357,174	-	-	3,513,768	3,419,813	-93,955
1912	30/06/1911	30/06/1912	321,417	-	-	365,585	-	-	3,419,813	3,375,630	-44,183
1913	30/06/1912	30/06/1913	170,457	-	-	354,651	-	-	3,375,630	3,191,421	-184,209
1914	30/06/1913	30/06/1914	133,319	-	-	344,725	-	-	3,191,421	2,979,999	-211,421
1915	30/06/1914	30/06/1915	97,092	-	-	341,361	-	-	2,979,999	2,735,715	-244,284
1916	30/06/1915	30/06/1916	172,046	-	-	321,677	-	-	2,735,715	2,586,070	-149,645
1917	30/06/1916	30/06/1917	380,067	-	-	314,708	-	-	2,586,070	2,651,443	65,374
1918	30/06/1917	30/06/1918	518,835	-	-	318,523	-	-	2,651,443	2,851,770	200,327
1919	30/06/1918	30/06/1919	250,153	-	-	331,781	-	-	2,851,770	2,770,127	-81,643
1920	30/06/1919	30/06/1920	121,849	-	-	334,737	-	-	2,770,127	2,557,225	-212,902
1921	30/06/1920	30/06/1921	314,288	-	-	311,634	-	-	2,557,225	2,559,879	2,654
1922	30/06/1921	30/06/1922	268,997	-	-	313,816	-	-	2,559,879	2,501,657	-58,221
1923	30/06/1922	30/06/1923	75,720	-	-	313,319	-	-	2,501,657	2,277,446	-224,212
1924	30/06/1923	30/06/1924	284,663	-	-	295,134	-	-	2,277,446	2,266,975	-10,471
1925	30/06/1924	30/06/1925	348,002	-	-	295,006	-	-	2,266,975	2,319,971	52,996
1926	30/06/1925	30/06/1926	380,160	-	-	314,804	-	-	2,319,971	2,385,327	65,356
1927	30/06/1926	30/06/1927	297,658	-	-	301,549	-	-	2,385,327	2,381,436	-3,891
1928	30/06/1927	30/06/1928	224,936	-	-	295,061	-	-	2,381,436	2,311,311	-70,125
1929	30/06/1928	30/06/1929	195,565	-	-	303,211	-	-	2,311,311	2,203,651	-107,660
1930	30/06/1929	30/06/1930	269,717	-	-	293,907	-	-	2,203,651	2,179,461	-24,190
1931	30/06/1930	30/06/1931	251,172	-	-	294,814	-	-	2,179,461	2,135,818	-43,642
1932	30/06/1931	30/06/1932	279,922	-	-	294,881	-	-	2,135,818	2,121,659	-14,159
1933	30/06/1932	30/06/1933	269,848	-	-	289,973	-	-	2,121,659	2,101,535	-20,124
1934	30/06/1933	30/06/1934	589,343	-	-	290,439	-	-	2,101,535	2,400,453	298,919
1935	30/06/1934	30/06/1935	279,041	-	-	298,469	-	-	2,400,453	2,381,025	-19,429
1936	30/06/1935	30/06/1936	191,582	-	-	304,784	-	-	2,381,025	2,267,823	-113,201
1937	30/06/1936	30/06/1937	236,634	-	-	299,208	-	-	2,267,823	2,205,236	-62,588
1938	30/06/1937	30/06/1938	297,442	-	-	294,304	-	-	2,205,236	2,208,374	3,138
1939	30/06/1938	30/06/1939	578,014	-	-	297,044	-	-	2,208,374	2,489,371	280,997
1940	30/06/1939	30/06/1940	210,440	-	-	307,886	-	-	2,489,371	2,391,911	-97,460
1941	30/06/1940	30/06/1941	427,532	-	-	302,770	-	-	2,391,911	2,516,687	124,776
1942	30/06/1941	30/06/1942	303,308	-	-	315,234	-	-	2,516,687	2,504,762	-11,925
1943	30/06/1942	30/06/1943	232,343	-	-	307,720	-	-	2,504,762	2,429,384	-75,377
1944	30/06/1943	30/06/1944	191,669	-	-	304,787	-	-	2,429,384	2,316,252	-113,132
1945	30/06/1944	30/06/1945	306,668	-	-	297,146	-	-	2,316,252	2,325,774	9,521
1946	30/06/1945	30/06/1946	366,215	-	-	308,005	-	-	2,325,774	2,383,983	58,210
1947	30/06/1946	30/06/1947	436,571	-	-	305,637	-	-	2,383,983	2,514,932	130,948
1948	30/06/1947	30/06/1948	430,618	-	-	303,376	-	-	2,514,932	2,642,189	127,257
1949	30/06/1948	30/06/1949	296,681	-	-	318,316	-	-	2,642,189	2,620,554	-21,635
1950	30/06/1949	30/06/1950	393,887	-	-	311,038	-	-	2,620,554	2,703,403	82,850
1951	30/06/1950	30/06/1951	338,410	-	-	319,989	-	-	2,703,403	2,721,824	18,420
1952	30/06/1951	30/06/1952	204,177	-	-	318,536	-	-	2,721,824	2,607,465	-114,359
1953	30/06/1952	30/06/1953	181,175	-	-	306,889	-	-	2,607,465	2,481,737	-125,728
1954	30/06/1953	30/06/1954	330,077	-	-	307,217	-	-	2,481,737	2,504,597	22,860
1955	30/06/1954	30/06/1955	580,346	-	-	316,463	-	-	2,504,597	2,768,494	263,897
1956	30/06/1955	30/06/1956	980,805	-	-	321,101	-	-	2,768,494	3,428,260	659,765
1957	30/06/1956	30/06/1957	303,171	-	-	360,933	-	-	3,428,260	3,370,482	-57,778
1958	30/06/1957	30/06/1958	284,550	-	-	359,826	-	-	3,370,482	3,295,206	-75,276
1959	30/06/1958	30/06/1959	276,016	-	-	354,097	-	-	3,295,206	3,217,124	-78,082
1960	30/06/1959	30/06/1960	340,231	-	-	351,227	-	-	3,217,124	3,206,129	-10,995
1961	30/06/1960	30/06/1961	141,362	-	-	349,159	-	-	3,206,129	2,998,316	-207,813
1962	30/06/1961	30/06/1962	373,739	-	-	335,727	-	-	2,998,316	3,036,328	38,013
1963	30/06/1962	30/06/1963	242,434	-	-	338,113	-	-	3,036,328	2,940,635	-95,694
1964	30/06/1963	30/06/1964	253,476	-	-	346,829	-	-	2,940,635	2,847,282	-93,353
1965	30/06/1964	30/06/1965	146,699	-	-	341,129	-	-	2,847,282	2,652,836	-194,445
1966	30/06/1965	30/06/1966	326,023	-	-	321,857	-	-	2,652,836	2,657,002	4,166
1967	30/06/1966	30/06/1967	243,140	-	-	322,272	-	-	2,657,002	2,577,855	-79,147
1968	30/06/1967	30/06/1968	153,034	-	-	325,416	-	-	2,577,855	2,405,459	-172,396
1969	30/06/1968	30/06/1969	113,592	-	-	302,485	-	-	2,405,459	2,216,552	-188,907
1970	30/06/1969	30/06/1970	160,808	-	-	289,876	-	-	2,216,552	2,087,484	-129,068
