

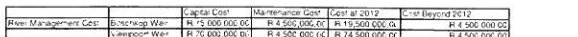
1. Energy
Megaflex

Pumping hours	24
High	25
Standard	62
Off Peak	81
Check sum	25

	$\$/kW$	$R/\$W$
Pumping hours	24	24
Cost per mine	2912.0	
Cost per day	416.0	
Cost per hr	17.3	1.73

Yr1	Charged per account	Must confirm a per Po. site, or one for final scheme	
Yr2	Applicable during all time periods		100%
Yr3	Payable for each kVA supplied during peak and standard periods		114%
Yr4	Applied to portion supplied in excess of 30% of kVA reconnected during peak and standard periods		
Yr5	Calculated as a percentage of network demand, network access and active energy charges	Includes for expected 25% increase in the voltage surcharge from 1.63%	
Yr6	Case specific		

2. Main categories of future costs & escalation of energy										
	Discount rates (avg. 3.5%)									
Escalator of energy cost	9.1%	9.2%	9.3%	9.4%	9.5%	9.6%	9.7%	9.8%	9.9%	10.0%
Escalator of energy mean (x/ai)	10.0%	10.1%	10.2%	10.3%	10.4%	10.5%	10.6%	10.7%	10.8%	10.9%
Actual Year	2006	2010	2015	2020	2025	2030	2035	2040	2045	2050



Year	Sum Water Requirement					Total (HRT Gal)	Gross Water Requirement	Raw Water Cost
	Prate 1A	Prate 2A	Prate 2B	Prate 3				
2018	12.131	6.604	0.000	0.000	7.331	12.621	25,242.773	
2019	13.241	6.604	0.000	0.000	7.453	14.293	28,586.587	
2020	14.591	6.604	0.000	0.000	14.761		29,523.974	
2021	16.221	6.604	0.000	0.000	20.782	21.700	43,405.087	
2022	18.131	6.604	0.000	0.000	24.735	25.113	50,231.234	
2023	20.629	6.604	0.000	0.000	27.233	28.000	56,005.000	
2024	20.412	13.242	0.000	0.000	30.652	32.877	65,754.338	
2025	20.741	14.644	0.000	0.000	35.385	38.000	76,000.000	
2026	20.709	16.721	0.000	0.000	37.421	40.000	79,976.477	
2027	20.700	18.834	0.000	0.000	39.534	42.000	84,011.261	
2028	20.734	19.644	0.000	0.000	40.378	43.000	85,662.131	
2029	20.823	20.834	0.000	0.000	41.653	44.000	87,322.427	
2030	20.900	22.000	0.000	0.000	42.900	45.000	89,000.000	
2031	20.900	23.000	25.000	0.000	45.900	46.000	90,700.000	
2032	20.900	24.000	52.500	0.000	73.400	53.000	106,022.500	
2033	20.900	25.000	104.500	0.000	130.400	54.000	108,988.500	
2034	20.900	26.000	156.500	0.000	182.400	55.000	111,954.500	
2035	20.900	27.000	208.500	0.000	234.400	56.000	114,920.500	
2036	20.900	28.000	260.500	0.000	286.400	57.000	117,886.500	
2037	20.900	29.000	312.500	0.000	338.400	58.000	120,852.500	
2038	20.900	30.000	364.500	0.000	390.400	59.000	123,818.500	
2039	20.900	31.000	416.500	0.000	442.400	60.000	126,784.500	
2040	20.900	32.000	468.500	0.000	494.400	61.000	129,750.500	
2041	20.900	33.000	520.500	0.000	546.400	62.000	132,716.500	
2042	20.900	34.000	572.500	0.000	598.400	63.000	135,682.500	
2043	20.900	35.000	624.500	0.000	650.400	64.000	138,648.500	
2044	20.900	36.000	676.500	0.000	702.400	65.000	141,614.500	
2045	20.900	37.000	728.500	0.000	754.400	66.000	144,580.500	
2046	20.900	38.000	780.500	0.000	806.400	67.000	147,546.500	
2047	20.900	39.000	832.500	0.000	858.400	68.000	150,512.500	
2048	20.900	40.000	884.500	0.000	910.400	69.000	153,478.500	
2049	20.900	41.000	936.500	0.000	962.400	70.000	156,444.500	
2050	20.900	42.000	988.500	0.000	1,014.400	71.000	159,410.500	
2051	20.900	43.000	1,040.500	0.000	1,066.400	72.000	162,376.500	
2052	20.900	44.000	1,092.500	0.000	1,118.400	73.000	165,342.500	
2053	20.900	45.000	1,144.500	0.000	1,170.400	74.000	168,308.500	
2054	20.900	46.000	1,196.500	0.000	1,222.400	75.000	171,274.500	
2055	20.900	47.000	1,248.500	0.000	1,274.400	76.000	174,240.500	
2056	20.900	48.000	1,300.500	0.000	1,326.400	77.000	177,206.500	
2057	20.900	49.000	1,352.500	0.000	1,378			

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PROJECT
OPTION
DATE

Mokoio and Crocodile (West) Water Augmentation Project Feasibility Study
8-P2A&B-TV, CB1-DB1
September 2008

PUMP STATION, RISING MAIN AND ELECTRICITY COST CALCULATIONS

DESCRIPTION	UNIT/RATE	P1	P6	TOTAL
Start Chainage		0		
End Chainage		07 864		
PUMP HEAD AND FLOW RATE				
Flow rate (duty) (Qd) 24/7 day average flow	m ³ /s	3.744	0.000	
Installed capacity (Q _i) = Q _p x (1 + P _s)	m ³ /s	5.34	0.00	
Required peak capacity (Q _p) = Q365 x Peak Refill factor)	m ³ /s	4.271	0.000	
Peak factor	1.20000			
Head pumped (under normal operating conditions):				
static head (H _{st})	m	95.00	0.00	95.00
rising main friction loss(H _f)	m	131.43	0.00	131.43
rising main secondary losses(H _v)	m	24.47	0.00	24.47
pump station secondary losses(H _{ps})	m	4.00	0.00	4.00
additional pumping head	m	1.00	0.00	1.00
Total head (duty) (H _d) = H _{st} + H _f + H _v + H _{ps})	m	255.80	0.00	255.80
Head pumped (under peak operating conditions):				
static head (H _{st})	m	95.00	0	95.00
rising main friction loss(H _f)	m	160.73	0.00	160.73
rising main secondary losses(H _v)	m	24.47	0.00	24.47
pump station secondary losses(H _{ps})	m	4.00	0.00	4.00
Total head (peak) (H _d) = H _{st} + H _f + H _v + H _{ps})	m	293.19	0.00	293.19
All further information on this sheet is calculated for normal operating conditions				
RISING MAIN				
length (L)	m	97 864	0	97 864
nominal diameter (ND)	mm	1 600	0	
outer diameter (OD)	mm	1 626		
inner diameter (ID)	mm	1 554	0	
minimum yield stress of steel	MPa	200	0	
minimum wall thickness (t _{min}) = D/160)	mm	10	0	
required wall thickness (t)	mm	16	#DIV/0!	
chosen wall thickness (t)	mm	16	0	
number of pipes in parallel (n)	no	1	1	
flow per pipe (Q _p)	m ³ /s	3.74	0.00	
velocity per pipe (V _p)	m/s	1.88	0.00	
secondary losses in rising main	m ³ /m	0.25	0.00	
INPUT FOR COLEBROOK-WHITE & DARCY-WEISBACH				
friction coefficient (f)	-	0.01193	#DIV/0!	
effective roughness (k)	mm	0.100	0.100	
Reynolds number (Re)	-	2 646 460	0	
pipe cross sectional area (A)	m ²	1.0956	0.0000	
kinematic viscosity (ν)	m ² /s	1.13E-06	1.13E-06	
gravity constant (g)	m/s ²	9.81	9.81	
PUMP SET EFFICIENCIES				
Efficiency of pump (E _p)	%	90.0%	90.0%	
Efficiency of motor (E _m)	%	97.0%	97.0%	
Average loss in efficiency between major overhauls (E _o)	%	1.5%	1.5%	
Overall efficiency (E _t) = E _p x E _m x (1 - E _o)	%	86.0%	86.0%	
M/W/MVA ratio (power factor PF)	-	0.96	0.96	
Standby allowance (P _s)	%	25.0%	25.0%	

PUMP STATION, RISING MAIN AND ELECTRICITY COST CALCULATIONS

DESCRIPTION	UNIT/RATE	P1	P6	TOTAL
PUMP STATION POWER REQUIREMENTS				
power req'd at duty point (P _d) = 0.81 x 1000 x Q _d x H _d / E _t)	MW	10.9	0.0	10.9
power absorbed at Q _d (P _d / P _f)	MVA	11.4	0.0	11.4
power absorbed at Q _i (P _d x P _f x (1 + P _s))	MVA	14.2	0.0	14.2
head pumped (H _d)	m	255.80	0.00	255.9
Energy consumed over 24 hours (continuous use)	MWh	262	0	262
power req'd at peak point (P _p) = 0.81 x 1000 x Q _p x H _p / E _t)	MW	14.3	0.0	14.3
ADDITIONAL PUMP STATION PARAMETERS				
Access road to pump station	km	5.00	0.00	5.00
PUMP STATION COST (single stage vertical)				
mechanical pump & motor	60% of total A1	R 33 937 715	R 0	R 33 937 715
mechanical valves	25% of total A1	R 14 140 714	R 0	R 14 140 714
mechanical pipework	15% of total A1	R 8 484 429	R 0	R 8 484 429
Total mechanical cost (total A1)	50% of total A2	R 56 562 858	R 0	R 56 562 858
Total electrical cost	20% of total A2	R 22 625 143	R 0	R 22 625 143
Total civil cost	30% of total A2	R 33 937 715	R 0	R 33 937 715
Subtotal: electromechanical cost (total A2)		113 125 715.78	0.00	R 113 125 716
access road cost	R/km	R 3 000 000	R 0	R 15 000 000
Subtotal: (total A3)		R 128 125 716	R 0	R 128 125 716
landscaping	5%	R 6 406 286	R 0	R 6 406 286
miscellaneous	10%	R 12 812 572	R 0	R 12 812 572
Subtotal: (total A)		R 147 344 573	R 0	R 147 344 573
Preliminary and General	30%	R 44 203 372	R 0	R 44 203 372
Preliminary Work		R 0	R 0	R 0
Subtotal: (total B)		R 191 547 945	R 0	R 191 547 945
Contingencies	20%	R 38 309 589	R 0	R 38 309 589
Subtotal: (total C)		R 229 857 534	R 0	R 229 857 534
Planning, design and supervision fees	15%	R 34 478 630	R 0	R 34 478 630
Total cost excluding VAT (total D)		R 264 336 164	R 0	R 264 336 164
Cost of Eskom transmission lines to site		R 36 147 000	R 0	R 36 147 000
Connection fee		R 0	R 0	R 0
Value Added Tax	14%	R 42 067 643	R 0	R 42 067 643
Relocations and land acquisition		R 375 000	R 0	R 375 000
Total cost including VAT		R 342 825 807	R 0	R 342 825 807

