

ANNEX

ANNEX A
ENGINEERING

ANNEX A : ENGINEERING

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**Table A.1-1 Supply Capacity of Existing Pipelines
(Rand Water Supply Area)**

Sizing of Vaalkop to Rustenburg Pipeline for 40Mld module

From To	Hartebeeshoek		Total to Rosslyn	Rosslyn		Total to Soshanguve
	Rosslyn			Soshanguve		
	H18	H28		H16	H28	
TWL (upstream)	1406.5	1406.5		1396	1396	
TWL (downstream)	1396	1396		1358	1358	
D	0.9	1.4		0.9	1.2	
H	10.5	10.5		38	38	
L	3600	3600		11790	11790	
viscosity	0.00000113	0.00000113		0.00000113	0.00000113	
k	0.0006	0.0006		0.0006	0.0006	
sqrt (2gDH/L)	0.227	0.283		0.239	0.275	
V (Colebrook - White)	1.685	2.213		1.772	2.117	
Q (m3/s)	1.072	3.407		1.127	2.394	
Q (ML/day)	92.608	294.401	387.008	97.390	206.864	304.254

Demand	Downstream Hartebeeshoek		Downstream Rosslyn	
	Average Mld	Peak Mld	Average Mld	Peak Mld
Klipkruisfontein	20.810	26.013	20.810	26.013
Soshanguve	95.828	119.785	95.828	119.785
Akasia	9.577	11.971	9.577	11.971
Rosslyn Industries	31.425	39.281		
Ga Rankuwa	19.239	24.049		
Ga Rankuwa Industries	15.918	19.898		
Kgabalatsane	1.670	2.088	1.670	2.088
Ga Rankuwa Police St	0.035	0.044		
Hebron	3.471	4.339	3.471	4.339
Klippgat	3.265	4.081	3.265	4.081
Mabopane	29.256	36.570	29.256	36.570
Makanyaneng inc Mapoch	0.814	1.018	0.814	1.018
Mapetla	0.338	0.423		
Nooitgedacht	1.090	1.363	1.090	1.363
Winterveld and Klippan	37.785	47.231	37.785	47.231
Total	270.521	338.151	203.566	254.458

Surplus in 2015

48.857

49.797

**Table A.1-2 Supply Capacity of Existing Pipelines
(Barnardsvlei Supply Area)**

Sizing of Vaalkop to Rustenburg Pipeline for 40Mld module

From To	Randfontein Waterkloof B.P.		Total	Waterkloof B.P. Buffelshoek		Total	Buffelshoek B.P. Barnardsvlei		Total
	P1	P2		P1	P2		P1	P2	
	TWL (upstream)	1730		1730			1645.9	1645.9	
TWL (downstream)	1645.9	1645.9		1543.2	1543.2		1475.4	1475.4	
D	0.61	0.9		0.61	0.9		0.61	0.9	
H	84.1	84.1		102.7	102.7		67.8	67.8	
L	23279	21426		23965	23835		5080	5080	
viscosity	0.00000113	0.00000113		0.00000113	0.00000113		0.00000113	0.00000113	
k	0.0006	0.0006		0.0006	0.0006		0.0006	0.0006	
sqrt (2gDH/L)	0.208	0.263		0.226	0.276		0.400	0.485	
V (Colebrook - White)	1.472	1.957		1.605	2.051		2.843	3.620	
Q (m3/s)	0.430	1.245		0.469	1.305		0.831	2.303	
Q (Ml/day)	37.176	107.556	144.732	40.521	112.727	153.249	71.787	199.001	
								270.788	

Demand	Downstream Barnardsvlei	
	Average Mid	Peak Mid
Vaalkop South and Bospoort		
Thlaseng supply unit	2.247	2.809
Marakana supply unit	0.508	0.635
Mabitse supply unit	0.366	0.458
Kana supply unit	3.564	4.455
Boitekong supply unit	14.800	18.500
Meriting supply unit	4.710	5.888
Impala supply unit	5.000	6.250
Ga-luka supply unit	2.634	3.293
Pbokeng supply unit	8.200	10.250
Thlabane supply unit	5.615	7.019
Rustenburg north supply unit	16.365	20.456
RPM supply unit	2.930	3.663
Barnardsvlei Western supply block		
Rustenburg South supply unit	17.434	21.793
Impala supply unit	32.000	40.000
RPM supply unit	16.350	20.438
Karee supply unit	6.871	8.589
Diverse consumers supply unit	6.792	8.490
Barnardsvlei Eastern supply block		
Bapong supply unit	6.545	8.181
Segwaclane supply unit	1.258	1.573
Wonderkoppies supply unit	0.777	0.971
Mooinooi supply unit	0.672	0.840
Western Plats supply unit	26.782	33.478
Total	182.420	228.025

Shortfall in 2015 83.293

Made up by:
Proposed Vaalkop supply to Bospoort 85
Bospoort Dam 11

Surplus in 2015 12.707

Table A.1-3

**Cost Estimate by Pipe Size
(Rand Water Supply Area) (1)**

Sizing of Temba to Soshanguve Pipeline for 47 Mld Module

Sizing of Vaalkop to Rustenburg Pipeline for 40Mld module

From To	Temba Soshanguve	Temba Soshanguve	Temba Soshanguve	Temba Soshanguve
TWL (upstream)	1107	1107	1107	1107
Pump head	473.5	300.8	278.1	266.7
Total head (upstream)	1580.5	1407.8	1385.1	1373.7
TWL (downstream)	1358	1358	1358	1358
D	0.6	0.8	0.9	1
H	222.53	49.85	27.08	15.72
L	35200	35200	35200	35200
viscosity	0.00000113	0.00000113	0.00000113	0.00000113
k	0.0006	0.0006	0.0006	0.0006
sqrt (2gDH/L)	0.273	0.149	0.117	0.094
V (Colebrook - White)	1.932	1.087	0.859	0.696
Q (m3/s)	0.546	0.546	0.546	0.546
Q (Ml/day)	47.200	47.200	47.200	47.200