1971	30/06/1970	30/06/1971	293,290	-	-	284,778	-	-	2,087,484	2,095,995	8,511
1972	30/06/1971	30/06/1972	308,183	-	-	291,063	-	-	2,095,995	2,113,115	17,120
1973	30/06/1972	30/06/1973	201,956	-	-	290,344	-	-	2,113,115	2,024,714	-88,401
1974	30/06/1973	30/06/1974	363,157	-	-	282,020	-	-	2,024,714	2,105,864	81,151
1975	30/06/1974	30/06/1975	168,364	-	-	280,787	-	-	2,105,864	1,993,427	-112,437
1976	30/06/1975	30/06/1976	256,682	-	-	273,215	-	-	1,993,427	1,978,894	-14,533
1977	30/06/1976	30/06/1977	266,390	-	-	281,975	-	-	1,978,894	1,963,309	-15,585
1978	30/06/1977	30/06/1978	168,629	-	-	280,470	-	-	1,963,309	1,851,454	-111,855
1979	30/06/1978	30/06/1979	174,319	-	-	272,627	-	-	1,851,454	1,753,146	-98,308
1980	30/06/1979	30/06/1980	187,614	-	-	265,683	-	-	1,753,146	1,675,063	-78,083
1981	30/06/1980	30/06/1981	468,206	-	-	261,330	-	-	1,675,063	1,881,953	206,890
1982	30/06/1981	30/06/1982	218,922	-	-	272,687	-	-	1,881,953	1,828,187	-53,765
1983	30/06/1982	30/06/1983	481,978	-	-	268,531	-	-	1,828,187	2,041,648	213,460
1984	30/06/1983	30/06/1984	336,740	-	-	282,290	-	-	2,041,648	2,096,112	54,464
1985	30/06/1984	30/06/1985	318,833	-	-	297,628	-	-	2,096,112	2,117,317	21,205
1986	30/06/1985	30/06/1986	259,035	-	-	292,056	-	-	2,117,317	2,084,297	-33,021
1987	30/06/1986	30/06/1987	188,393	-	-	284,041	-	-	2,084,297	1,988,635	-95,661
1988	30/06/1987	30/06/1988	518,872	-	-	285,625	-	-	1,988,635	2,221,896	233,261
1989	30/06/1988	30/06/1989	257,088	-	-	293,091	-	-	2,221,896	2,185,893	-36,003
1990	30/06/1989	30/06/1990	278,261	-	-	289,498	-	-	2,185,893	2,174,656	-11,238
1991	30/06/1990	30/06/1991	136,506	-	-	299,808	-	-	2,174,656	2,011,339	-163,316
1992	30/06/1991	30/06/1992	136,935	-	-	279,120	-	-	2,011,339	1,869,141	-142,198
1993	30/06/1992	30/06/1993	191,510	-	-	272,827	-	-	1,869,141	1,787,825	-81,317
1994	30/06/1993	30/06/1994	503,601	-	-	274,122	-	-	1,787,825	2,017,317	229,492
1995	30/06/1994	30/06/1995	250,234	-	-	281,829	-	-	2,017,317	1,985,721	-31,59



Scenario 1 - Pit & catchment – low supply volume

Mass water movement profiles											
FY	StartDate	EndDate	Rainfall	Groundwater	OtherWaterIn	Evaporation	Kogan			Change	
							GroundwaterOut	PumpingOut	StartVolume		
1901	30/06/1900	30/06/1901	171,984	-	-	68,310	-	-	94,130	197,837	103,708
1902	30/06/1901	30/06/1902	113,051	-	-	91,540	-	-	197,837	219,348	21,511
1903	30/06/1902	30/06/1903	194,490	-	-	91,342	-	-	219,348	322,539	103,191
1904	30/06/1903	30/06/1904	381,011	-	-	150,609	-	-	322,539	553,025	230,486
1905	30/06/1904	30/06/1905	299,554	-	-	178,015	-	-	553,025	674,579	121,554
1906	30/06/1905	30/06/1906	393,314	-	-	189,490	-	-	674,579	878,419	203,840
1907	30/06/1906	30/06/1907	322,466	-	-	207,565	-	-	878,419	993,335	114,916
1908	30/06/1907	30/06/1908	188,817	-	-	214,080	-	-	993,335	968,072	-25,263
1909	30/06/1908	30/06/1909	267,509	-	-	216,425	-	-	968,072	1,019,172	51,100
1910	30/06/1909	30/06/1910	359,458	-	-	217,628	-	-	1,019,172	1,161,014	141,842
1911	30/06/1910	30/06/1911	263,219	-	-	225,147	-	-	1,161,014	1,199,085	38,072
1912	30/06/1911	30/06/1912	321,417	-	-	236,591	-	-	1,199,085	1,283,924	84,839
1913	30/06/1912	30/06/1913	170,457	-	-	233,726	-	-	1,283,924	1,220,643	-63,281
1914	30/06/1913	30/06/1914	133,319	-	-	227,740	-	-	1,220,643	1,126,209	-94,434
1915	30/06/1914	30/06/1915	97,092	-	-	229,086	-	-	1,126,209	994,199	-132,010
1916	30/06/1915	30/06/1916	172,046	-	-	212,579	-	-	994,199	953,666	-40,533
1917	30/06/1916	30/06/1917	380,067	-	-	217,268	-	-	953,666	1,116,480	162,815
1918	30/06/1917	30/06/1918	518,835	-	-	231,114	-	-	1,116,480	1,404,226	287,745
1919	30/06/1918	30/06/1919	250,153	-	-	246,764	-	-	1,404,226	1,407,615	3,389
1920	30/06/1919	30/06/1920	121,849	-	-	251,436	-	-	1,407,615	1,278,016	-129,600
1921	30/06/1920	30/06/1921	314,288	-	-	238,921	-	-	1,278,016	1,353,395	75,379
1922	30/06/1921	30/06/1922	268,997	-	-	244,107	-	-	1,353,395	1,364,977	11,582
1923	30/06/1922	30/06/1923	75,720	-	-	243,340	-	-	1,364,977	1,210,653	-154,324
1924	30/06/1923	30/06/1924	284,663	-	-	231,884	-	-	1,210,653	1,263,432	52,779
1925	30/06/1924	30/06/1925	348,002	-	-	235,940	-	-	1,263,432	1,375,506	112,075
1926	30/06/1925	30/06/1926	380,160	-	-	254,401	-	-	1,375,506	1,501,277	125,771
1927	30/06/1926	30/06/1927	297,658	-	-	248,777	-	-	1,501,277	1,550,158	48,881
1928	30/06/1927	30/06/1928	224,936	-	-	245,634	-	-	1,550,158	1,529,461	-20,698
1929	30/06/1928	30/06/1929	195,565	-	-	256,228	-	-	1,529,461	1,468,797	-60,663
1930	30/06/1929	30/06/1930	269,717	-	-	250,881	-	-	1,468,797	1,487,633	18,835
1931	30/06/1930	30/06/1931	251,172	-	-	254,204	-	-	1,487,633	1,494,600	-3,032
1932	30/06/1931	30/06/1932	279,922	-	-	254,149	-	-	1,494,600	1,510,373	25,773