PUMP STATION, RISING MAIN AND ELECTRICITY COST CALCULATIONS

ANNUAL COST OF ELECTRICITY (24 h operation @ Design Capacity)				
Network Access Charge	R/kVA/mth	R 8.40	R 1 147 606	R 0
Network Demand Charge	R/kVA/mth	R 9.50	R 672 121	R 0
Reactive Energy Charge	R/kVA/Rh	R 0.0374	R 482 001	R 0
Voltage Surcharge	%/R	11.00%	R 1 935 875	R 0
Annual energy cost	R/MWh	R 173.34	R 15 777 316	R 0
Service & Admin Charge	R/day	R 131.66	R 48 056	R 0
Total annual cost			R 20 063 674	R 0

PUMP STATION, RISING MAIN AND ELECTRICITY COST CALCULATIONS

DESCRIPTION	UNIT/RATE	P1	P6	TOTAL
RISING MAIN COST				
Pipeline		1 142 076 369	0	1 142 076 369
Road, river and rail crossings:				
(a) national & provincial road		3 500 000	0	3 500 000
(b) national & provincial road		5 880 000	0	5 880 000
(c) river		3 330 000	0	3 330 000
(d) rail		1 750 000	0	1 750 000
Sub-total A		1 156 536 369	0	1 156 536 369
landscaping	5%	57 826 818	0	57 826 818
miscellaneous	10%	115 653 637	0	115 653 637
Sub-total B		1 330 016 825	0	1 330 016 825
preliminary and general	30%	399 005 047	0	399 005 047
preliminary works		34 252 505	0	34 252 505
accommodation		0	0	0
Sub-total C		1 763 274 377	0	1 763 274 377
contingencies	20%	352 654 875	0	352 654 875
Sub-total D		2 115 929 252	0	2 115 929 252
planning, design and supervision	15%	317 389 388	0	317 389 388
Sub-total E		2 433 318 640	0	2 433 318 640
VAT	14%	340 664 610	0	340 664 610
Relocations and land acquisition		7 117 554	0	7 117 554
Total cost including VAT		2 781 100 804	0	2 781 100 804

Mexico and Guatemala Fresh Water Augmentation Project Feasibility Study												
0-22A33-1V-G31-001												
September 2008												
Number of pumps		4 decreasing steadily					Down Time		18 days			
Steady pumps		1					Down Time Phase		1.05			
Flow per pump 347 days		0.005 m3/s					Build pump		20 days			
Flow per 247 days		0.004 m3/s					Build Phase		1-2003			
Flow per 250 days		0.005 m3/s										
Pumps station		347 days per station										
Scheduling from 2003 to 2013 on cell period												
ELECTRICITY COSTS												
YEAR	HOURS	NUMBER OF PUMPS		MWh	ANNUAL ELECTRICITY COST FOR PUMP STATIONS					ENERGY ON FACTOR	TOTAL ESCALATED	
		PUMPED	INSTALLED		ACTIVE	per day	DEMAND& ACCESS	ENERGY	SERVICE			REACTIVE & SURCHARGE
2008	0.00				0	0	0		0	1	0	
2009	0.00				0	0	0		0	1.2	0	
2010	0.00				0	0	0		0	1.44	0	
2011	0.00				0	0	0		0	1.73	0	
2012	0.00				0	0	0		0	2.07	0	
2013	0.00				0	0	0		0	2.49	0	
0	2014	6.10	3	2	33	909,863	2,006,588	48,056	975,265	3,939,773	2.49	9,803,416
1	2015	19.49	3	2	107	909,863	6,406,782	48,056	2,054,961	9,419,662	2.49	23,439,134
2	2016	23.66	4	3	194	1,364,795	11,663,842	48,056	2,390,906	15,467,599	2.49	38,488,336
3	2017	21.79	5	4	238	1,819,727	14,326,311	48,056	2,240,556	18,434,649	2.49	45,871,306
4	2018	22.84	5	4	250	1,819,727	15,011,634	48,056	2,324,636	19,204,053	2.49	47,785,828
5	2019	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
6	2020	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
7	2021	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
8	2022	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
9	2023	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
10	2024	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
11	2025	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
12	2026	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
13	2027	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
14	2028	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
15	2029	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
16	2030	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
17	2031	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
18	2032	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
19	2033	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
20	2034	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
21	2035	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
22	2036	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
23	2037	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
24	2038	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
25	2039	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
26	2040	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
27	2041	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
28	2042	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
29	2043	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
30	2044	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
31	2045	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
32	2046	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
33	2047	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
34	2048	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
35	2049	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
36	2050	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
37	2051	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
38	2052	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
39	2053	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
40	2054	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
41	2055	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
42	2056	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
43	2057	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
44	2058	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
45	2059	24.00	5	4	262	1,819,727	15,777,316	48,056	2,418,575	20,063,674	2.49	49,924,841
TOTAL					81,432,775	696,285,107	2,210,571	109,147,916	889,076,370	2,212,306,571		

[illegible]

Mokolo and Crocodile (West) Water Augmentation Project Feasibility Study
8-P2A&B-TV CB1-CB1
PUMP STATION BILL OF QUANTITIES
September 2008

September 2008										
No	PAY REF	DESCRIPTION	UNIT	RATE 2008 RAND	P1	P2	P3	P4	P5	P6
					QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
1.		Mechanical and Electrical	Sum				0	0	0	
2.		Civils (a) (% of 1)	%	43%			0	0	0	
		(c) Permanent access road	km	3 000 000	5.00	15 000 000	0	0.00	0	0.00
		SUB-TOTAL A				128 125 716	0	0	0	0
3.	11.0	Landscaping (% of Sub-total A)	%	5		6 406 286	0	0	0	
4.	12.0	Miscellaneous (% of Sub-total A)	%	10		12 812 572	0	0	0	
		SUB-TOTAL B				147 344 573	0	0	0	0
5.	13.0	Preliminary & General (% of sub-total B)	%	30		44 203 372	0	0	0	
		SUB-TOTAL C				191 547 945	0	0	0	0
6.	17.0	Contingencies (% of sub total C)	%	20		38 309 589	0	0	0	
		SUB-TOTAL D				229 857 534	0	0	0	0
7.	16.0	Planning design & supervision fees. time cost & transport (% of sub total D)	%	15		34 478 630	0	0	0	
		SUB-TOTAL E				264 336 164	0	0	0	0
8.	18.0	VAT (% of sub total E)	%	14		37 007 063	0	0	0	
		NETT PUMP STATION COST				301 343 227	0	0	0	0
9.	19.0	Cost of relocations	Sum			0	0	0	0	0
10.	20.0	Cost of land acquisition	Sum			375 000	0	0	0	0
11.	21.0	Cost of ESKOM transmission lines to site + Connection fee	Sum			41 207 580	0	0	0	0
TOTAL PUMP STATION COST						342 925 807	0	0	0	0
TOTAL PUMP STATION COST (EXCL VAT)						305 918 744	0	0	0	305 918 744

River Crossing (below river bed level). Concrete encasement																						
	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	1
Ave Length	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	2
Average Dia	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	3
Side allowance	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	4
Vol CC/m	1.243650459	1.407256661	1.5751549	1.747345175	1.923827488	2.104601837	2.289668222	2.479026645	2.672677104	2.8706196	3.072854132	3.279380702	3.490199308	3.705309951	3.92471263	4.148407346	4.376394099	4.608672889	4.845243716	5.086106579	5.331261479	5
																						6
CC Volume	62	70	79	87	96	105	114	124	134	144	154	164	175	185	196	207	219	230	242	254	267	7
CC Rate	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	8
Excavation	191.70	212.42	234.42	257.75	281.95	307.49	334.14	361.62	390.48	420.15	545.29	580.70	616.86	654.48	692.82	773.97	815.93	859.00	902.74	952.97	993.95	9
Excvation Rate	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	10
																						11
Concrete	111 928.54	126 653.10	141 763.94	157 261.07	173 144.47	189 414.17	206 070.14	223 112.40	240 540.94	258 355.76	276 556.87	295 144.26	314 117.94	333 477.90	353 224.14	373 356.66	393 875.47	414 780.56	436 071.93	457 749.59	479 813.53	12
Excavation	9 585.02	10 620.86	11 721.21	12 887.69	14 097.42	15 374.36	16 706.81	18 080.89	19 523.80	21 007.26	27 264.38	29 034.93	30 842.81	32 723.82	34 641.08	38 698.56	40 796.54	42 950.02	45 137.09	47 648.51	49 697.49	13
Erosion Protection	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	14
EO for excavation/River diversion	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	150 000.00	15
Pipe materials (stainless steel)	86 791.62	99 882.71	130 845.00	148 850.00	178 295.00	215 670.00	251 485.00	289 250.00	333 970.00	378 495.00	429 455.00	484 575.00	539 500.00	595 790.00	664 430.00	725 335.00	797 875.00	897 195.00	967 200.00	1 054 560.00	1 130 675.00	16
Total	508 305.18	537 156.67	584 330.15	618 998.75	665 536.89	720 458.53	774 261.95	830 443.28	894 034.74	957 858.02	1 033 276.25	1 108 754.19	1 184 460.74	1 261 991.71	1 352 295.22	1 437 390.22	1 532 547.01	1 654 925.58	1 748 409.02	1 859 958.10	1 960 186.02	17
Rounded	510 000.00	540 000.00	580 000.00	620 000.00	670 000.00	720 000.00	770 000.00	830 000.00	890 000.00	960 000.00	1 030 000.00	1 110 000.00	1 180 000.00	1 260 000.00	1 350 000.00	1 440 000.00	1 530 000.00	1 650 000.00	1 750 000.00	1 860 000.00	1 960 000.00	18

Gravel Road Crossing (Cut&cover concrete encased)																					
	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500
Average length (m)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Gravel wearing course	13.59	14.49	15.40	16.32	17.23	18.14	19.06	19.97	20.89	21.80	22.72	23.63	24.54	25.46	26.37	29.09	30.01	30.92	31.83	32.85	33.66
WC Rate	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
CC Volume	37.31	42.22	47.25	52.42	57.71	63.14	68.69	74.37	80.18	86.12	92.19	98.38	104.71	111.16	117.74	124.45	131.29	138.26	145.36	152.58	159.94
CC Rate	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Excavation	115.02	127.45	140.65	154.65	169.17	184.49	200.48	216.97	234.29	252.09	327.17	348.42	370.11	392.69	415.69	464.38	489.56	515.40	541.65	571.78	596.37
Excvation Rate	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
WC	3397.5	3622.5	3849.75	4079.25	4306.5	4536	4765.5	4992.75	5222.25	5449.5	5679	5908.5	6135.75	6365.25	6592.5	7272	7501.5	7731	7958.25	8212.5	8415
Excavation	5 751.01	6 372.52	7 032.73	7 732.61	8 458.45	9 224.62	10 024.09	10 848.53	11 714.28	12 604.35	16 358.63	17 420.96	18 505.68	19 634.29	20 784.65	23 219.13	24 477.92	25 770.01	27 082.25	28 589.10	29 818.49
Concrete	67 157.12	75 991.86	85 058.36	94 356.64	103 886.68	113 648.50	123 642.08	133 867.44	144 324.56	155 013.46	165 934.12	177 086.56	188 470.76	200 086.74	211 934.48	224 014.00	236 325.28	248 868.34	261 643.16	274 649.76	287 888.12
Pipe materials (stainless steel)	52 074.97	59 929.62	78 507.00	89 310.00	106 977.00	129 402.00	150 891.00	173 550.00	200 382.00	227 097.00	257 673.00	290 745.00	323 700.00	357 474.00	398 658.00	435 201.00	478 725.00	538 317.00	580 320.00	632 736.00	678 405.00
Total	128 380.61	145 916.50	174 447.84	195 478.50	223 628.64	256 811.12	289 322.67	323 258.72	361 643.09	400 164.31	445 644.75	491 161.01	536 812.20	583 560.28	637 969.63	689 706.13	747 029.70	820 686.35	877 003.66	944 187.36	1 004 526.61
Rounded	130 000.00	150 000.00	170 000.00	200 000.00	220 000.00	260 000.00	290 000.00	320 000.00	360 000.00	400 000.00	450 000.00	490 000.00	540 000.00	580 000.00	640 000.00	690 000.00	750 000.00	820 000.00	880 000.00	940 000.00	1 000 000.00