Pipeline cost per meter	R 639	R 864	R 977	R 1,090
Pipeline cost	R 22,480,858	R 30,430,192	R 34,404,858	R 38,379,525
Pump station KW (installed)	5472KW	3476KW	3213KW	3082KW
Pump station cost	R 5,761,856	R 4,551,128	R 4,368,698	R 4,274,918
Water Treatment Works	R 35,399,846	R 35,399,973	R 35,399,989	R 35,399,999
Sub-total capital works	R 63,642,561	R 70,381,293	R 74,173,546	R 78,054,442
P&G (20%)	R 12,728,512	R 14,076,259	R 14,834,709	R 15,610,888
Engineering Fees (15%)	R 11,455,661	R 12,668,633	R 13,351,238	R 14,049,800
Contingencies (10%)	R 8,782,673	R 9,712,618	R 10,235,949	R 10,771,513
Initial cost (excl VAT)	R 96,609,407	R 106,838,803	R 112,595,442	R 118,486,643
Annual Energy cost	R 3,324,926	R 2,113,023	R 1,953,285	R 1,873,520
Annual Mechanical O&M	R 69,972	R 55,269	R 53,053	R 51,915
Annual Civil O&M	R 237,150	R 263,643	R 278,173	R 292,972
Total annual cost	R 3,632,048	R 2,431,934	R 2,284,512	R 2,218,407
Average annual flow	13,782,340kl	13,782,390kl	13,782,396kl	13,782,400kl

Demand		
	Average Mld	Peak Mld
Soshanguve	95.828	119.785
Winterveld and Klippan	37.785	47.231
Total	133.613	167.016

Table A.1-4

**Cost Estimate by Pipe Size
(Rand Water Supply Area) (2)**

Sizing of Brits to Ga Rankuwa Pipeline for 44 Mld Module

Sizing of Vaalkop to Rustenburg Pipeline for 40Mld module

From To	Brits Branch pipe	Brits Branch pipe	Brits Branch pipe	Brits Branch pipe
River abstraction level	1087	1087	1087	1087
Total pump head from river	361.0	278.8	245.4	222.5
Total head (upstream)	1448.0	1365.8	1332.4	1309.5
TWL (downstream)	1351.7	1322.6	1310.8	1302.7
D	0.6	0.7	0.8	1
H	96.37	43.20	21.60	6.82
L	17200	17200	17200	17200
viscosity	0.00000113	0.00000113	0.00000113	0.00000113
k	0.0006	0.0006	0.0006	0.0006
sqrt (2gDH/L)	0.257	0.186	0.140	0.088
V (Colebrook - White)	1.818	1.336	1.023	0.654
Q (m3/s)	0.514	0.514	0.514	0.514
Q (Ml/day)	44.413	44.413	44.413	44.413
	44.413	44.413	44.413	44.413

Pipeline cost per meter	R 639	R 752	R 864	R 1,090
Pipeline cost	R 10,984,965	R 12,927,132	R 14,869,298	R 18,753,632
Pump station KW (installed)	3926KW	3032KW	2668KW	2420KW
Pump station cost	R 4,847,957	R 4,238,286	R 3,790,913	R 3,325,280
Water Treatment Works	R 33,309,743	R 33,309,746	R 33,309,748	R 33,309,412
Sub-total capital works	R 49,142,665	R 50,475,164	R 51,969,959	R 55,388,324
P&G (20%)	R 9,828,533	R 10,095,033	R 10,393,992	R 11,077,665
Engineering Fees (15%)	R 8,845,680	R 9,085,529	R 9,354,593	R 9,969,898
Contingencies (10%)	R 6,781,688	R 6,965,573	R 7,171,854	R 7,643,589
Initial cost (excl VAT)	R 74,598,566	R 76,621,298	R 78,890,398	R 84,079,475
Annual Energy cost	R 2,385,791	R 1,842,797	R 1,622,236	R 1,471,252
Annual Mechanical O&M	R 58,874	R 51,470	R 46,037	R 40,382
Annual Civil O&M	R 182,817	R 188,336	R 194,349	R 207,675
Total annual cost	R 2,627,482	R 2,082,603	R 1,862,622	R 1,719,309
Average annual flow	12,968,593kl	12,968,594kl	12,968,595kl	12,968,464kl

Demand	Average Mld	Peak Mld
Ga Rankuwa	19.239	24.049
Ga Rankuwa Industries	15.918	19.898
Ga Rankuwa Police St	0.035	0.044
Mapetla	0.338	0.423
Total	35.530	44.413