1933	30/06/1932	30/06/1933	269,848	-	-	253,937	-	-	1,510,373	1,536,284	25,911
1934	30/06/1933	30/06/1934	589,343	-	-	258,508	-	-	1,536,284	1,857,146	320,862
1935	30/06/1934	30/06/1935	279,041	-	-	268,240	-	-	1,857,146	1,867,947	10,801
1936	30/06/1935	30/06/1936	191,582	-	-	273,564	-	-	1,867,947	1,785,966	-81,981
1937	30/06/1936	30/06/1937	236,634	-	-	271,143	-	-	1,785,966	1,751,457	-34,509
1938	30/06/1937	30/06/1938	297,442	-	-	269,991	-	-	1,751,457	1,778,908	27,451
1939	30/06/1938	30/06/1939	578,014	-	-	272,573	-	-	1,778,908	2,084,376	305,468
1940	30/06/1939	30/06/1940	210,440	-	-	283,380	-	-	2,084,376	2,011,422	-72,954
1941	30/06/1940	30/06/1941	427,532	-	-	281,504	-	-	2,011,422	2,157,464	146,042
1942	30/06/1941	30/06/1942	303,308	-	-	293,909	-	-	2,157,464	2,166,863	9,399
1943	30/06/1942	30/06/1943	232,343	-	-	287,026	-	-	2,166,863	2,112,180	-54,683
1944	30/06/1943	30/06/1944	191,669	-	-	290,418	-	-	2,112,180	2,013,417	-98,763
1945	30/06/1944	30/06/1945	306,668	-	-	278,647	-	-	2,013,417	2,041,438	28,021
1946	30/06/1945	30/06/1946	366,215	-	-	290,593	-	-	2,041,438	2,117,073	75,636
1947	30/06/1946	30/06/1947	436,571	-	-	290,302	-	-	2,117,073	2,263,356	146,283
1948	30/06/1947	30/06/1948	430,618	-	-	290,115	-	-	2,263,356	2,403,859	140,503
1949	30/06/1948	30/06/1949	296,681	-	-	303,612	-	-	2,403,859	2,396,928	-6,931
1950	30/06/1949	30/06/1950	393,887	-	-	298,843	-	-	2,396,928	2,491,986	95,058
1951	30/06/1950	30/06/1951	338,410	-	-	309,171	-	-	2,491,986	2,521,225	29,239
1952	30/06/1951	30/06/1952	204,177	-	-	307,342	-	-	2,521,225	2,418,059	-103,166
1953	30/06/1952	30/06/1953	181,175	-	-	296,368	-	-	2,418,059	2,302,852	-115,207
1954	30/06/1953	30/06/1954	330,077	-	-	296,803	-	-	2,302,852	2,336,127	33,274
1955	30/06/1954	30/06/1955	580,346	-	-	307,132	-	-	2,336,127	2,609,369	273,242
1956	30/06/1955	30/06/1956	980,805	-	-	314,783	-	-	2,609,369	3,275,436	666,068
1957	30/06/1956	30/06/1957	303,171	-	-	353,663	-	-	3,275,436	3,224,944	-50,492
1958	30/06/1957	30/06/1958	284,550	-	-	352,937	-	-	3,224,944	3,156,542	-68,402
1959	30/06/1958	30/06/1959	276,016	-	-	342,593	-	-	3,156,542	3,089,965	-66,577
1960	30/06/1959	30/06/1960	340,231	-	-	342,278	-	-	3,089,965	3,087,918	-2,046
1961	30/06/1960	30/06/1961	141,362	-	-	341,446	-	-	3,087,918	2,887,819	-200,099
1962	30/06/1961	30/06/1962	373,739	-	-	326,906	-	-	2,887,819	2,934,653	46,834
1963	30/06/1962	30/06/1963	242,434	-	-	332,857	-	-	2,934,653	2,844,230	-90,422
1964	30/06/1963	30/06/1964	253,476	-	-	340,207	-	-	2,844,230	2,757,484	-86,746
1965	30/06/1964	30/06/1965	146,699	-	-	334,186	-	-	2,757,484	2,569,983	-187,502
1966	30/06/1965	30/06/1966	326,023	-	-	312,194	-	-	2,569,983	2,583,811	13,829
1967	30/06/1966	30/06/1967	243,140	-	-	317,933	-	-	2,583,811	2,509,018	-74,793
1968	30/06/1967	30/06/1968	153,034	-	-	320,870	-	-	2,509,018	2,341,167	-167,850
1969	30/06/1968	30/06/1969	113,592	-	-	299,920	-	-	2,341,167	2,154,826	-186,342
1970	30/06/1969	30/06/1970	160,808	-	-	288,412	-	-	2,154,826	2,027,208	-127,618
1971	30/06/1970	30/06/1971	293,290	-	-	280,758	-	-	2,027,208	2,039,739	12,531
1972	30/06/1971	30/06/1972	308,183	-	-	287,291	-	-	2,039,739	2,060,644	20,906
1973	30/06/1972	30/06/1973	201,956	-	-	283,409	-	-	2,060,644	1,979,177	-81,467
1974	30/06/1973	30/06/1974	363,157	-	-	276,063	-	-	1,979,177	2,066,285	87,107
1975	30/06/1974	30/06/1975	168,364	-	-	276,777	-	-	2,066,285	1,957,858	-108,427
1976	30/06/1975	30/06/1976	258,682	-	-	273,215	-	-	1,957,858	1,943,325	-14,533
1977	30/06/1976	30/06/1977	266,390	-	-	281,006	-	-	1,943,325	1,928,709	-14,615
1978	30/06/1977	30/06/1978	168,629	-	-	278,970	-	-	1,928,709	1,818,355	-110,355
1979	30/06/1978	30/06/1979	174,319	-	-	269,543	-	-	1,818,355	1,723,118	-95,237
1980	30/06/1979	30/06/1980	187,614	-	-	264,719	-	-	1,723,118	1,646,012	-77,106
1981	30/06/1980	30/06/1981	468,206	-	-	260,508	-	-	1,646,012	1,853,724	207,712
1982	30/06/1981	30/06/1982	218,922	-	-	271,431	-	-	1,853,724	1,801,216	-52,508
1983	30/06/1982	30/06/1983	481,978	-	-	267,580	-	-	1,801,216	2,015,627	214,411
1984	30/06/1983	30/06/1984	336,740	-	-	279,969	-	-	2,015,627	2,072,412	56,785
1985	30/06/1984	30/06/1985	318,833	-	-	296,789	-	-	2,072,412	2,094,456	22,044
1986	30/06/1985	30/06/1986	259,035	-	-	290,975	-	-	2,094,456	2,062,515	-31,941
1987	30/06/1986	30/06/1987	188,393	-	-	282,941	-	-	2,062,515	1,967,953	-94,562
1988	30/06/1987	30/06/1988	518,872	-	-	284,313	-	-	1,967,953	2,202,526	234,573
1989	30/06/1988	30/06/1989	257,088	-	-	292,378	-	-	2,202,526	2,167,236	-35,290
1990	30/06/1989	30/06/1990	278,261	-	-	289,498	-	-	2,167,236	2,155,999	-11,238
1991	30/06/1990	30/06/1991	136,506	-	-	298,331	-	-	2,155,999	1,994,159	-161,840