Road/Rail Crossing - steel pipe jacked																						
	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	
Average length (m)	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
Pipe jacking (R20 000 /m)	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000	
Pipe materials (2 x steel pipe cost)	133 525.58	153 665.70	201 300.00	229 000.00	274 300.00	331 800.00	386 900.00	445 000.00	513 800.00	582 300.00	660 700.00	745 500.00	830 000.00	916 600.00	1 022 200.00	1 115 900.00	1 227 500.00	1 380 300.00	1 488 000.00	1 622 400.00	1 739 500.00	
Total	1 133 525.58	1 153 665.70	1 201 300.00	1 229 000.00	1 274 300.00	1 331 800.00	1 386 900.00	1 445 000.00	1 513 800.00	1 582 300.00	1 660 700.00	1 745 500.00	1 830 000.00	1 916 600.00	2 022 200.00	2 115 900.00	2 227 500.00	2 380 300.00	2 488 000.00	2 622 400.00	2 739 500.00	
Rounded	1 130 000.00	1 150 000.00	1 200 000.00	1 230 000.00	1 270 000.00	1 330 000.00	1 390 000.00	1 450 000.00	1 510 000.00	1 580 000.00	1 660 000.00	1 750 000.00	1 830 000.00	1 920 000.00	2 020 000.00	2 120 000.00	2 230 000.00	2 380 000.00	2 490 000.00	2 620 000.00	2 740 000.00	

Provincial, National Road Crossing + Rail crossings (PJ)

1500 mm dia, 275m	
Contract Value	10 500 000.00
P&G's, H&S, Site establishment etc	3 000 000.00

Construction Value	7 500 000.00
Rate/m	27 272.73
Esclated	36 068.18
Pipe jacking rate (sav)	40 000.00

Average length (prov road servitude = -	50
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Cost/PJ	2 000 000.00
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Airvalve, scour & isolating budget estimate

Valve Chamber Cost Estimate

		Civil Rate/m	Mechanical Rate/m	Escalation Factor	Total
500		21.00	40.00	1.70	100.00
600		21.00	46.00	1.70	110.00
700		21.00	60.00	1.70	140.00
800		21.00	84.00	1.70	180.00
900		21.00	114.45	1.70	230.00
1000		23.10	144.90	1.70	290.00
1100		25.20	208.95	1.70	400.00
1200		27.30	273.00	1.70	510.00
1300		29.40	284.55	1.70	530.00
1400		29.40	296.10	1.70	550.00
1500		31.50	310.80	1.70	580.00
1600		33.60	329.70	1.70	620.00
1700		35.70	340.20	1.70	640.00
1800		37.80	352.80	1.70	660.00
1900		39.90	373.80	1.70	700.00
2000		42.00	401.10	1.70	750.00
2100		44.10	424.20	1.70	800.00
2200		46.20	447.30	1.70	840.00
2300		48.30	455.70	1.70	860.00
2400		50.40	478.80	1.70	900.00
2500		52.50	497.49	1.70	930.00

ABSTRACTION WEIR COST MODEL
Vlieëpoort Weir

No	PAY REF	DESCRIPTION	UNIT	RATE 01-Apr-08 (Rand)	QUANTITY	AMOUNT (Rand)
1	1.0	Clearing				
	1.1	a) Sparse	ha	5 533	-	-
	1.2	b) Bush	ha	16 598	1.0	16 598
	1.3	c) Trees	ha	27 664	1.5	41 496
2	2.0	River diversion	Sum	1 725 000	1	1 725 000
3	3.0	Excavation				
	3.1	(a) Bulk				
	3.1.1	(i) all materials	m ³	40	12 189	487 560
	3.1.2	(ii) extra over for rock	m ³	71	1 219	86 542
	3.2	(b) Confined				
	3.2.1	(i) all materials	m ³	59	-	-
	3.2.2	(ii) extra over for rock	m ³	99	-	-
4	4.0	Preparation of solum				
	4.1	a) all materials	m ²	20	6 778	135 560
	4.2	b) extra over for rock	m ²	20	678	13 556
5	5.0	Drilling & Grouting				
	5.1	(a) Curtain grouting	m drill	443	-	-
	5.2	(b) Consolidation grouting	m drill	443	-	-
	5.3	(c) Jet grouting	m drill	4 370	6 200	27 094 000
6	6.0	Embankment				
	6.1	(a) Earthfill	m ³	47	26 007	1 222 329
	6.2	(b) Filters	m ³	174	4 551	791 913
	6.3	(c) Rip-rap	m ³	95	9 288	882 360
	6.4	(d) Geofabric	m ²	30	7 144	214 320
	6.5	(e) Overhaul beyond 5km	m ³ .km	4	-	-
7	7.0	Concrete works				
	7.1	a) Formwork				
	7.1.1	(i) Gang formed	m ²	257	11 568	2 972 976
	7.1.2	(ii) Intricate	m ²	316	868	274 162
	7.2	(b) Concrete				
	7.2.1	(i) Mass	m ³	1 156	3 425	3 959 300
	7.2.2	(ii) Structural	m ³	1 482	3 275	4 853 550
	7.3	(c) Reinforcing	t	12 350	180	2 224 544
		SUB-TOTAL				46 995 765

8	8.0	Mechanical Items				
	8.1	(a) Pipes, Valves, Screens & Gates	Sum	11 840 000	1	11 840 000
	8.2	(b) Cranes & hoists	Sum	600 000	1	600 000
	8.3	(c) Structural steelwork	t	19 760	24	474 240
9	9.0	Fencing	km	27 664	2.9	81 572
10	10.0	Landscaping (% of 1-9)	%	5		2 349 788
11	11.0	Miscellaneous (% of 1-9)	%	10		4 699 577
		SUB TOTAL A				67 040 943
12	12.0	Preliminary & General (% of sub-total A)	%	30		20 112 283
13	13.0	Preliminary works				
	13.1	(a) Access road	km	350 000	1.0	350 000
	13.2	(b) Electricity to site	Sum	250 000	1	250 000
	13.3	(c) Water to site-construction (not potable)	Sum	150 000	1	150 000
	13.4	(d) Railhead & materials handling	Sum	-	1	-
14	14.0	Accomodation	Sum	-	1	-
		SUB TOTAL B				87 903 225
15	15.0	Contingencies (% of sub total B)	%	20		17 580 645
		SUB TOTAL C (Civils Total)				105 483 870
16	16.0	Planning design & supervision (% of sub-total C)	%	15		15 822 581
		SUB TOTAL D				121 306 451
17	17.0	VAT (% of sub-total D)	%	14		16 982 903
		NETT PROJECT COST				138 289 354
18	18.0	Cost of relocations	Sum	-	1	-
19	19.0	Cost of land acquisition	Sum	-	1	-
		TOTAL PROJECT COST				138 289 354

ABSTRACTION WEIR COST MODEL
Vlieëpoort De-Silting Works

No	PAY REF	DESCRIPTION	UNIT	RATE 01-Apr-08 (Rand)	QUANTITY	AMOUNT (Rand)
1	1.0	Clearing				
	1.1	a) Sparse	ha	5 533	-	-
	1.2	b) Bush	ha	16 598	0.5	8 299
	1.3	c) Trees	ha	27 664	1.0	27 664
2	2.0	Excavation				
	2.1	(a) Bulk				
	2.1.1	(i) all materials	m ³	40	-	-
	2.1.2	(ii) extra over for rock	m ³	71	-	-
	2.2	(b) Confined				
	2.2.1	(i) all materials	m ³	59	-	-
	2.2.2	(ii) extra over for rock	m ³	99	-	-
4	4.0	Preparation of solum				
	4.1	a) all materials	m ²	20	8 000	160 000
	4.2	b) extra over for rock	m ²	20	4 800	96 000
5	5.0	Drilling & Grouting				
	5.1	(a) Curtain grouting	m drill	443	-	-
	5.2	(b) Consolidation grouting	m drill	443	-	-
	5.3	(c) Jet grouting	m drill	4 370	-	-
6	6.0	Embankment				
	6.1	(a) Earthfill	m ³	47	26 066	1 225 079
	6.2	(b) Filters	m ³	174	4 561	793 695
	6.3	(c) Rip-rap	m ³	95	918	87 238
	6.4	(d) Overhaul beyond 5km	m ³ .km	4	-	-
7	7.0	Concrete works				
	7.1	a) Formwork				
	7.1.1	(i) Gang formed	m ²	257	6 514	1 674 098
	7.1.2	(ii) Intricate	m ²	316	977	308 764
	7.2	(b) Concrete				
	7.2.1	(i) Mass	m ³	1 156	240	277 787
	7.2.2	(ii) Structural	m ³	1 482	3 204	4 748 328
	7.3	(c) Reinforcing	t	12 350	176	2 176 317
		SUB-TOTAL				11 583 268

8	8.0	Mechanical Items				
	8.1	(a) Pipes, Valves & Gates	Sum	39 190 800	1	39 190 800
	8.2	(b) Cranes & hoists	Sum	600 000	1	600 000
	8.3	(c) Structural steelwork	t	19 760	24	474 240
9	9.0	Fencing	km	27 664	1.1	31 394
10	10.0	Landscaping (% of 1-9)	%	5		579 163
11	11.0	Miscellaneous (% of 1-9)	%	10		1 158 327
		SUB TOTAL A				53 617 193
12	12.0	Preliminary & General (% of sub-total A)	%	30		16 085 158
13	13.0	Preliminary works				
	13.1	(a) Access road	km	350 000	0.2	70 000
	13.2	(b) Electricity to site	Sum	250 000	1	250 000
	13.3	(c) Water to site-construction (not potable)	Sum	150 000	1	150 000
	13.4	(d) Railhead & materials handling	Sum	-	1	-
14	14.0	Accomodation	Sum	-	1	-
		SUB TOTAL B				70 172 351
15	15.0	Contingencies (% of sub total B)	%	20		14 034 470
		SUB TOTAL C (Civils Total)				84 206 821
16	16.0	Planning design & supervision (% of sub-total C)	%	15		12 631 023
		SUB TOTAL D				96 837 844
17	17.0	VAT (% of sub-total D)	%	14		13 557 298
		NETT PROJECT COST				110 395 142
18	18.0	Cost of relocations	Sum	-	1	-
19	19.0	Cost of land acquisition	Sum	-	1	-
		TOTAL PROJECT COST				110 395 142