**Table A.1-5 Cost Estimate by Pipe Size
(Barnardsvlei Supply Area) (1)**

Sizing of Brits to Barnardsvlei Pipeline for 45 Mld module

From To	Brits		Brits	
	Barnardsvlei East	Barnardsvlei East	Barnardsvlei East	Barnardsvlei East
River abstraction level	1087	1087	1087	1087
Total pump head from river	292.4	149.3	121.1	113.1
Total head (upstream)	1379.4	1236.3	1208.1	1200.1
TWL (downstream)	1195.0	1195.0	1195.0	1195.0
D	0.6	0.8	1	1.2
H	184.37	41.32	13.04	5.11
L	32000	32000	32000	32000
viscosity	0.00000113	0.00000113	0.00000113	0.00000113
k	0.0006	0.0006	0.0006	0.0006
sqrt (2gDHL)	0.260	0.142	0.089	0.061
V (Colebrook - White)	1.844	1.037	0.564	0.461
Q (m ³ /s)	0.521	0.521	0.521	0.521
Q (Mld/day)	45.043	45.043	45.043	45.043

Pipeline cost per meter	R 639	R 864	R 1,090	R 1,316
Pipeline cost	R 20,437,144	R 27,663,811	R 34,890,477	R 42,117,144
Pump station KW (installed)	3224KW	1647KW	1335KW	1248KW
Pump station cost	R 4,376,401	R 1,985,548	R 1,336,499	R 1,297,251
Water Treatment Works	R 33,782,424	R 33,782,240	R 33,782,223	R 33,782,251
Sub-total capital works	R 58,595,970	R 63,431,599	R 70,009,199	R 77,196,647
F&O (20%)	R 11,719,194	R 12,686,320	R 14,001,840	R 15,439,329
Engineering Fees (15%)	R 10,547,275	R 11,417,688	R 12,601,656	R 13,895,396
Contingencies (10%)	R 8,086,244	R 8,753,561	R 9,661,269	R 10,653,157
Initial cost (excl VAT)	R 88,948,682	R 96,289,168	R 106,273,964	R 117,184,518
Annual Energy cost	R 1,959,908	R 1,001,842	R 812,442	R 759,341
Annual Mechanical O&M	R 53,147	R 24,112	R 16,230	R 15,754
Annual Civil O&M	R 219,050	R 239,216	R 264,671	R 291,977
Total annual cost	R 2,232,105	R 1,245,170	R 1,093,343	R 1,067,072
Average annual flow	13,152,624kl	13,152,552kl	13,152,545kl	13,152,557kl

Demand	Average	
	Mld	Peak Mld
Barnardsvlei Eastern supply block		
Bopeng supply unit	6.545	8.181
Segwacane supply unit	1.258	1.573
Wanderkoppies supply unit	0.777	0.971
Mooimooi supply unit	0.672	0.840
Western Flats supply unit	26.782	33.478
TOTAL	36.034	45.043

From To	Mooimooi	
	West Flats	West Flats
Total head (upstream)	1195.0	1195.0
TWL (downstream)	1143.5	1143.5
D	0.35	0.45
H	51.52	51.52
L	8200	8200
viscosity	0.00000113	0.00000113
k	0.0006	0.0006
sqrt (2gDHL)	0.208	0.236
V (Colebrook - White)	1.370	1.607
Q (m ³ /s)	0.132	0.256
Q (Mld/day)	11.392	22.086
Total		33.479
Target peak capacity		33.478

**Table A.1-6 Cost Estimate by Pipe Size
(Barnardsvlei Supply Area) (2)**

Sizing of Vaalkop to Rustenburg Pipeline for 40 Mld module

From To	Vaalkop Rustenburg	Vaalkop Rustenburg	Vaalkop Rustenburg	Vaalkop Rustenburg
River abstraction level	980	980	980	980
Total pump head from river	588.1	381.7	340.9	329.4
Total head (upstream)	1568.1	1361.7	1320.9	1309.4
TWL (downstream)	1302	1302	1302	1302
D	0.6	0.8	1	1.2
H	266.07	59.71	18.87	7.40
L	58450	58450	58450	58450
viscosity	0.00000113	0.00000113	0.00000113	0.00000113
k	0.0006	0.0006	0.0006	0.0006
sqrt (2gDH/L)	0.231	0.127	0.080	0.055
V (Colebrook - White)	1.637	0.921	0.589	0.409
Q (m ³ /s)	0.463	0.463	0.463	0.463
Q (Ml/day)	39.999	40.000	40.001	40.000

1250

Pipeline cost per meter	R 639	R 864	R 1,090	R 1,316
Pipeline cost	R 37,329,721	R 50,529,679	R 63,729,638	R 76,929,596
Pump station KW (installed)	5759KW	3738KW	3338KW	3226KW
Pump station cost	R 5,916,997	R 4,726,073	R 4,456,052	R 4,377,431
Water Treatment Works	R 29,999,366	R 29,999,944	R 30,000,641	R 30,000,002
Sub-total capital works	R 73,246,084	R 85,255,695	R 98,186,330	R 111,307,029
P&G (20%)	R 14,649,217	R 17,051,139	R 19,637,266	R 22,261,406
Engineering Fees (15%)	R 13,184,295	R 15,346,025	R 17,673,539	R 20,035,265
Contingencies (10%)	R 10,107,960	R 11,765,286	R 13,549,714	R 15,360,370
Initial cost (excl VAT)	R 111,187,555	R 129,418,145	R 149,046,849	R 168,964,069
Annual Energy cost	R 3,499,138	R 2,271,862	R 2,029,020	R 1,960,794
Annual Mechanical O&M	R 71,856	R 57,393	R 54,114	R 53,160
Annual Civil O&M	R 273,478	R 319,958	R 369,235	R 419,088
Total annual cost	R 3,844,472	R 2,649,214	R 2,452,370	R 2,433,042
Average annual flow	11,679,753kl	11,679,978kl	11,680,249kl	11,680,001kl