1992	30/06/1991	30/06/1992	136,935	-	-	278,506	-	-	1,994,159	1,852,575	-141,584
1993	30/06/1992	30/06/1993	191,510	-	-	272,827	-	-	1,852,575	1,771,259	-81,317
1994	30/06/1993	30/06/1994	503,601	-	-	273,008	-	-	1,771,259	2,001,865	230,607
1995	30/06/1994	30/06/1995	250,234	-	-	281,396	-	-	2,001,865	1,970,703	-31,163
1996	30/06/1995	30/									



Scenario 2 - Pit & catchment – full supply volume

Mass water movement profiles											
FY	StartDate	EndDate	Rainfall	Groundwater	OtherWaterIn	Evaporation	Kogan		StartVolume	EndVolume	Change
							GroundwaterOut	PumpingOut			
1901	30/06/1900	30/06/1901	107,930	-	-	1,020,185	-	-	19,240,865	18,328,550	-912,314
1902	30/06/1901	30/06/1902	67,298	-	-	1,011,213	-	-	18,328,550	17,384,605	-943,945
1903	30/06/1902	30/06/1903	117,205	-	-	953,658	-	-	17,384,605	16,548,090	-836,515
1904	30/06/1903	30/06/1904	219,496	-	-	902,173	-	-	16,548,090	15,865,386	-682,704
1905	30/06/1904	30/06/1905	172,382	-	-	887,348	-	-	15,865,386	15,150,393	-714,994
1906	30/06/1905	30/06/1906	221,656	-	-	847,265	-	-	15,150,393	14,524,733	-625,660
1907	30/06/1906	30/06/1907	188,403	-	-	824,995	-	-	14,524,733	13,888,116	-636,617
1908	30/06/1907	30/06/1908	112,304	-	-	824,528	-	-	13,888,116	13,175,866	-712,250
1909	30/06/1908	30/06/1909	146,401	-	-	796,794	-	-	13,175,866	12,525,424	-650,442
1910	30/06/1909	30/06/1910	203,896	-	-	757,633	-	-	12,525,424	11,971,663	-553,761
1911	30/06/1910	30/06/1911	160,577	-	-	720,390	-	-	11,971,663	11,411,827	-559,837
1912	30/06/1911	30/06/1912	176,440	-	-	735,597	-	-	11,411,827	10,852,623	-559,204
1913	30/06/1912	30/06/1913	105,189	-	-	697,716	-	-	10,852,623	10,260,074	-592,549
1914	30/06/1913	30/06/1914	84,478	-	-	674,298	-	-	10,260,074	9,670,209	-589,865
1915	30/06/1914	30/06/1915	58,339	-	-	663,986	-	-	9,670,209	9,064,540	-605,669
1916	30/06/1915	30/06/1916	108,984	-	-	625,595	-	-	9,064,540	8,547,886	-516,654
1917	30/06/1916	30/06/1917	210,062	-	-	595,744	-	-	8,547,886	8,162,183	-385,703
1918	30/06/1917	30/06/1918	285,107	-	-	566,784	-	-	8,162,183	7,880,506	-281,677
1919	30/06/1918	30/06/1919	140,235	-	-	581,761	-	-	7,880,506	7,438,938	-441,568
1920	30/06/1919	30/06/1920	68,984	-	-	574,593	-	-	7,438,938	6,933,310	-505,628
1921	30/06/1920	30/06/1921	187,612	-	-	525,924	-	-	6,933,310	6,594,978	-338,332
1922	30/06/1921	30/06/1922	152,408	-	-	515,730	-	-	6,594,978	6,223,260	-371,719
1923	30/06/1922	30/06/1923	49,591	-	-	506,443	-	-	6,223,260	5,774,747	-448,513
1924	30/06/1923	30/06/1924	164,161	-	-	469,486	-	-	5,774,747	5,469,403	-305,344
1925	30/06/1924	30/06/1925	202,473	-	-	454,157	-	-	5,469,403	5,217,701	-251,701
1926	30/06/1925	30/06/1926	200,840	-	-	463,996	-	-	5,217,701	4,954,527	-263,174
1927	30/06/1926	30/06/1927	169,272	-	-	434,603	-	-	4,954,527	4,689,179	-265,348
1928	30/06/1927	30/06/1928	137,178	-	-	412,506	-	-	4,689,179	4,413,834	-275,345
1929	30/06/1928	30/06/1929	109,405	-	-	419,280	-	-	4,413,834	4,103,942	-309,892
1930	30/06/1929	30/06/1930	151,144	-	-	396,584	-	-	4,103,942	3,858,486	-245,457
1931	30/06/1930	30/06/1931	144,451	-	-	385,518	-	-	3,858,486	3,617,386	-241,099
1932	30/06/1931	30/06/1932	160,577	-	-	372,374	-	-	3,617,386	3,405,573	-211,813
1933	30/06/1932	30/06/1933	151,881	-	-	360,738	-	-	3,405,573	3,196,701	-208,872
1934	30/06/1933	30/06/1934	323,367	-	-	343,279	-	-	3,196,701	3,176,790	-19,911
1935	30/06/1934	30/06/1935	167,744	-	-	337,781	-	-	3,176,790	3,006,754	-170,037
1936	30/06/1935	30/06/1936	116,889	-	-	337,968	-	-	3,006,754	2,785,644	-221,110
1937	30/06/1936	30/06/1937	129,747	-	-	327,594	-	-	2,785,644	2,587,783	-197,861
1938	30/06/1937	30/06/1938	169,167	-	-	314,148	-	-	2,587,783	2,442,802	-144,981
1939	30/06/1938	30/06/1939	310,825	-	-	305,379	-	-	2,442,802	2,448,248	5,446
1940	30/06/1939	30/06/1940	125,163	-	-	304,226	-	-	2,448,248	2,269,170	-179,077
1941	30/06/1940	30/06/1941	231,564	-	-	292,005	-	-	2,269,170	2,208,716	-60,455
1942	30/06/1941	30/06/1942	161,473	-	-	295,800	-	-	2,208,716	2,074,388	-134,327
1943	30/06/1942	30/06/1943	136,757	-	-	277,534	-	-	2,074,388	1,933,597	-140,792
1944	30/06/1943	30/06/1944	116,204	-	-	274,912	-	-	1,933,597	1,774,875	-158,722
1945	30/06/1944	30/06/1945	177,125	-	-	261,500	-	-	1,774,875	1,690,467	-84,388
1946	30/06/1945	30/06/1946	198,416	-	-	263,424	-	-	1,690,467	1,625,478	-65,009
1947	30/06/1946	30/06/1947	233,988	-	-	256,910	-	-	1,625,478	1,602,556	-22,922
1948	30/06/1947	30/06/1948	245,951	-	-	249,537	-	-	1,602,556	1,598,970	-3,586
1949	30/06/1948	30/06/1949	166,532	-	-	252,193	-	-	1,598,970	1,513,297	-85,673
1950	30/06/1949	30/06/1950	225,978	-	-	242,786	-	-	1,513,297	1,496,488	-16,809
1951	30/06/1950	30/06/1951	190,511	-	-	248,656	-	-	1,496,488	1,438,343	-58,145