ABSTRACTION WEIR COST MODEL
Vlieëpoort Balancing Dam

No	PAY REF	DESCRIPTION	UNIT	RATE 01-Apr-08 (Rand)	QUANTITY	AMOUNT (Rand)
1	1.0	Clearing				
	1.1	a) Sparse	ha	5 533	-	-
	1.2	b) Bush	ha	16 598	1.0	16 598
	1.3	c) Trees	ha	27 664	7.0	193 648
2	2.0	Excavation				
	2.1	(a) Bulk				
	2.1.1	(i) all materials	m ³	40	26 160	1 046 388
	2.1.2	(ii) extra over for rock	m ³	71	15 696	1 114 404
	2.2	(b) Confined				
	2.2.1	(i) all materials	m ³	59		-
	2.2.2	(ii) extra over for rock	m ³	99		-
4	4.0	Preparation of solum				
	4.1	a) all materials	m ²	20	41 400	828 000
	4.2	b) extra over for rock	m ²	20	24 840	496 800
5	5.0	Drilling & Grouting				
	5.1	(a) Curtain grouting	m drill	443	-	-
	5.2	(b) Consolidation grouting	m drill	443	-	-
	5.3	(c) Jet grouting	m drill	4 370	-	-
6	6.0	Embankment				
	6.1	(a) Earthfill	m ³	47	74 400	3 496 800
	6.2	(b) Filters	m ³	174	13 020	2 265 480
	6.3	(c) Rip-rap	m ³	95	2 720	258 400
	6.4	(d) Overhaul beyond 5km	m ³ .km	4	-	-
	6.5	(e) Waterproof Membrane	m ²	100	31 100	3 110 000
7	7.0	Concrete works				
	7.1	a) Formwork				
	7.1.1	(i) Gang formed	m ²	257	2 200	565 400
	7.1.2	(ii) Intricate	m ²	316	330	104 280
	7.2	(b) Concrete				
	7.2.1	(i) Mass	m ³	1 156	528	610 368
	7.2.2	(ii) Structural	m ³	1 482	750	1 111 500
	7.3	(c) Reinforcing	t	12 350	41	509 438
		SUB-TOTAL				15 727 503

8	8.0	Mechanical Items				
	8.1	(a) Pipes, Valves & Screens	Sum	2 118 800	1	2 118 800
	8.2	(b) Cranes & hoists	Sum	600 000	1	600 000
	8.3	(c) Structural steelwork	t	19 760	24	474 240
9	9.0	Fencing	km	27 664	2.1	58 013
10	10.0	Landscaping (% of 1-9)	%	5		786 375
11	11.0	Miscellaneous (% of 1-9)	%	10		1 572 750
		SUB TOTAL A				21 337 682
12	12.0	Preliminary & General (% of sub-total A)	%	30		6 401 305
13	13.0	Preliminary works				
	13.1	(a) Access road	km	350 000	0.2	70 000
	13.2	(b) Electricity to site	Sum	250 000	1	250 000
	13.3	(c) Water to site-construction (not potable)	Sum	150 000	1	150 000
	13.4	(d) Railhead & materials handling	Sum	-	1	-
14	14.0	Accomodation	Sum	-	1	-
		SUB TOTAL B				28 208 986
15	15.0	Contingencies (% of sub total B)	%	20		5 641 797
		SUB TOTAL C (Civils Total)				33 850 784
16	16.0	Planning design & supervision (% of sub-total C)	%	15		5 077 618
		SUB TOTAL D				38 928 401
17	17.0	VAT (% of sub-total D)	%	14		5 449 976
		NETT PROJECT COST				44 378 377
		TOTAL PROJECT COST				44 378 377

Sub total D **257 072 696**

Subtotal A **141 995 817**

ABSTRACTION WEIR COST MODEL
7 Separate Client Balancing Dams

No	PAY REF	DESCRIPTION	UNIT	RATE 01-Apr-08 (Rand)	QUANTITY	AMOUNT (Rand)
1	1.0	Clearing				
	1.1	a) Sparse	ha	5 533	39	217 326
	1.2	b) Bush	ha	16 598	65	1 086 564
	1.3	c) Trees	ha	27 664	157	4 346 360
2	2.0	Excavation				
	2.1	(a) Bulk				
	2.1.1	(i) all materials	m ³	40	320 095	12 803 800
	2.1.2	(ii) extra over for rock	m ³	71	80 024	5 681 686
	2.2	(b) Confined				
	2.2.1	(i) all materials	m ³	59	14 000	826 000
	2.2.2	(ii) extra over for rock	m ³	99	12 600	1 247 400
4	4.0	Preparation of solum				
	4.1	a) all materials	m ²	20	2 618 541	52 370 826
	4.2	b) extra over for rock	m ²	20	654 635	13 092 706
5	5.0	Drilling & Grouting				
	5.1	(a) Curtain grouting	m drill	443		-
	5.2	(b) Consolidation grouting	m drill	443		-
	5.3	(c) Jet grouting	m drill	4 370		-
6	6.0	Embankment				
	6.1	(a) Earthfill	m ³	47	3 200 950	150 444 651
	6.2	(b) Filters	m ³	174	285 416	49 662 362
	6.3	(c) Rip-rap	m ³	95	570 832	54 229 016
	6.4	(d) Overhaul beyond 5km	m ³ .km	4	570 832	2 283 327
	6.5	(e) Waterproof Membrane System	m ²	100	1 902 773	190 277 250
7	7.0	Concrete works				
	7.1	a) Formwork				
	7.1.1	(i) Gang formed	m ²	257	1 627	418 023
	7.1.2	(ii) Intricate	m ²	316	122	38 549
	7.2	(b) Concrete				
	7.2.1	(i) Mass	m ³	1 156	214	247 825
	7.2.2	(ii) Structural	m ³	1 482	1 429	2 118 092
	7.3	(c) Reinforcing	t	12 350	107	1 323 808
		SUB-TOTAL				542 715 572

8	8.0	Mechanical Items				
8.1	(a) Pipes, Valves & Gates	Sum	141 540 000	1	141 540 000	
8.2	(b) Cranes & hoists	Sum	600 000	1	600 000	
8.3	(c) Structural steelwork	t	19 760	21	414 960	
			-			
9	9.0	Fencing	km	27 664	4.4	122 476
10	10.0	Landscaping (% of 1-9)	%	5		27 135 779
11	11.0	Miscellaneous (% of 1-9)	%	10		54 271 557
		SUB TOTAL A				766 800 345
12	12.0	Preliminary & General (% of sub-total A)	%	30		230 040 103
13	13.0	Preliminary works				
13.1	(a) Access road	km	350 000	1.0	350 000	
13.2	(b) Electricity to site	Sum	250 000	1	250 000	
13.3	(c) Water to site-construction (not potable)	Sum	150 000	1	150 000	
13.4	(d) Railhead & materials handling	Sum	-	1	-	
14	14.0	Accomodation	Sum	-	1	-
		SUB TOTAL B				997 590 448
15	15.0	Contingencies (% of sub total B)	%	20		199 518 090
		SUB TOTAL C (Civils Total)				1 197 108 538
16	16.0	Planning design & supervision (% of sub-total C)	%	15		179 566 281
		SUB TOTAL D				1 376 674 818
17	17.0	VAT (% of sub-total D)	%	14		192 734 475
		NETT PROJECT COST				1 569 409 293
18	18.0	Cost of relocations	Sum	-	1	-
19	19.0	Cost of land acquisition	Sum	-	1	-
		TOTAL PROJECT COST				1 569 409 293

Mokolo and Crocodile (West) Water Augmentation Project Feasibility Study
S-P2A&B-TV CBI-DB1

YEAR	RAW WATER COST	SEWER MANAGEMENT COST	BALANCING RESERVOIR ON TERMINAL DAM (1.5x7)		RISING 1 MAIN COSTS (Phase 2A)		RISING 2 MAIN COSTS (PHASE 2B)		WEIR COSTS		PUMP STATION COSTS (PHASE 2A)				PUMP STATION COSTS (PHASE 2B)				
			CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	MAINTENANCE & OPERATION	ELECTRICITY
2008	25,242,212																		
2009	25,242,212																		
2010	25,242,212																		
2011	25,242,212																		
2012	25,242,212																		
2013	25,242,212																		
2014	25,242,212																		
2015	25,242,212																		
2016	25,242,212																		
2017	25,242,212																		
2018	25,242,212																		
2019	25,242,212																		
2020	25,242,212																		
2021	25,242,212																		
2022	25,242,212																		
2023	25,242,212																		
2024	25,242,212																		
2025	25,242,212																		
2026	25,242,212																		
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2041	25,242,212																		
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2099	25,242,212																		
2100	25,242,212																		
2101	25,242,212																		
2102	25,242,212																		
2103	25,242,212																		
2104	25,242,212																		
2105	25,242,212																		
2106	25,242,212																		
2107	25,242,212																		
2108	25,242,212																		
2109	25,242,212																		
2110	25,242,212																		
2111	25,242,212																		
2112	25,242,212																		
2113	25,242,212																		
2114	25,242,212																		
2115	25,242,212																		
2116	25,242,212																		
2117	25,242,212																		
2118	25,242,212																		
2119	25,242,212																		
2120	25,242,212																		
2121	25,242,212																		
2122	25,242,212																	</	

PROJECT: Mokoia and Crocodile (West) Water Augmentation Project Feasibility Study
OPTION: 8-P2A&B-TV CB1-DB1
DATE: September 2008