Demand	Average Mld	Peak Mld
	Barnardsvlei Western supply block	
Rustenburg South supply unit	17.434	21.793
Impala supply unit	32.000	40.000
RPM supply unit	16.350	20.438
Karee supply unit	6.871	8.589
Diverse consumers supply unit	6.792	8.490
TOTAL	79.447	99.309

ANNEXE B
ECONOMIC

ANNEX B : ECONOMIC

B-1 List of Tables

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Table B.1-1 : Unit Cost for Rand Water Supply Area (RWSA) - Temba to Soshanguve

Description	600mm	800mm	900mm	1000mm
Annualized Capital Cost	9,935	10,957	11,540	12,139
Re-current Cost	6,088	4868	4719	4654
Total Cost	16,023	15,825	16,259	16,793
Unit Cost (c/kl)	116.00	115.00	118.00	122.00
RW MC 1996/97 values	89.65	89.65	89.65	89.65
Unit Raw Water Cost (c/kl)	26.35	25.35	28.35	32.35
RW MC 1997 values (April-Sept. 98)	129.17	129.17	129.17	129.17
Unit Raw Water Cost (c/kl)	-13.17	-14.17	-11.17	-7.17
RW MC 1997 values (Oct 88-Mar 99)	155.07	155.07	155.07	155.07
Unit Raw Water Cost (c/kl)	-39.07	-40.07	-37.07	-33.07
RW MC 1997 values (April-Mar 2000)	165.24	165.24	165.24	165.24
Unit Raw Water Cost (c/kl)	-49.24	-50.24	-47.24	-43.24

Refers Table B.1-3 to Table B.1-6

Table B.1-2 : Unit Cost for Rand Water Supply Area (RWSA) - Brits to Ga Rankuwa

Description	600mm	700mm	800mm	1000mm
Annualized Capital Cost	8,661	9,058	9,400	10,275
Re-current Cost	10,095	9535	9340	9208
Total Cost	18,756	18,593	18,740	19,483
Unit Cost (c/kl)	145.00	144.00	144.00	150.00
RW MC 1996/97 values	89.65	89.65	89.65	89.65
Unit Raw Water Cost (c/kl)	55.35	54.35	54.35	60.35
RW MC 1997 values (April-Sept. 98)	129.17	129.17	129.17	129.17
Unit Raw Water Cost (c/kl)	15.83	14.83	14.83	20.83
RW MC 1997 values (Oct 88-Mar 99)	155.07	155.07	155.07	155.07
Unit Raw Water Cost (c/kl)	-10.07	-11.07	-11.07	-5.07
RW MC 1997 values (April-Mar 2000)	165.24	165.24	165.24	165.24
Unit Raw Water Cost (c/kl)	-20.24	-21.24	-21.24	-15.24

Refers to Table B.1-7 to Table B.1-10

**Table B.1-3 : Calculation Table of Annualized Capital Cost -
Temba to Soshanguve 600mm diameter**

Rand Water Supply Area: Temba to Soshanguve Pipeline for 47Ml/Day - 0.6 m

Analysis period (Yr) 20
Discount Rate (%) 8 4.660957144 0.10185221
0.46319349

Base Cost (Initial) of Pipeline 22,481
Pump Station 5,762
Operation Cost: Energy cost 3,325

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	22,481			11		
Engineering services	3,372			0		
Total	25,853			11		
<i>2. Water Treatment Works</i>						
Base Cost	35,400					
Engineering services	5,310					
Total	40,710					
<i>3. Pump Station</i>						
Base cost						
Civil	3,745	0	0	237		
Mechanical	2,017	2,017	3,325	70		
Sub-total	5,762	2,017	3,325	307		
Engineering	864	0	0	0		
Total	6,626	2,017	3,325	307		
<i>4. Provisional and General (P&G)</i>						
Base cost	12,729					
Engineering services	1,909					
Total	14,638					
<i>5. Contingencies</i>	8,783					
<i>6. Raw Water Costs</i>	13782.34					
<i>7. Purification Costs</i>	13782.34				2,067	
Total Real Costs	96,610	2,017				
B. Annual Cost						
Pipeline	2,633	0	0	11		2,644
Water Treatment	4,146	0	0	0		4,146
Pump Station	675	95	3,325	307		4,402
P&G	1,491	0	0	0		1,491
Contingencies	895	0	0	0		895
Raw water charges					0	0
Purification costs					2,067	2,067
Total	9,840	95	3,325	318	2,067	15,646
Water Research Levy					263	263
Administration fee					114	1,390
Total Costs	9,840	95	3,325	318	2,445	16,023
Total unit cost (R/kl)						1.16

**Table B.1-4 : Calculation Table of Annualized Capital Cost -
Temba to Soshanguve 800mm diameter**

Rand Water Supply Area: Temba to Soshanguve Pipeline for 47Ml/Day - 0.8 m

Analysis period (Yr)	20		
Discount Rate (%)	8	4.660957144	0.10185221
			0.46319349
Base Cost (Initial) of Pipeline	30,430		
Pump Station	4,551		
Operation Cost: Energy cost	2,113		