1952	30/06/1951	30/06/1952	122,317	-	-	243,533	-	-	1,438,343	1,317,114	-121,229
1953	30/06/1952	30/06/1953	114,254	-	-	231,583	-	-	1,317,114	1,199,772	-117,342
1954	30/06/1953	30/06/1954	189,509	-	-	229,279	-	-	1,199,772	1,160,003	-39,770
1955	30/06/1954	30/06/1955	320,047	-	-	229,046	-	-	1,160,003	1,251,004	91,001
1956	30/06/1955	30/06/1956	521,783	-	-	228,915	-	-	1,251,004	1,543,896	292,892
1957	30/06/1956	30/06/1957	168,060	-	-	250,522	-	-	1,543,896	1,461,434	-82,462
1958	30/06/1957	30/06/1958	155,834	-	-	247,752	-	-	1,461,434	1,369,504	-91,930
1959	30/06/1958	30/06/1959	159,207	-	-	239,900	-	-	1,369,504	1,288,811	-80,693
1960	30/06/1959	30/06/1960	190,458	-	-	234,994	-	-	1,288,811	1,244,263	-44,548
1961	30/06/1960	30/06/1961	89,379	-	-	232,184	-	-	1,244,263	1,101,446	-142,817
1962	30/06/1961	30/06/1962	214,594	-	-	218,773	-	-	1,101,446	1,097,267	-4,179
1963	30/06/1962	30/06/1963	142,659	-	-	222,868	-	-	1,097,267	1,017,058	-80,209
1964	30/06/1963	30/06/1964	138,706	-	-	220,620	-	-	1,017,058	935,128	-81,929
1965	30/06/1964	30/06/1965	86,006	-	-	214,680	-	-	935,128	806,440	-128,689
1966	30/06/1965	30/06/1966	182,974	-	-	199,713	-	-	806,440	789,701	-16,738
1967	30/06/1966	30/06/1967	141,710	-	-	196,128	-	-	789,701	735,268	-54,434
1968	30/06/1967	30/06/1968	84,900	-	-	194,509	-	-	735,268	625,644	-109,623
1969	30/06/1968	30/06/1969	73,517	-	-	175,344	-	-	625,644	523,790	-101,855
1970	30/06/1969	30/06/1970	100,446	-	-	156,153	-	-	523,790	468,083	-55,707
1971	30/06/1970	30/06/1971	167,164	-	-	149,925	-	-	468,083	485,322	17,239
1972	30/06/1971	30/06/1972	176,545	-	-	157,901	-	-	485,322	503,966	18,644
1973	30/06/1972	30/06/1973	115,466	-	-	157,617	-	-	503,966	461,814	-42,152
1974	30/06/1973	30/06/1974	212,170	-	-	153,519	-	-	461,814	520,466	58,651
1975	30/06/1974	30/06/1975	101,553	-	-	154,503	-	-	520,466	467,516	-52,950
1976	30/06/1975	30/06/1976	159,734	-	-	152,636	-	-	467,516	474,614	7,098
1977	30/06/1976	30/06/1977	150,353	-	-	157,530	-	-	474,614	467,437	-7,176
1978	30/06/1977	30/06/1978	99,392	-	-	141,767	-	-	467,437	425,033	-42,404
1979	30/06/1978	30/06/1979	107,508	-	-	136,648	-	-	425,033	395,893	-29,140
1980	30/06/1979	30/06/1980	107,297	-	-	136,348	-	-	395,893	366,842	-29,051
1981	30/06/1980	30/06/1981	259,284	-	-	137,036	-	-	366,842	489,119	122,277
1982	30/06/1981	30/06/1982	125,321	-	-	157,222	-	-	489,119	457,217	-31,902
1983	30/06/1982	30/06/1983	264,291	-	-	149,336	-	-	457,217	572,199	114,982
1984	30/06/1983	30/06/1984	188,455	-	-	175,335	-	-	572,199	585,320	13,120
1985	30/06/1984	30/06/1985	177,494	-	-	181,264	-	-	585,320	581,549	-3,770
1986	30/06/1985	30/06/1986	150,880	-	-	177,870	-	-	581,549	554,559	-26,990
1987	30/06/1986	30/06/1987	110,723	-	-	161,397	-	-	554,559	503,858	-50,701
1988	30/06/1987	30/06/1988	279,521	-	-	167,894	-	-	503,858	615,512	111,654
1989	30/06/1988	30/06/1989	151,249	-	-	177,160	-	-	615,512	589,601	-25,911
1990	30/06/1989	30/06/1990	160,735	-	-	174,648	-	-	589,601	575,688	-13,913
1991	30/06/1990	30/06/1991	76,310	-	-	170,833	-	-	575,688	481,137	-94,551
1992	30/06/1991	30/06/1992	88,536	-	-	150,975	-	-	481,137	418,669	-62,468
1993	30/06/1992	30/06/1993	112,462	-	-	135,554	-	-	418,669	395,577	-23,092
1994	30/06/1993	30/06/1994	268,770	-	-	145,189	-	-	395,577	519,188	123,611
1995	30/06/1994	30/06/1995	142,079	-	-	157,448	-	-	519,188	503,819	-15,369
1996	30/06/1995	30/06/1996	212,539	-	-	158,					



Scenario 2 - Pit & catchment – mid supply volume

Mass water movement profiles											
FY	StartDate	EndDate	Rainfall	Groundwater	OtherWaterIn	Evaporation	Kogan			Change	
							GroundwaterOut	PumpingOut	StartVolume		
1901	30/06/1900	30/06/1901	107.930	-	-	423.592	-	-	4,681.691	4,366.012	-315.680
1902	30/06/1901	30/06/1902	67.298	-	-	416.219	-	-	4,366.012	4,017.057	-348.954
1903	30/06/1902	30/06/1903	117.205	-	-	390.794	-	-	4,017.057	3,743.452	-273.606
1904	30/06/1903	30/06/1904	219.496	-	-	370.939	-	-	3,743.452	3,591.992	-151.460
1905	30/06/1904	30/06/1905	172.382	-	-	365.370	-	-	3,591.992	3,398.988	-193.004
1906	30/06/1905	30/06/1906	221.656	-	-	350.183	-	-	3,398.988	3,270.462	-128.527
1907	30/06/1906	30/06/1907	188.403	-	-	344.324	-	-	3,270.462	3,114.524	-155.937
1908	30/06/1907	30/06/1908	112.304	-	-	342.760	-	-	3,114.524	2,884.053	-230.471
1909	30/06/1908	30/06/1909	146.401	-	-	330.340	-	-	2,884.053	2,700.099	-183.954
1910	30/06/1909	30/06/1910	203.896	-	-	315.463	-	-	2,700.099	2,588.518	-111.581
1911	30/06/1910	30/06/1911	160.577	-	-	302.300	-	-	2,588.518	2,446.794	-141.724
1912	30/06/1911	30/06/1912	176.440	-	-	309.514	-	-	2,446.794	2,313.706	-133.089
1913	30/06/1912	30/06/1913	105.189	-	-	295.934	-	-	2,313.706	2,122.947	-190.759