UNIT REFERENCE VALUE CALCULATIONS AT DIFFERENT DISCOUNTED RATES

Year	Net Demand Mm ³ /a	Total annual costs (excl VAT)	Discounted Figures 6%		Discounted Figures 8%		Discounted Figures 10%	
			Demand	Costs	Demand	Costs	Demand	Costs
2008	12.13	25,242.213	12.13	25,242.213	12.13	25,242.213	12.13	25,242.213
2009	13.75	28,605.488	12.97	26,986.309	12.73	26,486.563	12.50	26,004.989
2010	14.60	2,507,748.721	12.99	2,231,887.434	12.51	2,149,990.330	12.06	2,072,519.604
2011	20.25	2,518,051,242	17.00	2,114,204.378	16.08	1,998,910.260	15.22	1,891,849.167
2012	28.03	2,063,181,084	22.20	1,634,232.662	20.60	1,516,499.688	19.14	1,409,180.441
2013	39.63	2,047,217.604	29.61	1,529,800.086	26.97	1,393,301.902	24.61	1,271,161.063
2014	50.40	254,226.172	35.53	179,219.420	31.76	160,205.612	28.45	143,504.047
2015	72.07	375,934.369	47.93	250,017.826	42.05	219,354.093	36.98	192,913.773
2016	110.02	519,958.949	69.03	326,228.677	59.44	280,917.641	51.33	242,564.687
2017	128.58	1,403,073.030	76.11	830,476.771	64.32	701,885.834	54.53	595,039.931
2018	133.36	1,434,856.464	74.47	801,216.355	61.77	664,616.170	51.42	553,199.281
2019	146.22	1,470,366.731	77.03	774,570.852	62.71	630,615.088	51.25	515,354.569
2020	155.93	1,470,366.731	77.49	730,727.219	61.92	583,902.859	49.68	468,504.154
2021	164.38	897,119.410	77.07	420,604.587	60.44	329,868.945	47.62	259,863.537
2022	190.96	1,074,496.020	84.46	475,250.626	65.01	365,824.034	50.29	282,948.385
2023	207.14	1,182,526.865	86.43	493,427.144	65.30	372,781.785	49.59	283,087.530
2024	211.84	1,213,877.384	83.39	477,838.321	61.83	354,319.237	46.10	264,175.086
2025	216.70	1,248,449.368	80.48	463,629.674	58.57	337,417.102	42.87	246,999.052
2026	218.77	1,260,115.646	76.64	441,473.693	54.75	315,342.717	39.35	228,642.875
2027	219.00	1,261,646.897	72.38	416,990.714	50.74	292,338.807	35.81	206,289.349
2028	219.23	1,263,177.051	68.36	393,864.575	47.03	271,012.372	32.59	187,763.220
2029	219.58	1,270,658.809	64.59	373,771.154	43.62	252,423.676	29.67	171,704.850
2030	219.95	1,267,983.254	61.04	351,871.816	40.46	233,233.483	27.02	155,766.637
2031	219.95	1,267,983.254	57.58	331,954.543	37.46	215,956.928	24.56	141,606.034
2032	219.95	1,272,225.949	54.32	314,212.518	34.69	200,629.189	22.33	129,163.500
2033	219.95	1,267,983.254	51.25	295,438.362	32.12	185,148.258	20.30	117,029.780
2034	219.95	1,267,983.254	48.35	278,715.436	29.74	171,433.572	18.45	106,390.709
2035	219.95	1,267,983.254	45.61	262,939.090	27.53	158,734.789	16.78	96,718.827
2036	219.95	1,267,983.254	43.03	248,055.745	25.49	146,976.657	15.25	87,926.206
2037	219.95	1,267,983.254	40.59	234,014.854	23.61	136,089.497	13.87	79,932.914
2038	219.95	1,267,983.254	38.29	220,768.730	21.86	126,008.793	12.60	72,666.286
2039	219.95	1,267,983.254	36.13	208,272.387	20.24	116,674.809	11.46	66,060.260
2040	219.95	1,270,084.071	34.08	196,808.921	18.74	108,211.220	10.42	60,154.282
2041	219.95	1,267,983.254	32.15	185,361.683	17.35	100,029.843	9.47	54,595.256
2042	219.95	1,267,983.254	30.33	174,869.512	16.07	92,620.225	8.61	49,632.051
2043	219.95	1,267,983.254	28.62	164,971.238	14.88	85,759.468	7.83	45,120.046
2044	219.95	1,273,073.911	27.00	156,258.075	13.77	79,725.715	7.12	41,182.903
2045	219.95	1,267,983.254	25.47	146,823.815	12.75	73,524.921	6.47	37,289.295
2046	219.95	1,267,983.254	24.03	138,513.033	11.81	68,078.630	5.88	33,899.359
2047	219.95	1,272,225.949	22.67	131,109.905	10.93	63,246.688	5.35	30,920.715
2048	219.95	1,267,983.254	21.38	123,276.106	10.12	58,366.453	4.86	28,015.999
2049	219.95	1,267,983.254	20.17	116,298.213	9.37	54,043.012	4.42	25,469.090
2050	219.95	1,267,983.254	19.03	109,715.295	8.68	50,039.826	4.02	23,153.718
2051	219.95	1,267,983.254	17.95	103,504.996	8.04	46,333.172	3.65	21,048.835
2052	219.95	1,267,983.254	16.94	97,646.222	7.44	42,901.085	3.32	19,135.304
2053	219.95	1,267,983.254	15.98	92,119.078	6.89	39,723.227	3.02	17,395.731
2054	219.95	1,267,983.254	15.07	86,904.790	6.38	36,780.766	2.74	15,814.301
2055	219.95	1,267,983.254	14.22	81,985.651	5.91	34,056.264	2.49	14,376.637
2056	219.95	1,267,983.254	13.42	77,344.954	5.47	31,533.578	2.27	13,069.670
2057	219.95	1,267,983.254	12.66	72,966.938	5.06	29,197.758	2.06	11,881.518
2058	219.95	1,267,983.254	11.94	68,836.734	4.69	27,034.961	1.87	10,801.380
2059	219.95	1,267,983.254	11.26	64,940.315	4.34	25,032.371	1.70	9,819.437
TOTAL	9390.93	64,846,070,729	2,148.85	20,548,159,645	1,484.20	16,080,382,085	1,073.36	13,152,548,484
URV			9.562		10.834			12.254

UNIT REFERENCE VALUE CALCULATIONS AT DIFFERENT DISCOUNTED RATES- 30 year analysis period (2014-2044)

TOTAL	6091.75	45,822,079,225	1886.66	19,036,173,601	1366.30	15,400,489,375	1019.24	12,840,457,495
URV			10.090		11.272			12.598

UNIT REFERENCE VALUE CALCULATIONS AT DIFFERENT DISCOUNTED RATES- 20 year analysis period (2014-2034)

TOTAL	3892.29	33,135,055,212	1530.83	16,983,853,365	1166.76	14,249,658,360	905.84	12,186,468,464
URV			11.095		12.213			13.453

Scenario N - Phase 2: transfer from Sleepcreek via Central Route to BFT and delivery to Terminal Reservoir

Keywords: *workplace spirituality, organizational commitment, organizational trust, organizational identification, organizational citizenship behaviors*

Energy charge - weekly allocation for 24 hr pumping	
Pumping hours	24
High	2.5
Standard	6
Off Peak	8
Check Sum	24

	£ kW ^h	£ kW ^h
Pumping hours	24	24
Cost per litre	29.12 p	
Cost per day	4.6 p	
Cost per ha	17.3 p	17.3 p

• Rate: Charged per account	Must confirm it per PS sh. or sh. for total scheme	
• Rate: Applicable during all time periods		
• Rate: Payable for each kWh supplied during peak and standard periods		1
• Rate: applied to portion supplied in excess of 30% of kWh recorded during peak and standard periods		1
• Rate: Calculated as a percentage of network demand, network access and active energy charges. Includes for expected 25% increase in the voltage surcharge from 7.63%		1

Discount rates (year) (%)	0	10	20
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Escalation of energy (m)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Escalation of energy (m) (the a)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Actual Year	2019	2010	2011	2012	2013	2014	2015	2016	2017	2018

Long Term Forecasting

[illegible]

Fig. 1

M.N. Cover

200

D2

12

A-A

		Capital Cost	Maintenance Cost	Cost at 2012	Cost Beyond 2012
River Management Cost	Brownapp Wer.	R 15,000,000.00	R 4,500,000.00	R 19,500,000.00	R 4,500,000.00
	Deepport Wer.	R 70,000,000.00	R 4,500,000.00	R 74,500,000.00	R 4,500,000.00

Year	New Water Requirement					Total LWR Cst.	Cross Water Requirement	Raw Water Cst.
	Phase 1a	Phase 2a	Phase 2b	Phase 2				
2044	17.37	2.60	6.00	7.37	17.67	23,603,448	25,242,717	
2045	17.47	2.60	6.00	7.47	17.67	23,603,448	25,242,717	
2046	14.55	6.00	6.00	14.55	15.18	10,373,746	10,373,746	
2047	36.24	6.00	6.00	26.24	27.67	42,146,887	42,146,887	
2048	36.24	6.00	6.00	26.24	27.67	42,146,887	42,146,887	
2049	36.49	6.00	6.00	26.49	27.92	42,403,343	42,403,343	
2050	37.92	6.00	6.00	27.92	29.35	43,215,346	43,215,346	
2051	37.92	6.00	6.00	27.92	29.35	43,215,346	43,215,346	
2052	37.46	6.00	6.00	27.46	28.89	42,768,116	42,768,116	
2053	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2054	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2055	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2056	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2057	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2058	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2059	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2060	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2061	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2062	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2063	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2064	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2065	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2066	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2067	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2068	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2069	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2070	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2071	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2072	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2073	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2074	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2075	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2076	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2077	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2078	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2079	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2080	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2081	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2082	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2083	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2084	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2085	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	
2086	36.76	6.00	6.00	26.76	28.19	41,634,766	41,634,766	

6.509
1.80
2100
7.43
7.14
2.00

PROJECT: Mokolole and Crocodile (West) Water Augmentation Project Feasibility Study
OPTION: 8 P2 TV CB1 DB1
DATE: September 2008

PUMP STATION, RISING MAIN AND ELECTRICITY COST CALCULATIONS

DESCRIPTION	UNIT RATE	PI	TOTAL
Start Chaining		0	
End Chaining		97,864	
PUMP HEAD AND FLOW RATE			
Flow rate (duty) (Qd) 347 day average flow	m ³ /s	6.509	
installed capacity (Qi = Qp x (1 + P _{si}))	m ³ /s	9.28	
Required peak capacity (Qp = Q355 x Peak Refill factor)	m ³ /s	7.426	
Peak factor	1.20000		
Head pumped (under normal operating conditions):			
static head (Hst)	m	95.00	95.00
rising main friction loss(Hf)	m	95.59	95.59
rising main secondary losses(Hv)	m	24.47	24.47
pump station secondary losses(Hps)	m	4.00	4.00
additional pumping head	m	16.00	16.00
Total head (duty) (Hd = Hst + Hf + Hv + Hps)	m	235.15	235.15
Head pumped (under peak operating conditions):			
static head (Hst)	m	95.00	95.00
rising main friction loss(Hf)	m	123.58	123.58
rising main secondary losses(Hv)	m	24.47	24.47
pump station secondary losses(Hps)	m	4.00	4.00
Total head (peak) (Hd = Hst + Hf + Hv + Hps)	m	247.05	247.05
All further information on this sheet is calculated for normal operating conditions			
RISING MAIN			
length (L)	m	97,864	97,864
nominal diameter (ND)	mm	2,100	
outer diameter (OD)	mm	2,134	
inner diameter (ID)	mm	2,098	
minimum yield stress of steel	MPa	250	
minimum wall thickness (tmin = D/160)	mm	13	
required wall thickness (t)	mm	18	
chosen wall thickness (t)	mm	18	
number of pipes in parallel (n)	no	1	
flow per pipe (Qp)	m ³ /s	6.51	
velocity per pipe (Vp)	m/s	1.88	
secondary losses in rising main	m/km	0.25	
INPUT FOR COLEBROOK-WHITE & DARCY-WEISBACH			
friction coefficient (f)		0.01135	
effective roughness (k)	mm	0.100	
Reynolds number (Re)		3,495,811	
pipe cross sectional area (A)	m ²	3.4570	
kinematic viscosity (nu)	m ² /s	1.13E-06	
gravity constant (g)	m/s ²	9.81	
PUMP SET EFFICIENCIES			
Efficiency of pump (E _p)	%	90.0%	
Efficiency of motor (E _m)	%	97.0%	
Average loss in efficiency between major overhauls (E _{ol})	%	1.5%	
Overall efficiency (E _t = E _p x E _m x (1 - E _{ol}))	%	86.0%	
MVA/MVA ratio (power factor Pf)		0.96	
Standby allowance (Ps)	%	25.0%	