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	30,430			15		
Engineering services	4,565			0		
Total	34,995			15		
<i>2. Water Treatment Works</i>						
Base Cost	35,400					
Engineering services	5,310					
Total	40,710					
<i>3. Pump Station</i>						
Base cost						
Civil	2,958	0	0	264		
Mechanical	1,593	1,593	2,113	55		
Sub-total	4,551	1,593	2,113	319		
Engineering	683	0	0	0		
Total	5,234	1,593	2,113	319		
<i>4. Provisional and General (P&G)</i>						
Base cost	14,076					
Engineering services	2,111					
Total	16,188					
<i>5. Contingencies</i>	9,713					
<i>6. Raw Water Costs</i>	13782.39					
<i>7. Purification costs</i>	13782.39				2,067	
Total Real Costs	106,838	1,593				
B. Annual Cost						
Pipeline	3,564	0	0	15		3,579
Water Treatment	4,146	0	0	0		4,146
Pump Station	533	75	2,113	319		3,040
P&G	1,649	0	0	0		1,649
Contingencies	989	0	0	0		989
Raw water charges					0	0
Purification costs					2,067	2,067
Total	10,882	75	2,113	334	2,067	15,471
Water Research Levy					263	263
Administration fee					90	90
Total Costs	10,882	75	2,113	334	2,421	15,825
Total unit cost (R/kl)						1.15

**Table B.1-5 : Calculation Table of Annualized Capital Cost -
Temba to Soshanguve 900mm diameter**

Rand Water Supply Area: Temba to Soshanguve Pipeline for 47Ml/Day - 0.9 m

Analysis period (Yr) 20

Discount Rate (%) 8

4.660957144 0.10185221

0.46319349

Base Cost (Initial) of Pipeline 34,405

Pump Station 4,369

Operation Cost: Energy cost 1,953

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	34,405			17		
Engineering services	5,161			0		
Total	39,566			17		
<i>2. Water Treatment Works</i>						
Base Cost	35,400					
Engineering services	5,310					
Total	40,710					
<i>3. Pump Station</i>						
Base cost						
Civil	2,840	0	0	278		
Mechanical	1,529	1,529	1,953	53		
Sub-total	4,369	1,529	1,953	331		
Engineering	655	0	0	0		
Total	5,024	1,529	1,953	331		
<i>4. Provisional and General (P&G)</i>						
Base cost	14,835					
Engineering services	2,225					
Total	17,060					
<i>5. Contingencies</i>	10,236					
<i>6. Raw Water Costs</i>	13,782					
<i>7. Purification Costs</i>	13,782				2,067	
Total Real Costs	112,596	1,529				
B. Annual Cost						
Pipeline	4,030	0	0	17		4,047
Water Treatment	4,146	0	0	0		4,146
Pump Station	512	72	1,953	331		2,868
P&G	1,738	0	0	0		1,738
Contingencies	1,043	0	0	0		1,043
Raw water charges					0	0
Purification costs					2,067	2,067
Sub-Total	11,468	72	1,953	348	2,067	15,909
Water Research Levy					263	263
Administration fee					87	87
Total Cost	11,468	72	1,953	348	2,418	16,259
Total unit cost (R/l)						1.18

**Table B.1-6 : Calculation Table of Annualized Capital Cost -
Temba to Soshanguve 1,000mm diameter**

Rand Water Supply Area: Temba to Soshanguve Pipeline for 47Ml/Day - 1.0 m

Analysis period (Yr) 20

Discount Rate (%) 8

4.660957144 0.10185221

0.46319349

Base Cost (Initial) of Pipeline 38,380

Pump Station 4,275

Operation Cost: Energy cost 1,873

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	38,380				19	
Engineering services	5,757				0	
Total	44,137				19	
<i>2. Water Treatment Works</i>						
Base Cost	35,400					
Engineering services	5,310					
Total	40,710					
<i>3. Pump Station</i>						
Base cost						
Civil	2,779	0	0		293	
Mechanical	1,496	1,496	1,873		52	
Sub-total	4,275	1,496	1,873		345	
Engineering	641	0	0		0	
Total	4,916	1,496	1,873		345	
<i>4. Provisional and General (P&G)</i>						
Base cost	15,611					
Engineering services	2,342					
Total	17,953					
<i>5. Contingencies</i>	10,772					
<i>6. Raw Water Costs</i>	13782.4					
<i>7. Purification costs</i>	13782.4				2,067	
Total Real Costs	118,487	1,496				
B. Annual Cost						
Pipeline	4,495	0	0		19	4,515
Water Treatment	4,146	0	0		0	4,146
Pump Station	501	71	1,873		345	2,789
P&G	1,829	0	0		0	1,829
Contingencies	1,097	0	0		0	1,097
Raw water charges					0	0
Purification costs					2,067	2,067
Total	12,068	71	1,873		364	16,443
Water Research Levy					263	263
Administration fee					86	86
Total Costs	12,068	71	1,873		2,417	16,793
Total unit cost (R/k)						1.22

**Table B.1-7 : Calculation Table of Annualized Capital Cost -
Brits to Ga Rankuwa 600mm diameter**

Rand Water Supply Area: Brits to Garankuwa Pipeline for 44Ml/Day - 0.6 m

Analysis period (Yr) 20
Discount Rate (%) 8 4.660957144 0.10185221
0.46319349

Base Cost (Initial) of Pipeline 17,344
Pump Station 4,848
Operation Cost: Energy cost 2,386