1914	30/06/1913	30/06/1914	84.478	-	-	283.943	-	-	2,122.947	1,923.468	-199.479
1915	30/06/1914	30/06/1915	58.339	-	-	278.434	-	-	1,923.468	1,703.346	-220.122
1916	30/06/1915	30/06/1916	108.984	-	-	259.316	-	-	1,703.346	1,553.000	-150.345
1917	30/06/1916	30/06/1917	210.062	-	-	248.147	-	-	1,553.000	1,514.915	-38.085
1918	30/06/1917	30/06/1918	285.107	-	-	246.805	-	-	1,514.915	1,553.217	38.302
1919	30/06/1918	30/06/1919	140.235	-	-	255.063	-	-	1,553.217	1,438.389	-114.828
1920	30/06/1919	30/06/1920	68.984	-	-	252.002	-	-	1,438.389	1,255.348	-183.042
1921	30/06/1920	30/06/1921	187.612	-	-	230.570	-	-	1,255.348	1,212.390	-42.958
1922	30/06/1921	30/06/1922	152.408	-	-	232.505	-	-	1,212.390	1,124.289	-88.101
1923	30/06/1922	30/06/1923	49.591	-	-	225.318	-	-	1,124.289	956.538	-167.751
1924	30/06/1923	30/06/1924	164.161	-	-	209.275	-	-	956.538	911.424	-45.114
1925	30/06/1924	30/06/1925	202.473	-	-	206.708	-	-	911.424	907.189	-4.235
1926	30/06/1925	30/06/1926	200.840	-	-	215.909	-	-	907.189	892.120	-15.069
1927	30/06/1926	30/06/1927	169.272	-	-	201.055	-	-	892.120	860.321	-31.798
1928	30/06/1927	30/06/1928	137.178	-	-	195.706	-	-	860.321	801.794	-58.528
1929	30/06/1928	30/06/1929	109.405	-	-	196.606	-	-	801.794	714.577	-87.216
1930	30/06/1929	30/06/1930	151.144	-	-	189.734	-	-	714.577	675.987	-38.591
1931	30/06/1930	30/06/1931	144.451	-	-	184.782	-	-	675.987	635.641	-40.346
1932	30/06/1931	30/06/1932	160.577	-	-	181.221	-	-	635.641	614.996	-20.644
1933	30/06/1932	30/06/1933	151.881	-	-	179.262	-	-	614.996	587.516	-27.480
1934	30/06/1933	30/06/1934	323.367	-	-	179.919	-	-	587.516	731.079	143.563
1935	30/06/1934	30/06/1935	167.744	-	-	184.126	-	-	731.079	714.697	-16.382
1936	30/06/1935	30/06/1936	116.889	-	-	189.380	-	-	714.697	642.191	-72.506
1937	30/06/1936	30/06/1937	129.747	-	-	180.410	-	-	642.191	591.528	-50.663
1938	30/06/1937	30/06/1938	169.167	-	-	178.459	-	-	591.528	582.237	-9.292
1939	30/06/1938	30/06/1939	310.825	-	-	178.509	-	-	582.237	714.567	132.330
1940	30/06/1939	30/06/1940	125.163	-	-	187.231	-	-	714.567	652.499	-62.068
1941	30/06/1940	30/06/1941	231.564	-	-	180.574	-	-	652.499	703.489	50.990
1942	30/06/1941	30/06/1942	161.473	-	-	188.383	-	-	703.489	676.579	-26.910
1943	30/06/1942	30/06/1943	136.757	-	-	182.806	-	-	676.579	630.515	-46.064
1944	30/06/1943	30/06/1944	116.204	-	-	178.493	-	-	630.515	568.225	-62.290
1945	30/06/1944	30/06/1945	177.125	-	-	174.723	-	-	568.225	570.627	2.402
1946	30/06/1945	30/06/1946	198.416	-	-	178.652	-	-	570.627	590.390	19.763
1947	30/06/1946	30/06/1947	233.988	-	-	177.587	-	-	590.390	646.805	56.415
1948	30/06/1947	30/06/1948	245.957	-	-	177.586	-	-	646.805	715.171	68.365
1949	30/06/1948	30/06/1949	166.532	-	-	188.146	-	-	715.171	693.556	-21.614
1950	30/06/1949	30/06/1950	225.978	-	-	182.049	-	-	693.556	737.485	43.929
1951	30/06/1950	30/06/1951	190.511	-	-	187.527	-	-	737.485	740.468	2.983
1952	30/06/1951	30/06/1952	122.317	-	-	188.476	-	-	740.468	674.309	-66.159
1953	30/06/1952	30/06/1953	114.254	-	-	178.079	-	-	674.309	610.469	-63.840
1954	30/06/1953	30/06/1954	189.509	-	-	174.521	-	-	610.469	625.457	14.988
1955	30/06/1954	30/06/1955	320.047	-	-	185.841	-	-	625.457	759.678	134.220
1956	30/06/1955	30/06/1956	521.783	-	-	193.831	-	-	759.678	1,087.676	327.999
1957	30/06/1956	30/06/1957	168.060	-	-	223.273	-	-	1,087.676	1,032.463	-55.213
1958	30/06/1957	30/06/1958	155.834	-	-	217.292	-	-	1,032.463	970.989	-61.474
1959	30/06/1958	30/06/1959	159.207	-	-	209.955	-	-	970.989	920.241	-50.748
1960	30/06/1959	30/06/1960	190.458	-	-	209.389	-	-	920.241	901.309	-18.931
1961	30/06/1960	30/06/1961	89.379	-	-	203.346	-	-	901.309	787.327	-113.982
1962	30/06/1961	30/06/1962	214.584	-	-	195.117	-	-	787.327	806.804	19.477
1963	30/06/1962	30/06/1963	142.659	-	-	192.029	-	-	806.804	752.946	-53.859
1964	30/06/1963	30/06/1964	138.706	-	-	195.379	-	-	752.946	696.273	-56.673
1965	30/06/1964	30/06/1965	86.006	-	-	191.189	-	-	696.273	591.076	-105.197
1966	30/06/1965	30/06/1966	182.974	-	-	177.180	-	-	591.076	596.870	5.794
1967	30/06/1966	30/06/1967	141.710	-	-	175.933	-	-	596.870	562.647	-34.223
1968	30/06/1967	30/06/1968	84.900	-	-	168.805	-	-	562.647	478.714	-83.933
1969	30/06/1968	30/06/1969	73.517	-	-	147.347	-	-	478.714	404.854	-73.861
1970	30/06/1969	30/06/1970	100.446	-	-	133.894	-	-	404.854	371.406	-33.448
1971	30/06/1970	30/06/1971	167.164	-	-	126.798	-	-	371.406	411.772	40.366
1972	30/06/1971	30/06/1972	176.545	-	-	145.290	-	-	411.772	443.056	31.284
1973	30/06/1972	30/06/1973	115.466	-	-	142.426	-	-	443.056	416.066	-26.991
1974	30/06/1973	30/06/1974	212.170	-	-	149.710	-	-	416.066	478.556	62.490
1975	30/06/1974	30/06/1975	101.553	-	-	152.294	-	-	478.556	427.786	-50.770