PUMP STATION, RISING MAIN AND ELECTRICITY COST CALCULATIONS

DESCRIPTION	UNIT RATE	PI	TOTAL
PUMP STATION POWER REQUIREMENTS			
power req'd at duty point (Pd = 9.81 x 1000 x Qd x Hd / Et)	MW	17.5	17.5
power absorbed at Qd (Pd / Pf)	MVA	18.2	18.2
power absorbed at Qp (Pd x Pf x (1 + P _{si}))	MVA	22.7	22.7
head pumped (Hd)	m	235.15	235.2
Energy consumed over 24 hours (continuous use)	24 MWh	419	419
power req'd at peak point (Pp = 9.81 x 1000 x Qp x Hp / Et)	MW	20.9	20.9
ADDITIONAL PUMP STATION PARAMETERS			
Access road to pump station	km	5.00	5.00
PUMP STATION COST (single stage vertical)			
mechanical pump & motor	60% of total A1	R 44,860,587	R 44,860,587
mechanical valves	25% of total A1	R 18,691,911	R 18,691,911
mechanical pipework	15% of total A1	R 11,215,147	R 11,215,147
Total mechanical cost (total A1)	50% of total A1	R 74,767,644	R 74,767,644
Total electrical cost	20% of total A2	R 29,907,058	R 29,907,058
Total civil cost	30% of total A2	R 44,860,587	R 44,860,587
Subtotal: elec mech/civil cost (total A2)		149,535,288.82	R 149,535,289
access road cost	R/km	R 3,000,000	R 15,000,000
Subtotal: total A3			R 164,535,289
landscaping	5%	R 8,226,764	R 8,226,764
miscellaneous	10%	R 16,453,529	R 16,453,529
Subtotal: (total A)		R 189,215,582	R 189,215,582
Preliminary and General	30%	R 56,764,675	R 56,764,675
Preliminary Work		R 0	R 0
Subtotal: (total B)		R 245,980,257	R 245,980,257
Contingencies	20%	R 49,196,051	R 49,196,051
Subtotal: total C)		R 295,176,308	R 295,176,308
Planning, design and supervision fees	15%	R 44,276,446	R 44,276,446
Total cost excluding VAT (total D)		R 339,452,754	R 339,452,754
Cost of ESKOM transmission lines to site		R 36,939,000	R 36,939,000
Connection fee		R 0	R 0
Value Added Tax	14%	R 52,694,846	R 52,694,846
Relocations and land acquisition		R 375,000	R 375,000
Total cost including VAT		R 429,461,600	R 429,461,600

PUMP STATION, RISING MAIN AND ELECTRICITY COST CALCULATIONS

ANNUAL COST OF ELECTRICITY (24 h operation @ Design Capacity)			
Network Access Charge	R/kVA.mth	R 9.49	R 1,833,501
Network Demand Charge	R/kVA.mth	R 9.50	R 1,073,830
Reactive Energy Charge	R/kVA.Rh	R 0.0374	R 771,518
Voltage Surcharge	%/R	11.00%	R 3,092,578
Annual energy Cost	R/MWh	R 173.34	R 25,207,014
Service & Admin Charge	R/day	R 131.66	R 48,056
Total annual cost			R 32,026,497

Mokond and Gredoula (West) Water Augmentation Project Feasibility Study												
DPR/DAI												
September 2009												
Number of pumps:								4 (existing standing)		Down Time		10 days
Shedding pumps:								1		Down Time Pump		1.0%
Flow rate pump 200 days:								1,897 m³/sec		RBM pump		50 days
Total flow 200 days:								6,920 m³/sec		RBM Pump		1,00%
Total flow 280 days:								8,184 m³/sec		RBM Pump		1,00%
Pumps 4-hour:								240 days per annum				
Operating Costs from Demand on other projects												
ELECTRICITY COSTS												
YEAR	HOURS PUMPED	NUMBER OF PUMPS		MWh per day	ANNUAL ELECTRICITY COST FOR PUMP STATIONS					ENERGY ON FACTOR	TOTAL ESCALATED	
		INSTALLED	ACTIVE		DEMAND & ACCESS	ENERGY	SERVICE	REACTIVE & SURCHARGE	TOTAL			
2008	0.00			0	0	0			0	1	0	
2009	0.00			0	0	0			0	1.2	0	
2010	0.00			0	0	0			0	1.44	0	
2011	0.00			0	0	0			0	1.73	0	
2012	0.00			0	0	0			0	2.07	0	
2013	0.00			0	0	0			0	2.49	0	
2014	3.51	3	2	31	1,453,665	1,843,945	48.056	1,223,975	4,569,642	2.49	11,370,731	
2015	11.21	3	2	98	1,453,665	5,887,485	48.056	2,216,156	9,605,363	2.49	23,901,216	
2016	20.41	3	2	178	1,453,665	10,718,438	48.056	3,401,548	15,621,708	2.49	38,871,807	
2017	16.71	4	3	219	2,180,498	13,165,102	48.056	2,925,104	18,318,761	2.49	45,582,939	
2018	17.51	4	3	229	2,180,498	13,794,877	48.056	3,028,125	19,051,556	2.49	47,406,367	
2019	19.66	4	3	258	2,180,498	15,490,061	48.056	3,305,428	21,024,043	2.49	52,314,547	
2020	21.29	4	3	279	2,180,498	16,768,920	48.056	3,514,627	22,512,101	2.49	56,017,312	
2021	22.70	4	3	297	2,180,498	17,893,591	48.056	3,696,969	23,809,113	2.49	59,244,692	
2022	20.36	5	4	356	2,907,331	21,386,235	48.056	3,395,335	27,736,957	2.49	69,018,424	
2023	22.39	5	4	391	2,907,331	23,519,512	48.056	3,657,061	30,131,960	2.49	74,977,960	
2024	22.98	5	4	401	2,907,331	24,138,589	48.056	3,733,014	30,826,990	2.49	76,707,415	
2025	23.59	5	4	412	2,907,331	24,779,795	48.056	3,811,682	31,546,863	2.49	78,498,691	
2026	23.85	5	4	417	2,907,331	25,051,653	48.056	3,845,035	31,852,075	2.49	79,258,155	
2027	23.88	5	4	417	2,907,331	25,081,890	48.056	3,848,745	31,886,022	2.49	79,342,626	
2028	23.91	5	4	418	2,907,331	25,112,106	48.056	3,852,452	31,919,945	2.49	79,427,038	
2029	23.95	5	4	418	2,907,331	25,159,323	48.056	3,858,245	31,972,955	2.49	79,558,943	
2030	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2031	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2032	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2033	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2034	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2035	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2036	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2037	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2038	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2039	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2040	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2041	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2042	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2043	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2044	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2045	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2046	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2047	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2048	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2049	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2050	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2051	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2052	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2053	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2054	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2055	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2056	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2057	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2058	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
2059	24.00	5	4	419	2,907,331	25,207,014	48.056	3,864,096	32,026,497	2.49	79,692,172	
TOTAL					125,742,065	1,045,991,936	2,210,571	169,236,382	1,343,180,954		3,342,264,033	

				P1		P1			
No	Pay Ref	Description	Unit	Rate	QUANTITY	AMOUNT	Quantity	Amount	
								Rands	
1		Route Clearing & grubbing (a) Sparse bush & trees	Ha	10.300	294	3.028.200	294	3.028.200	
2		Road, river and rail crossings (a) national & provincial road (b) gravel road (c) river (d) rail	2 100 no no no no	2.230.000 750.000 1.530.000 2.230.000	2 12 3 1	4.460.000 9.000.000 4.590.000 2.230.000	2 12 3 1	4.460.000 9.000.000 4.590.000 2.230.000	
3		Trench Excavation & backfill (a) Excavation All materials E O Hard (b) Bedding From trench From commercial sources (c) Bedding Cradle & Fill Blanket From trench From commercial sources (d) Main Fill From trench (e) Spoil	m³ m³ m³ m³ m³ m³ m³ m³	50 100 135 235 210 245 55 45	1597010 734625 94947 2937 478344 14794 655959 367759	79.850.491 73.462.452 12.817.893 690.081 100.452.272 3.624.567 36.077.771 16.549.148	1.597.010 734.625 94.947 2.937 478.344 14.794 655.959 367.759	79.850.491 73.462.452 12.817.893 690.081 100.452.272 3.624.567 36.077.771 16.549.148	
4		Pipelines (a) Supply of steel pipe: D1 ratio as specified. Sintakote external coating and epoxy internal lining Dia (mm) Grade D.I 2100 API Grade X42 120 2100 API Grade X42 160 2100 API Grade X42 160 (b) Laying & jointing (% of a) (c) Air valve, Isolating Valve, Scour Valve, Access All valve types, Incl chamber - civil & mechanical (d) Cathodic Protection	m m m m Sum	16.739 12.975 12.975 800	97.864 97.864	1.638.150.501 78.291.439	97.864 0 0 97.864	1.638.150.501 0 0 78.291.439	
SUB-TOTAL A						2.462.455.047		2.462.455.047	
5		Landscaping & EIA Remediation (% of Sub-total A)	%	5		123.122.752		123.122.752	
6		Miscellaneous (% of Sub-total A)	%	10		246.245.505		246.245.505	
SUB TOTAL B						2.831.823.304		2.831.823.304	
7		Preliminary & General (% of Sub-total B) To include below Preliminary works (a) Access road	% km	30 350.000		849.546.991 34.252.505		849.546.991 34.252.505	
8					97.86	34.252.505	98	34.252.505	
SUB TOTAL C						3.715.622.800		3.715.622.800	
10		Contingencies (% of Sub-total C)	%	20		743.124.560		743.124.560	
SUB TOTAL D						4.458.747.360		4.458.747.360	
11		Planning design & supervision (% of Sub-total D)	%	15		668.812.104		668.812.104	
SUB TOTAL E						5.127.559.464		5.127.559.464	
12		VAT (% of sub total E)	%	14		717.858.325		717.858.325	
NETT PROJECT COST						5.845.417.789		5.845.417.789	
13		Cost of relocations	Sum			2.280.000		2.280.000	
14		Cost of land acquisition	Sum			4.837.554		4.837.554	
TOTAL RISING MAIN COST						5.852.535.343		5.852.535.343	
TOTAL RISING MAIN COST (EXCL VAT)						5.134.677.018		5.134.677.018	

Mokolo and Crocodile (West) Water Augmentation Project Feasibility Study
8-P2-TV CB1-DB1
PUMP STATION BILL OF QUANTITIES
September 2008

No	PAY REF	DESCRIPTION	UNIT	RATE 2008 RAND	P1		AMOUNT
					QUANTITY	AMOUNT	
1.		Mechanical and Electrical	Sum			104,674,702	104,674,702
2.		Civils (a) (% of 1)	%	43%		44,860,587	44,860,587
		(c) Permanent access road	km	3,000,000	5.00	15,000,000	15,000,000
		SUB-TOTAL A				164,535,289	164,535,289
3.	11.0	Landscaping (% of Sub-total A)	%	5		8,226,764	8,226,764
4.	12.0	Miscellaneous (% of Sub-total A)	%	10		16,453,529	16,453,529
		SUB TOTAL B				189,215,582	189,215,582
5.	13.0	Preliminary & General (% of sub-total B)	%	30		56,764,675	56,764,675
		SUB TOTAL C				245,980,257	245,980,257
6.	17.0	Contingencies (% of sub total C)	%	20		49,196,051	49,196,051
		SUB TOTAL D				295,176,308	295,176,308
7.	16.0	Planning design & supervision fees, time cost & transport (% of sub total D)	%	15		44,276,446	44,276,446
		SUB TOTAL E				339,452,754	339,452,754
8.	18.0	VAT (% of sub total E)	%	14		47,523,386	47,523,386
		NETT PUMP STATION COST				386,976,140	386,976,140
10.	20.0	Cost of land acquisition	Sum			375,000	375,000
11.	21.0	Cost of ESKOM transmission lines to site + Connection fee	Sum			42,110,460	42,110,460
		TOTAL PUMP STATION COST				429,461,600	429,461,600
		TOTAL PUMP STATION COST (EXCL VAT)				381,938,214	381,938,214