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	17,344			9		
Engineering services	2,602			0		
Total	19,946			9		
<i>2. Water Treatment Works</i>						
Base Cost	33,310					
Engineering services	4,997					
Total	38,307					
<i>3. Pump Station</i>						
Base cost						
Civil	3,151	0	0	207		
Mechanical	1,697	1,697	2,386	59		
Sub-total	4,848	1,697	2,386	266		
Engineering	727	0	0	0		
Total	5,575	1,697	2,386	266		
<i>4. Provisional and General (P&G)</i>						
Base cost	11,100					
Engineering services	1,665					
Total	12,765					
<i>5. Contingencies</i>	7,659					
<i>6. Raw Water Costs</i>	12968.593					
<i>7. Purification costs</i>	12968.593				6,046	
Total Real Costs	84,252	1,697				
B. Annual Cost						
Pipeline	2,032	0	0	9		2,040
Water Treatment	3,902	0	0	0		3,902
Pump Station	568	80	2,386	266		3,300
P&G	1,300	0	0	0		1,300
Contingencies	780	0	0	0		780
Raw water charges					0	0
Purification costs					6,046	6,046
Total	8,581	80	2,386	275	6,046	17,368
Water Research Levy					350	350
Administration fee					1,037	1,037
Total Costs	8,581	80	2,386	275	7,434	18,756
Total unit cost (R/kl)						1.45

**Table B.1-8 : Calculation Table of Annualized Capital Cost -
Brits to Ga Rankuwa 700mm diameter**

Rand Water Supply Area: Brits to Garankuwa Pipeline for 44Ml/Day - 0.7 m

Analysis period (Yr) 20

Discount Rate (%) 8

4.660957144 0.10185221

0.46319349

Base Cost (Initial) of Pipeline 20,582

Pump Station 4,238

Operation Cost: Energy cost 1,843

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
1. Pipeline						
Base Cost	20,582			10		
Engineering services	3,087			0		
Total	23,669			10		
2. Water Treatment Works						
Base Cost	33,310					
Engineering services	4,997					
Total	38,307					
3. Pump Station						
Base cost						
Civil	2,755	0	0	217		
Mechanical	1,483	1,483	1,843	51		
Sub-total	4,238	1,483	1,843	268		
Engineering	636	0	0	0		
Total	4,874	1,483	1,843	268		
4. Provisional and General (P&G)						
Base cost	11,626					
Engineering services	1,744					
Total	13,370					
5. Contingencies	8,022					
6. Raw Water Costs	12,968.59					
7. Purification costs	12,968.59				6,046	
Total Real Costs	88,241	1,483				
B. Annual Cost						
Pipeline	2,411	0	0	10		2,421
Water Treatment	3,902	0	0	0		3,902
Pump Station	496	70	1,843	268		2,677
P&G	1,362	0	0	0		1,362
Contingencies	817	0	0	0		817
Raw water charges					0	0
Purification costs					6,046	6,046
Total	8,988	70	1,843	278	6,046	17,225
Water Research Levy					350	350
Administration fee					1,037	1,037
Total Costs	8,988	70	1,843	278	7,434	18,612
Total unit cost (R/ld)						1.44

**Table B.1-9 : Calculation Table of Annualized Capital Cost -
Brits to Ga Rankuwa 800mm diameter**

Rand Water Supply Area: Brits to Garankuwa Pipeline for 44Ml/Day - 0.8 m

Analysis period (Yr) 20
Discount Rate (%) 8 4.660957144 0.10185221
0.46319349

Base Cost (Initial) of Pipeline 23,289
Pump Station 3,791
Operation Cost: Energy cost 1,622

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	23,289			12		
Engineering services	3,493			0		
Total	26,782			12		
<i>2. Water Treatment Works</i>						
Base Cost	33,310					
Engineering services	4,997					
Total	38,307					
<i>3. Pump Station</i>						
Base cost						
Civil	2,464	0	0	226		
Mechanical	1,327	1,327	1,622	46		
Sub-total	3,791	1,327	1,622	272		
Engineering	569	0	0	0		
Total	4,360	1,327	1,622	272		
<i>4. Provisional and General (P&G)</i>						
Base cost	12,078					
Engineering services	1,812					
Total	13,890					
<i>5. Contingencies</i>	8,334					
<i>6. Raw Water Costs</i>	12,968.60					
<i>7. Purification costs</i>	12,968.60				6,046	
Total Real Costs	91,672	1,327				
B. Annual Cost						
Pipeline	2,728	0	0	12		2,739
Water Treatment	3,902	0	0	0		3,902
Pump Station	444	63	1,622	272		2,401
P&G	1,415	0	0	0		1,415
Contingencies	849	0	0	0		849
Raw water charges					0	0
Purification costs					6,046	6,046
Total	9,337	63	1,622	284	6,046	17,351
Water Research Levy					350	350
Administration fee					1037	1,037
Total Costs	9,337	63	1,622	284	7,434	18,739
Total unit cost (R/kl)						1.44

**Table B.1-10 : Calculation Table of Annualized Capital Cost -
Brits to Ga Rankuwa 1,000mm diameter**

Rand Water Supply Area: Brits to Garankuwa Pipeline for 44MI/Day - 1.0 m

Analysis period (Yr)	20		
Discount Rate (%)	8	4.660957144	0.10185221
			0.46319349
Base Cost (Initial) of Pipeline	29,468		
Pump Station	3,325		
Operation Cost: Energy cost	1,471		