1976	30/06/1975	30/06/1976	159.734	-	-	146.802	-	-	427.786	440.717	12.931
1977	30/06/1976	30/06/1977	150.353	-	-	142.079	-	-	440.717	440.021	-0.696
1978	30/06/1977	30/06/1978	99.392	-	-	139.109	-	-	440.021	409.275	-30.747
1979	30/06/1978	30/06/1979	107.508	-	-	136.003	-	-	409.275	380.780	-28.495
1980	30/06/1979	30/06/1980	107.297	-	-	131.638	-	-	380.780	356.439	-24.341
1981	30/06/1980	30/06/1981	259.284	-	-	132.971	-	-	356.439	482.782	126.343
1982	30/06/1981	30/06/1982	125.321	-	-	157.023	-	-	482.782	451.079	-31.703
1983	30/06/1982	30/06/1983	264.291	-	-	146.617	-	-	451.079	568.780	117.701
1984	30/06/1983	30/06/1984	188.455	-	-	175.335	-	-	568.780	581.900	13.120
1985	30/06/1984	30/06/1985	177.494	-	-	181.264	-	-	581.900	578.130	-3.770
1986	30/06/1985	30/06/1986	150.880	-	-	177.870	-	-	578.130	551.140	-26.990
1987	30/06/1986	30/06/1987	110.723	-	-	160.505	-	-	551.140	501.330	-49.810
1988	30/06/1987	30/06/1988	279.521	-	-	167.454	-	-	501.330	613.424	112.094
1989	30/06/1988	30/06/1989	151.249	-	-	177.160	-	-	613.424	587.513	-25.911
1990	30/06/1989	30/06/1990	160.735	-	-	174.111	-	-	587.513	574.138	-13.376
1991	30/06/1990	30/06/1991	76.310	-	-	170.582	-	-	574.138	479.838	-94.299
1992	30/06/1991	30/06/1992	88.536	-	-	150.448	-	-	479.838	417.897	-61.942
1993	30/06/1992	30/06/1993	112.462	-	-	135.554	-	-	417.897	394.805	-23.092
1994	30/06/1993	30/06/1994	268.770	-	-	144.927	-	-	394.805	518.677	123.873
1995	30/06/1994	30/06/1995	142.079	-	-	157.448	-	-	518.677	503.309	-15.369
1996	30/06/1995	30/06/1996	212.539	-	-	158.823	-	-	503.309	557.052	53.743
1997	30/06/1996	30/06/1997	114.623	-	-	165.947	-	-	557.052	505.700	-51.352
1998	30/06/1997	30/06/1998	190.6								



Scenario 2 - Pit & catchment – low supply volume

Mass water movement profiles												
FY	StartDate	EndDate	Rainfall	Groundwater	OtherWaterIn	Evaporation	Kogan			StartVolume	EndVolume	Change
							GroundwaterOut	PumpingOut	StartVolume			
1901	30/06/1900	30/06/1901	107,930	-	-	50,734	-	-	56,188	113,414	57,226	
1902	30/06/1901	30/06/1902	67,298	-	-	62,749	-	-	113,414	117,963	4,549	
1903	30/06/1902	30/06/1903	117,205	-	-	63,906	-	-	117,963	171,295	53,332	
1904	30/06/1903	30/06/1904	219,496	-	-	93,976	-	-	171,295	296,857	125,562	
1905	30/06/1904	30/06/1905	172,382	-	-	114,970	-	-	296,857	354,268	57,412	
1906	30/06/1905	30/06/1906	221,656	-	-	127,119	-	-	354,268	448,863	94,595	
1907	30/06/1906	30/06/1907	188,403	-	-	152,162	-	-	448,863	485,104	36,241	
1908	30/06/1907	30/06/1908	112,304	-	-	150,904	-	-	485,104	446,504	-38,600	
1909	30/06/1908	30/06/1909	146,401	-	-	144,488	-	-	446,504	448,417	1,913	
1910	30/06/1909	30/06/1910	203,896	-	-	146,366	-	-	448,417	505,948	57,531	
1911	30/06/1910	30/06/1911	160,577	-	-	154,819	-	-	505,948	511,706	5,758	
1912	30/06/1911	30/06/1912	176,440	-	-	160,387	-	-	511,706	527,759	16,053	
1913	30/06/1912	30/06/1913	105,189	-	-	155,325	-	-	527,759	477,623	-50,136	
1914	30/06/1913	30/06/1914	84,478	-	-	140,672	-	-	477,623	421,399	-56,224	
1915	30/06/1914	30/06/1915	58,339	-	-	136,024	-	-	421,399	343,686	-77,713	
1916	30/06/1915	30/06/1916	108,984	-	-	114,084	-	-	343,686	338,586	-5,100	
1917	30/06/1916	30/06/1917	210,062	-	-	129,019	-	-	338,586	419,657	81,071	
1918	30/06/1917	30/06/1918	285,107	-	-	159,331	-	-	419,657	545,489	125,833	
1919	30/06/1918	30/06/1919	140,235	-	-	160,887	-	-	545,489	524,810	-20,680	
1920	30/06/1919	30/06/1920	68,984	-	-	159,576	-	-	524,810	434,188	-90,621	
1921	30/06/1920	30/06/1921	187,612	-	-	153,425	-	-	434,188	468,405	34,217	
1922	30/06/1921	30/06/1922	152,408	-	-	157,044	-	-	468,405	455,867	-12,538	
1923	30/06/1922	30/06/1923	49,591	-	-	141,156	-	-	455,867	372,175	-83,692	
1924	30/06/1923	30/06/1924	164,161	-	-	128,409	-	-	372,175	407,926	35,751	
1925	30/06/1924	30/06/1925	202,473	-	-	147,872	-	-	407,926	462,557	54,631	
1926	30/06/1925	30/06/1926	200,840	-	-	162,337	-	-	462,557	501,059	38,502	
1927	30/06/1926	30/06/1927	169,272	-	-	154,561	-	-	501,059	515,771	14,711	
1928	30/06/1927	30/06/1928	137,178	-	-	153,459	-	-	515,771	499,490	-16,281	
1929	30/06/1928	30/06/1929	109,405	-	-	154,269	-	-	499,490	454,626	-44,864	
1930	30/06/1929	30/06/1930	151,144	-	-	150,056	-	-	454,626	455,714	1,088	
1931	30/06/1930	30/06/1931	144,451	-	-	150,698	-	-	455,714	449,466	-6,248	
1932	30/06/1931	30/06/1932	160,577	-	-	156,235	-	-	449,466	453,808	4,342	
1933	30/06/1932	30/06/1933	151,881	-	-	142,926	-	-	453,808	462,763	8,955	
1934	30/06/1933	30/06/1934	323,367	-	-	166,468	-	-	462,763	619,690	156,927	
1935	30/06/1934	30/06/1935	167,744	-	-	174,362	-	-	619,690	613,072	-6,618	
1936	30/06/1935	30/06/1936	116,889	-	-	179,214	-	-	613,072	550,746	-62,325	
1937	30/06/1936	30/06/1937	129,747	-	-	164,213	-	-	550,746	516,254	-34,493	