ABSTRACTION WEIR COST MODEL

Vlieëpoort Weir

No	PAY REF	DESCRIPTION	UNIT	RATE 1-Apr-08 (Rand)	QUANTITY	AMOUNT (Rand)
1	1.0	Clearing				
	1.1	a) Sparse	ha	5.533	-	-
	1.2	b) Bush	ha	16.598	1.0	16.598
	1.3	c) Trees	ha	27.664	1.5	41.496
2	2.0	River diversion	Sum	1,725,000	1	1,725,000
3	3.0	Excavation				
	3.1	(a) Bulk				
	3.1.1	(i) all materials	m ³	40	12,189	487,560
	3.1.2	(ii) extra over for rock	m ³	71	1,219	86,542
	3.2	(b) Confined				
	3.2.1	(i) all materials	m ³	59	-	-
	3.2.2	(ii) extra over for rock	m ³	99	-	-
4	4.0	Preparation of solum				
	4.1	a) all materials	m ²	20	6,778	135,560
	4.2	b) extra over for rock	m ²	20	678	13,556
5	5.0	Drilling & Grouting				
	5.1	(a) Curtain grouting	m drill	443	-	-
	5.2	(b) Consolidation grouting	m drill	443	-	-
	5.3	(c) Jet grouting	m drill	4,370	6,200	27,094,000
6	6.0	Embankment				
	6.1	(a) Earthfill	m ³	47	26,007	1,222,329
	6.2	(b) Filters	m ³	174	4,551	791,913
	6.3	(c) Rip-rap	m ³	95	9,288	882,360
	6.4	(d) Geofabric	m ²	30	7,144	214,320
	6.5	(e) Overhaul beyond 5km	m ³ .km	4	-	-
7	7.0	Concrete works				
	7.1	a) Formwork				
	7.1.1	(i) Gang formed	m ²	257	11,568	2,972,976
	7.1.2	(ii) Intricate	m ²	316	868	274,162
	7.2	(b) Concrete				
	7.2.1	(i) Mass	m ³	1,156	3,425	3,959,300
	7.2.2	(ii) Structural	m ³	1,482	3,275	4,853,550
	7.3	(c) Reinforcing	t	12,350	180	2,224,544
		SUB-TOTAL				46,995,765

8	8.0	Mechanical Items				
	8.1	(a) Pipes, Valves, Screens & Gates	Sum	11,840,000	1	11,840,000
	8.2	(b) Cranes & hoists	Sum	600,000	1	600,000
	8.3	(c) Structural steelwork	t	19,760	24	474,240
9	9.0	Fencing	km	27.664	2.9	81,572
10	10.0	Landscaping (% of 1-9)	%	5		2,349,788
11	11.0	Miscellaneous (% of 1-9)	%	10		4,699,577
		SUB TOTAL A				67,040,943
12	12.0	Preliminary & General (% of sub-total A)	%	30		20,112,283
13	13.0	Preliminary works				
	13.1	(a) Access road	km	350,000	1.0	350,000
	13.2	(b) Electricity to site	Sum	250,000	1	250,000
	13.3	(c) Water to site-construction (not potable)	Sum	150,000	1	150,000
	13.4	(d) Railhead & materials handling	Sum	-	1	-
14	14.0	Accommodation	Sum	-	1	-
		SUB TOTAL B				87,903,225
15	15.0	Contingencies (% of sub total B)	%	20		17,580,645
		SUB TOTAL C (Civils Total)				105,483,870
16	16.0	Planning design & supervision (% of sub-total C)	%	15		15,822,581
		SUB TOTAL D				121,306,451
17	17.0	VAT (% of sub-total D)	%	14		16,982,903
		NETT PROJECT COST				138,289,354
18	18.0	Cost of relocations	Sum	-	1	-
19	19.0	Cost of land acquisition	Sum	-	1	-
		TOTAL PROJECT COST				138,289,354

ABSTRACTION WEIR COST MODEL
Vlieëpoort De-Silting Works

No	PAY REF	DESCRIPTION	UNIT	RATE 1-Apr-08 (Rand)	QUANTITY	AMOUNT (Rand)
1	1.0	Clearing				
	1.1	a) Sparse	ha	5,533	-	-
	1.2	b) Bush	ha	16,598	0.5	8,299
	1.3	c) Trees	ha	27,664	1.0	27,664
2	2.0	Excavation				
	2.1	(a) Bulk				
	2.1.1	(i) all materials	m ³	40	-	-
	2.1.2	(ii) extra over for rock	m ³	71	-	-
	2.2	(b) Confined				
	2.2.1	(i) all materials	m ³	59	-	-
4	4.0	Preparation of solum				
	4.1	a) all materials	m ²	20	8,000	160,000
	4.2	b) extra over for rock	m ²	20	4,800	96,000
5	5.0	Drilling & Grouting				
	5.1	(a) Curtain grouting	m drill	443	-	-
	5.2	(b) Consolidation grouting	m drill	443	-	-
	5.3	(c) Jet grouting	m drill	4,370	-	-
6	6.0	Embankment				
	6.1	(a) Earthfill	m ³	47	26,066	1,225,079
	6.2	(b) Filters	m ³	174	4,561	793,695
	6.3	(c) Rip-rap	m ³	95	918	87,238
	6.4	(d) Overhaul beyond 5km	m ³ km	4	-	-
7	7.0	Concrete works				
	7.1	a) Formwork				
	7.1.1	(i) Gang formed	m ²	257	6,514	1,674,098
	7.1.2	(ii) Intricate	m ²	316	977	308,764
	7.2	(b) Concrete				
	7.2.1	(i) Mass	m ³	1,156	240	277,787
	7.2.2	(ii) Structural	m ³	1,482	3,204	4,748,328
	7.3	(c) Reinforcing	l	12,350	176	2,176,317
		SUB-TOTAL				11,583,268

8	8.0	Mechanical Items				
	8.1	(a) Pipes, Valves & Gates	Sum	49,190,800	1	49,190,800
	8.2	(b) Cranes & hoists	Sum	600,000	1	600,000
	8.3	(c) Structural steelwork	l	19,760	24	474,240
9	9.0	Fencing	km	27,664	1.1	31,394
10	10.0	Landscaping (% of 1-9)	%	5		579,163
11	11.0	Miscellaneous (% of 1-9)	%	10		1,158,327
		SUB TOTAL A				63,617,193
12	12.0	Preliminary & General (% of sub-total A)	%	30		19,085,158
13	13.0	Preliminary works				
	13.1	(a) Access road	km	350,000	0.2	70,000
	13.2	(b) Electricity to site	Sum	250,000	1	250,000
	13.3	(c) Water to site-construction (not potable)	Sum	150,000	1	150,000
	13.4	(d) Railhead & materials handling	Sum	-	1	-
14	14.0	Accommodation	Sum	-	1	-
		SUB TOTAL B				83,172,351
15	15.0	Contingencies (% of sub total B)	%	20		16,634,470
		SUB TOTAL C (Civils Total)				99,806,821
16	16.0	Planning design & supervision (% of sub-total C)	%	15		14,971,023
		SUB TOTAL D				114,777,844
17	17.0	VAT (% of sub-total D)	%	14		16,068,896
		NETT PROJECT COST				130,846,742
18	18.0	Cost of relocations	Sum	-	1	-
19	19.0	Cost of land acquisition	Sum	-	1	-
		TOTAL PROJECT COST				130,846,742

ABSTRACTION WEIR COST MODEL
Vlieëpoort Balancing Dam

No	PAY REF	DESCRIPTION	UNIT	RATE 1-Apr-08 (Rand)	QUANTITY	AMOUNT (Rand)
1	1.0	Clearing				
	1.1	a) Sparse	ha	5,533	-	-
	1.2	b) Bush	ha	16,598	1.0	16,598
	1.3	c) Trees	ha	27,664	7.0	193,648
2	2.0	Excavation				
	2.1	(a) Bulk				
	2.1.1	(i) all materials	m ³	40	26,160	1,046,388
	2.1.2	(ii) extra over for rock	m ³	71	15,696	1,114,404
	2.2	(b) Confined				
	2.2.1	(i) all materials	m ³	59		-
	2.2.2	(ii) extra over for rock	m ³	99		-
4	4.0	Preparation of solum				
	4.1	a) all materials	m ²	20	41,400	828,000
	4.2	b) extra over for rock	m ²	20	24,840	496,800
5	5.0	Drilling & Grouting				
	5.1	(a) Curtain grouting	m drill	443	-	-
	5.2	(b) Consolidation grouting	m drill	443	-	-
	5.3	(c) Jet grouting	m drill	4,370	-	-
6	6.0	Embankment				
	6.1	(a) Earthfill	m ³	47	74,400	3,496,800
	6.2	(b) Filters	m ³	174	13,020	2,265,480
	6.3	(c) Rip-rap	m ³	95	2,720	258,400
	6.4	(d) Overhaul beyond 5km	m ³ km	4	-	-
	6.5	(e) Waterproof Membrane	m ²	100	31,100	3,110,000
7	7.0	Concrete works				
	7.1	a) Formwork				
	7.1.1	(i) Gang formed	m ²	257	2,200	565,400
	7.1.2	(ii) Intricate	m ²	316	330	104,280
	7.2	(b) Concrete				
	7.2.1	(i) Mass	m ³	1,156	528	610,368
	7.2.2	(ii) Structural	m ³	1,482	750	1,111,500
	7.3	(c) Reinforcing	t	12,350	41	509,438
		SUB-TOTAL				15,727,503

8	8.0	Mechanical Items				
	8.1	(a) Pipes, Valves & Screens	Sum	2,118,800	1	2,118,800
	8.2	(b) Cranes & hoists	Sum	600,000	1	600,000
	8.3	(c) Structural steelwork	t	19,760	24	474,240
9	9.0	Fencing	km	27,664	2.1	58,013
10	10.0	Landscaping (% of 1-9)	%	5		786,375
11	11.0	Miscellaneous (% of 1-9)	%	10		1,572,750
		SUB TOTAL A				21,337,682
12	12.0	Preliminary & General (% of sub-total A)	%	30		6,401,305
13	13.0	Preliminary works				
	13.1	(a) Access road	km	350,000	0.2	70,000
	13.2	(b) Electricity to site	Sum	250,000	1	250,000
	13.3	(c) Water to site-construction (not potable)	Sum	150,000	1	150,000
	13.4	(d) Railhead & materials handling	Sum	-	1	-
14	14.0	Accommodation	Sum	-	1	-
		SUB TOTAL B				28,208,986
15	15.0	Contingencies (% of sub total B)	%	20		5,641,797
		SUB TOTAL C (Civils Total)				33,850,784
16	16.0	Planning design & supervision (% of sub-total C)	%	15		5,077,618
		SUB TOTAL D				38,928,401
17	17.0	VAT (% of sub-total D)	%	14		5,449,976
		NETT PROJECT COST				44,378,377
		TOTAL PROJECT COST				44,378,377