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	29,468			15		
Engineering services	4,420			0		
Total	33,888			15		
<i>2. Water Treatment Works</i>						
Base Cost	33,309					
Engineering services	4,996					
Total	38,305					
<i>3. Pump Station</i>						
Base cost						
Civil	2,161	0	0	248		
Mechanical	1,164	1,164	1,471	40		
Sub-total	3,325	1,164	1,471	288		
Engineering	499	0	0	0		
Total	3,824	1,164	1,471	288		
<i>4. Provisional and General (P&G)</i>						
Base cost	13,220					
Engineering services	1,983					
Total	15,203					
<i>5. Contingencies</i>	9,122					
<i>6. Raw Water Costs</i>	12,968.46					
<i>7. Purification costs</i>	12,968.46				6,046	
Total Real Costs	100,343	1,164				
B. Annual Cost						
Pipeline	3,452	0	0	15		3,466
Water Treatment	3,901	0	0	0		3,901
Pump Station	389	55	1,471	288		2,203
P&G	1,549	0	0	0		1,549
Contingencies	929	0	0	0		929
Raw water charges					0	0
Purification costs					6,046	6,046
Total	10,220	55	1,471	303	6,046	18,095
Water Research Levy					350	350
Administration fee					1,037	1,037
Total Costs	10,220	55	1,471	303	7,434	19,482
Total unit cost (R/l)						1.50

**Table B.1-11 : Unit Cost for Barnardsvlei Supply Area (BSA)
- Brits to Barnardsvlei East**

Description	600mm	800mm	1000mm	1200mm
Annualized Capital Cost	9,131	9,840	10,846	11,956
Re-current Cost	9,781	8818	8649	8627
Total Cost	18,912	18,658	19,495	20,583
Unit Cost (c/kl)	144.00	142.00	148.00	157.00
RW MC 1996/97 values	99.63	99.63	99.63	99.63
Unit Raw Water Cost (c/kl)	44.37	42.37	48.37	57.37
RW MC 1997 values (April-Sept. 98)	139.15	139.15	139.15	139.15
Unit Raw Water Cost (c/kl)	4.85	2.85	8.85	17.85
RW MC 1997 values (Oct 88-Mar 99)	165.05	165.05	165.05	165.05
Unit Raw Water Cost (c/kl)	-21.05	-23.05	-17.05	-8.05
RW MC 1997 values (April-Mar 2000)	175.22	175.22	175.22	175.22
Unit Raw Water Cost (c/kl)	-31.22	-33.22	-27.22	-18.22

**Table B.1-12 : Unit Cost for Barnardsvlei Supply Area (BSA)
- Vaalkop to Rustenberg**

Description	600mm	800mm	1000mm	1200mm
Annualized Capital Cost	11,423	13,259	15,255	17,281
Re-current Cost	8,057	6868	6679	6665
Total Cost	19,480	20,127	21,934	23,946
Unit Cost (c/kl)	167.00	172.00	188.00	205.00
RW MC 1996/97 values	99.63	99.63	99.63	99.63
Unit Raw Water Cost (c/kl)	67.37	72.37	88.37	105.37
RW MC 1997 values (April-Sept. 98)	139.15	139.15	139.15	139.15
Unit Raw Water Cost (c/kl)	27.85	32.85	48.85	65.85
RW MC 1997 values (Oct 88-Mar 99)	165.05	165.05	165.05	165.05
Unit Raw Water Cost (c/kl)	1.95	6.95	22.95	39.95
RW MC 1997 values (April-Mar 2000)	175.22	175.22	175.22	175.22
Unit Raw Water Cost (c/kl)	-8.22	-3.22	12.78	29.78

**Table B1-13 : Calculation Table of Annualized Capital Cost
- Brits to Barnardsvlei East 600mm diameter**

Barnardsvlei East: Brits to Barnardsvlei East Pipeline for 45ML/Day - 0.6 m

Analysis period (Yr)	20		
Discount Rate (%)	8	4.660957144	0.10185221
			0.46319349
Base Cost (Initial) of Pipeline	20,437		
Pump Station	4,376		
Operation Cost: Energy cost	1,960		

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	20,437			10		
Engineering services	3,066			0		
Total	23,503			10		
<i>2. Water Treatment Works</i>						
Base Cost	33,782					
Engineering services	5,067					
Total	38,849					
<i>3. Pump Station</i>						
Base cost						
Civil	2,844	0	0	219		
Mechanical	1,532	1,532	1,960	53		
Sub-total	4,376	1,532	1,960	272		
Engineering	656	0	0	0		
Total	5,032	1,532	1,960	272		
<i>4. Provisional and General (P&G)</i>						
Base cost	11,719					
Engineering services	1,758					
Total	13,477					
<i>5. Contingencies</i>	8,086					
<i>6. Raw Water Costs</i>	13,152					
<i>7. Purification costs</i>	13,152				6,131	
Total Real Costs	88,947	1,532				
B. Annual Cost						
Pipeline	2,394	0	0	10		2,404
Water Treatment	3,957	0	0	0		3,957
Pump Station	513	72	1,960	272		2,817
P&G	1,373	0	0	0		1,373
Contingencies	824	0	0	0		824
Raw water charges					0	0
Purification costs					6,131	6,131
Sub-Total	9,059	72	1,960	282	6,131	17,505
Water Research Levy					355	355
Administration fee					1052	1,052
Total Cost	9,059	72	1,960	282	7,539	18,912

**Table B.1-14 Calculation Table of Annualized Capital Cost
- Brits to Barnardsvlei East 800mm diameter**

Barnardsvlei East: Brits to Barnardsvlei East Pipeline for 45Ml/Day - 0.8 m

Analysis period (Yr) 20
Discount Rate (%) 8 4.660957144 0.10185221
0.46319349

Base Cost (Initial) of Pipeline 27,664
Pump Station 1,986
Operation Cost: Energy cost 1,002