1938	30/06/1937	30/06/1938	169,167	-	-	159,663	-	-	516,254	525,758	9,504	
1939	30/06/1938	30/06/1939	310,825	-	-	170,951	-	-	525,758	665,673	139,916	
1940	30/06/1939	30/06/1940	125,163	-	-	179,811	-	-	665,673	611,010	-54,663	
1941	30/06/1940	30/06/1941	231,564	-	-	178,732	-	-	611,010	663,857	52,847	
1942	30/06/1941	30/06/1942	161,473	-	-	184,323	-	-	663,857	640,992	-22,864	
1943	30/06/1942	30/06/1943	136,757	-	-	175,981	-	-	640,992	601,768	-39,224	
1944	30/06/1943	30/06/1944	116,204	-	-	177,829	-	-	601,768	540,142	-61,626	
1945	30/06/1944	30/06/1945	177,125	-	-	166,847	-	-	540,142	550,419	10,277	
1946	30/06/1945	30/06/1946	198,416	-	-	176,302	-	-	550,419	572,533	22,114	
1947	30/06/1946	30/06/1947	233,988	-	-	169,416	-	-	572,533	637,105	64,572	
1948	30/06/1947	30/06/1948	245,951	-	-	177,039	-	-	637,105	706,031	68,927	
1949	30/06/1948	30/06/1949	166,532	-	-	188,146	-	-	706,031	684,417	-21,614	
1950	30/06/1949	30/06/1950	225,978	-	-	182,049	-	-	684,417	728,346	43,929	
1951	30/06/1950	30/06/1951	190,511	-	-	186,988	-	-	728,346	731,868	3,523	
1952	30/06/1951	30/06/1952	122,317	-	-	186,958	-	-	731,868	667,227	-64,641	
1953	30/06/1952	30/06/1953	114,254	-	-	177,138	-	-	667,227	604,328	-62,899	
1954	30/06/1953	30/06/1954	189,509	-	-	174,521	-	-	604,328	619,316	14,988	
1955	30/06/1954	30/06/1955	320,047	-	-	184,972	-	-	619,316	754,406	135,089	
1956	30/06/1955	30/06/1956	521,783	-	-	193,172	-	-	754,406	1,083,064	328,658	
1957	30/06/1956	30/06/1957	168,060	-	-	223,273	-	-	1,083,064	1,027,851	-55,213	
1958	30/06/1957	30/06/1958	155,834	-	-	217,063	-	-	1,027,851	966,606	-61,245	
1959	30/06/1958	30/06/1959	159,207	-	-	209,955	-	-	966,606	915,858	-50,748	
1960	30/06/1959	30/06/1960	190,458	-	-	209,118	-	-	915,858	897,198	-18,660	
1961	30/06/1960	30/06/1961	89,379	-	-	203,120	-	-	897,198	783,442	-113,755	
1962	30/06/1961	30/06/1962	214,594	-	-	195,117	-	-	783,442	802,919	19,477	
1963	30/06/1962	30/06/1963	142,659	-	-	195,589	-	-	802,919	749,974	-52,946	
1964	30/06/1963	30/06/1964	138,706	-	-	195,379	-	-	749,974	693,300	-56,673	
1965	30/06/1964	30/06/1965	86,006	-	-	191,024	-	-	693,300	588,268	-105,032	
1966	30/06/1965	30/06/1966	182,974	-	-	177,180	-	-	588,268	594,063	5,794	
1967	30/06/1966	30/06/1967	141,710	-	-	174,914	-	-	594,063	560,859	-33,204	
1968	30/06/1967	30/06/1968	84,900	-	-	168,373	-	-	560,859	477,358	-83,501	
1969	30/06/1968	30/06/1969	73,517	-	-	146,673	-	-	477,358	404,171	-73,187	
1970	30/06/1969	30/06/1970	100,446	-	-	133,894	-	-	404,171	370,723	-33,448	
1971	30/06/1970	30/06/1971	167,164	-	-	126,600	-	-	370,723	411,288	40,565	
1972	30/06/1971	30/06/1972	176,545	-	-	145,166	-	-	411,288	442,696	31,408	
1973	30/06/1972	30/06/1973	115,466	-	-	142,299	-	-	442,696	415,833	-26,863	
1974	30/06/1973	30/06/1974	212,170	-	-	149,522	-	-	415,833	478,512	62,678	
1975	30/06/1974	30/06/1975	101,553	-	-	152,294	-	-	478,512	427,741	-50,770	
1976	30/06/1975	30/06/1976	159,734	-	-	146,802	-	-	427,741	440,673	12,931	
1977	30/06/1976	30/06/1977	150,353	-	-	142,079	-	-	440,673	448,977	8,304	
1978	30/06/1977	30/06/1978	99,392	-	-	139,109	-	-	448,977	409,230	-39,747	
1979	30/06/1978	30/06/1979	107,508	-	-	136,003	-	-	409,230	380,735	-28,495	
1980	30/06/1979	30/06/1980	107,207	-	-	131,638	-	-	380,735	356,395	-24,341	
1981	30/06/1980	30/06/1981	259,284	-	-	132,942	-	-	356,395	482,767	126,372	
1982	30/06/1981	30/06/1982	125,321	-	-	157,023	-	-	482,767	451,064	-31,703	
1983	30/06/1982	30/06/1983	264,291	-	-	146,617	-	-	451,064	568,764	117,701	
1984	30/06/1983	30/06/1984	188,455	-	-	175,335	-	-	568,764	581,885	13,120	
1985	30/06/1984	30/06/1985	177,494	-	-	181,264	-	-	581,885	578,114	-3,770	
1986	30/06/1985	30/06/1986	150,880	-	-	177,870	-	-	578,114	551,124	-26,990	
1987	30/06/1986	30/06/1987	110,723	-	-	160,505	-	-	551,124	501,314	-49,810	
1988	30/06/1987	30/06/1988	279,521	-	-	167,454	-	-	501,314	613,409	112,094	
1989	30/06/1988	30/06/1989	151,249	-	-	177,160	-	-	613,409	587,498	-25,911	
1990	30/06/1989	30/06/1990	160,735	-	-	174,111	-	-	587,498	574,122	-13,376	
1991	30/06/1990	30/06/1991	76,310	-	-	170,582	-	-	574,122	479,823	-94,299	
1992	30/06/1991	30/06/1992	88,536	-	-	150,448	-	-	479,823	417,881	-61,942	
1993	30/06/1992	30/06/1993	112,462	-	-	135,554	-	-	417,881	394,789	-23,092	
1994	30/06/1993	30/06/1994	268,770	-	-	144,927	-	-	394,789	518,662	123,873	
1995	30/06/1994	30/06/1995	142,079	-	-	157,448	-	-	518,662	503,293	-15,369	
1996	30/06/1995	30/06/1996	212,539	-	-	158,823	-	-	503,293	557,037	53,743	
1997	30/06/1996	30/06/1997	114,623	-	-	165,947	-	-	557,037	505,685	-51,352	
1998	30/06/1997	30/06/1998	190,669	-	-	154,695	-	-	505,685	538,077	32,392	
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