Sub total D	275,012,696
Subtotal A	151,995,817

ABSTRACTION WEIR COST MODEL
7 Separate Off-Stream Balancing Dams

No	PAY REF	DESCRIPTION	UNIT	RATE 1-Apr-08 (Rand)	QUANTITY	AMOUNT (Rand)
1	1.0	Clearing				
	1.1	a) Sparse	ha	5,533	39	217,326
	1.2	b) Bush	ha	16,598	65	1,086,564
	1.3	c) Trees	ha	27,664	157	4,346,360
2	2.0	Excavation				
	2.1	(a) Bulk				
	2.1.1	(i) all materials	m ³	40	320,095	12,803,800
	2.1.2	(ii) extra over for rock	m ³	71	80,024	5,681,686
	2.2	(b) Contined				
	2.2.1	(i) all materials	m ³	59	14,000	826,000
	2.2.2	(ii) extra over for rock	m ³	99	12,600	1,247,400
4	4.0	Preparation of solum				
	4.1	a) all materials	m ³	20	2,618,541	52,370,826
	4.2	b) extra over for rock	m ³	20	654,635	13,092,706
5	5.0	Drilling & Grouting				
	5.1	(a) Curtain grouting	m drill	443		-
	5.2	(b) Consolidation grouting	m drill	443		-
	5.3	(c) Jet grouting	m drill	4,370		-
6	6.0	Embankment				
	6.1	(a) Earthfill	m ³	47	3,200,950	150,444,651
	6.2	(b) Filters	m ³	174	285,416	49,662,362
	6.3	(c) Rip-rap	m ³	95	570,832	54,229,016
	6.4	(d) Overhaul beyond 5km	m ³ .km	4	570,832	2,283,327
	6.5	(e) Waterproof Membrane System	m ²	100	1,902,773	190,277,250
7	7.0	Concrete works				
	7.1	a) Formwork				
	7.1.1	(i) Gang formed	m ²	257	1,627	418,023
	7.1.2	(ii) Intricate	m ²	316	122	38,549
	7.2	(b) Concrete				
	7.2.1	(i) Mass	m ³	1,156	214	247,825
	7.2.2	(ii) Structural	m ³	1,482	1,429	2,118,092
	7.3	(c) Reinforcing	t	12,350	107	1,323,808
		SUB-TOTAL				542,715,572

8	8.0	Mechanical Items				
	8.1	(a) Pipes, Valves & Gates	Sum	141,540,000	1	141,540,000
	8.2	(b) Cranes & hoists	Sum	600,000	1	600,000
	8.3	(c) Structural steelwork	t	19,760	21	414,960
				-		-
9	9.0	Fencing	km	27,664	4.4	122,476
10	10.0	Landscaping (% of 1-9)	%	5		27,135,779
11	11.0	Miscellaneous (% of 1-9)	%	10		54,271,557
		SUB TOTAL A				766,800,345
12	12.0	Preliminary & General (% of sub-total A)	%	30		230,040,103
13	13.0	Preliminary works				
	13.1	(a) Access road	km	350,000	1.0	350,000
	13.2	(b) Electricity to site	Sum	250,000	1	250,000
	13.3	(c) Water to site-construction (not potable)	Sum	150,000	1	150,000
	13.4	(d) Hailhead & materials handling	Sum	-	1	-
14	14.0	Accommodation	Sum	-	1	-
		SUB TOTAL B				997,590,448
15	15.0	Contingencies (% of sub total B)	%	20		199,518,090
		SUB TOTAL C (Civils Total)				1,197,108,538
16	16.0	Planning design & supervision (% of sub-total C)	%	15		179,566,281
		SUB TOTAL D				1,376,674,818
17	17.0	VAI (% of sub-total D)	%	14		192,734,475
		NET PROJECT COST				1,569,409,293
		TOTAL PROJECT COST				1,569,409,293

B-P2-TV CB1-DB1

361.938.214 83.991.34
6.628.101.10

8. DO TV/CBL DE

Discounted at 6%	20,176,811.304
Discounted at 8%	15,941,459.950
Discounted at 10%	13,164,472.523

PROJECT: Mokolo and Crocodile (West) Water Augmentation Project Feasibility Study
OPTION: 8-P2-TV CB1-DB1
DATE: September 2008

UNIT REFERENCE VALUE CALCULATIONS AT DIFFERENT DISCOUNTED RATES

Year	Net Demand Mm³/a	Total annual costs (excl VAT)	Discounted Figures 6%		Discounted Figures 8%		Discounted Figures 10%	
			Demand	Costs	Demand	Costs	Demand	Costs
2008	12.13	25,242,213	12.13	25,242,213	12.13	25,242,213	12.13	25,242,213
2009	13.75	28,605,488	12.97	26,986,309	12.73	26,486,563	12.50	26,004,989
2010	14.60	2,895,593,591	12.99	2,577,067,987	12.51	2,482,504,793	12.06	2,393,052,554
2011	20.25	2,905,896,111	17.00	2,439,846,410	16.08	2,306,794,022	15.22	2,183,242,758
2012	28.03	2,459,995,953	22.20	1,948,547,206	20.60	1,808,170,463	19.14	1,680,210,336
2013	39.63	2,444,032,474	29.61	1,826,323,241	26.97	1,663,367,434	24.61	1,517,551,877
2014	50.40	260,865,853	35.53	183,900,132	31.76	164,389,737	28.45	147,251,973
2015	72.07	381,468,816	47.93	253,698,550	42.05	222,583,390	36.98	195,753,820
2016	110.02	525,414,785	69.03	329,651,736	59.44	283,865,260	51.33	245,109,875
2017	128.58	648,166,161	76.11	383,648,555	64.32	324,244,453	54.53	274,885,725
2018	133.36	679,858,502	74.47	379,629,436	61.77	314,906,031	51.42	262,114,883
2019	146.22	765,165,770	77.03	403,079,783	62.71	328,166,483	51.25	268,185,935
2020	155.93	829,522,164	77.49	412,247,102	61.92	329,414,664	49.68	264,311,325
2021	164.38	885,616,064	77.07	415,211,369	60.44	325,639,189	47.62	256,531,428
2022	190.96	1,061,512,957	84.46	469,508,205	65.01	361,403,807	50.29	279,529,538
2023	207.14	1,168,649,448	86.43	487,636,583	65.30	368,407,045	49.59	279,765,386
2024	211.84	1,199,740,427	83.39	472,273,360	61.83	350,192,794	46.10	261,098,472
2025	216.70	1,234,043,592	80.48	458,279,881	58.57	333,523,668	42.87	244,148,946
2026	218.77	1,245,595,896	76.64	436,386,788	54.75	311,709,164	39.35	224,031,371
2027	219.00	1,247,114,471	72.38	412,187,558	50.74	288,971,468	35.81	203,913,181
2028	219.23	1,248,631,957	68.36	389,329,346	47.03	267,891,748	32.59	185,601,184
2029	219.58	1,257,732,351	64.59	369,968,766	43.62	249,855,760	29.67	169,958,091
2030	219.95	1,253,398,371	61.04	347,824,436	40.46	230,550,732	27.02	153,974,943
2031	219.95	1,253,398,371	57.58	328,136,261	37.46	213,472,900	24.56	139,977,221
2032	219.95	1,253,398,371	54.32	309,562,510	34.69	197,660,092	22.33	127,252,019
2033	219.95	1,253,398,371	51.25	292,040,104	32.12	183,018,604	20.30	115,683,654
2034	219.95	1,253,398,371	48.35	275,509,532	29.74	169,461,670	18.45	105,166,958
2035	219.95	1,253,398,371	45.61	259,914,653	27.53	156,908,954	16.78	95,606,325
2036	219.95	1,253,398,371	43.03	245,202,503	25.49	145,286,069	15.25	86,914,841
2037	219.95	1,253,398,371	40.59	231,323,116	23.61	134,524,138	13.87	79,013,492
2038	219.95	1,253,398,371	38.29	218,229,354	21.86	124,559,387	12.60	71,830,447
2039	219.95	1,253,398,371	36.13	205,876,749	20.24	115,332,765	11.46	65,300,407
2040	219.95	1,255,499,187	34.08	194,548,886	18.74	106,968,587	10.42	59,463,506
2041	219.95	1,253,398,371	32.15	183,229,574	17.35	98,879,257	9.47	53,967,278
2042	219.95	1,253,398,371	30.33	172,858,089	16.07	91,554,868	8.61	49,061,162
2043	219.95	1,253,398,371	28.62	163,073,669	14.88	84,773,026	7.83	44,601,056
2044	219.95	1,260,127,459	27.00	154,669,017	13.77	78,914,949	7.12	40,764,095
2045	219.95	1,253,398,371	25.47	145,134,985	12.75	72,679,206	6.47	36,860,377
2046	219.95	1,253,398,371	24.03	136,919,797	11.81	67,295,561	5.88	33,509,434
2047	219.95	1,253,398,371	22.67	129,169,620	10.93	62,310,705	5.35	30,463,122
2048	219.95	1,253,398,371	21.38	121,858,132	10.12	57,695,097	4.86	27,693,747
2049	219.95	1,253,398,371	20.17	114,980,502	9.37	53,421,386	4.42	25,176,134
2050	219.95	1,253,398,371	19.03	108,453,303	8.68	49,464,246	4.02	22,887,394
2051	219.95	1,253,398,371	17.95	102,314,437	8.04	45,800,228	3.65	20,806,722
2052	219.95	1,253,398,371	16.94	96,523,054	7.44	42,407,619	3.32	18,915,202
2053	219.95	1,253,398,371	15.98	91,059,465	6.89	39,266,313	3.02	17,195,638
2054	219.95	1,253,398,371	15.07	85,905,174	6.38	36,357,698	2.74	15,632,398
2055	219.95	1,253,398,371	14.22	81,042,617	5.91	33,664,535	2.49	14,211,271
2056	219.95	1,253,398,371	13.42	76,455,299	5.47	31,170,866	2.27	12,919,337
2057	219.95	1,253,398,371	12.66	72,127,641	5.06	28,861,913	2.06	11,744,852
2058	219.95	1,253,398,371	11.94	68,044,944	4.69	26,723,993	1.87	10,677,138
2059	219.95	1,253,398,371	11.26	64,193,344	4.34	24,744,438	1.70	9,706,489
TOTAL			9390.93	63,009,246,074	2,148.85	20,176,811,304	1,484.20	15,941,459,950
URV								
				9.390		10.741		12.283

UNIT REFERENCE VALUE CALCULATIONS AT DIFFERENT DISCOUNTED RATES- 30 year analysis period (2014-2044)

TOTAL	6091.75	44,208,270,511	1886.66	18,682,648,971	1366.30	15,269,596,148	1019.24	12,876,073,268
URV				9.903		11.176		12.633

UNIT REFERENCE VALUE CALCULATIONS AT DIFFERENT DISCOUNTED RATES- 20 year analysis period (2014-2034)

TOTAL	3892.29	31,665,456,897	1530.83	16,653,723,361	1166.76	14,131,894,149	905.84	12,229,550,657
URV				10.879		12.112		13.501