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	27,664			14		
Engineering services	4,150			0		
Total	31,814			14		
<i>2. Water Treatment Works</i>						
Base Cost	33,782					
Engineering services	5,067					
Total	38,849					
<i>3. Pump Station</i>						
Base cost						
Civil	1,291	0	0	239		
Mechanical	695	695	1,002	24		
Sub-total	1,986	695	1,002	263		
Engineering	298	0	0	0		
Total	2,284	695	1,002	263		
<i>4. Provisional and General (P&G)</i>						
Base cost	12,686					
Engineering services	1,903					
Total	14,589					
<i>5. Contingencies</i>	8,754					
<i>6. Raw Water Costs</i>	13,152.55					
<i>7. Purification costs</i>	13,152.55				6,132	
Total Real Costs	96,290	695				
B. Annual Cost						
Pipeline	3,240	0	0	14		3,254
Water Treatment	3,957	0	0	0		3,957
Pump Station	233	33	1,002	263		1,530
P&G	1,486	0	0	0		1,486
Contingencies	892	0	0	0		892
Raw water charges					0	0
Purification costs					6,132	6,132
Total	9,807	33	1,002	277	6,132	17,251
Water Research Levy					355	355
Administration fee					1,052	1,052
Total Cost	9,807	33	1,002	277	7,539	18,658
Total unit cost (Rand/kl)						1.42

**Table B.1-15 Calculation Table of Annualized Capital Cost
- Brits to Barnardsvlei East 1,000mm diameter**

Barnardsvlei East: Brits to Barnardsvlei East Pipeline for 45MI/Day - 1.0 m

Analysis period (Yr) 20
Discount Rate (%) 8 4.660957144 0.10185221
0.46319349

Base Cost (Initial) of Pipeline 34,890
Pump Station 1,337
Operation Cost: Energy cost 812

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	34,890			17		
Engineering services	5,234			0		
Total	40,124			17		
<i>2. Water Treatment Works</i>						
Base Cost	33,782					
Engineering services	5,067					
Total	38,849					
<i>3. Pump Station</i>						
Base cost						
Civil	869	0	0	265		
Mechanical	468	468	812	16		
Sub-total	1,337	468	812	281		
Engineering	201	0	0	0		
Total	1,538	468	812	281		
<i>4. Provisional and General (P&G)</i>						
Base cost	14,002					
Engineering services	2,100					
Total	16,102					
<i>5. Contingencies</i>	9,661					
<i>6. Raw Water Costs</i>	13,152.55					
<i>7. Purification costs</i>	13,152.55				6,132	
Total Real Costs	106,274	468				
B. Annual Cost						
Pipeline	4,087	0	0	17		4,104
Water Treatment	3,957	0	0	0		3,957
Pump Station	157	22	812	281		1,272
P&G	1,640	0	0	0		1,640
Contingencies	984	0	0	0		984
Raw water charges					0	0
Purification costs					6,132	6,132
Total	10,824	22	812	298	6,132	18,088
Water Research Levy					355	355
Administration fee					1,052	1,052
Total Costs	10,824	22	812	298	7,539	19,496
Total unit cost (Rand/kl)						1.48

**Table B.1-16 Calculation Table of Annualized Capital
- Brits to Barnardsvlei East 1,200mm diameter**

Barnardsvlei East: Brits to Barnardsvlei East Pipeline for 45ML/Day - 1.2 m

Analysis period (Yr) 20
Discount Rate (%) 8 4.660957144 0.10185221
0.46319349

Base Cost (Initial) of Pipeline 42,117
Pump Station 1,297
Operation Cost: Energy cost 759

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	42,117			21		
Engineering services	6,318			0		
Total	48,435			21		
<i>2. Water Treatment Works</i>						
Base Cost	33,782					
Engineering services	5,067					
Total	38,849					
<i>3. Pump Station</i>						
Base cost						
Civil	843	0	0	292		
Mechanical	454	454	759	16		
Sub-total	1,297	454	759	308		
Engineering	195	0	0	0		
Total	1,492	454	759	308		
<i>4. Provisional and General (P&G)</i>						
Base cost	15,439					
Engineering services	2,316					
Total	17,755					
<i>5. Contingencies</i>	10,653					
<i>6. Raw Water Costs</i>	13,152.56					
<i>7. Purification costs</i>	13,152.56				6,132	
Total Real Costs	117,184	454				
B. Annual Cost						
Pipeline	4,933	0	0	21		4,954
Water Treatment	3,957	0	0	0		3,957
Pump Station	152	21	759	308		1,240
P&G	1,808	0	0	0		1,808
Contingencies	1,085	0	0	0		1,085
Raw water charges					0	0
Purification costs					6,132	6,132
Total	11,935	21	759	329	6,132	19,177
Water Research Levy					355	355
Administration fee					1,052	1,052
Total Costs	11,935	21	759	329	7,539	20,584
Total unit cost (Rand/kl)						1.57

**Table B.1-17 Calculation Table of Annualized Capital Cost
- Vaalkop tp Rustenburg 600mm diameter**

Barnardsvllei East: Vaalkop to Rustenburg Pipeline for 40Ml/Day - 0.6 m

Analysis period (Yr) 20

Discount Rate (%) 8

4.660957144 0.10185221

0.46319349

Base Cost (Initial) of Pipeline 37,330

Pump Station 5,917

Operation Cost: Energy cost 3,499

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	37,330				19	
Engineering services	5,600				0	
Total	42,930				19	
<i>2. Water Treatment Works</i>						
Base Cost	29,999					
Engineering services	4,500					
Total	34,499					
<i>3. Pump Station</i>						
Base cost						
Civil	3,846	0	0		273	
Mechanical	2,071	2,071	3,499		72	
Sub-total	5,917	2,071	3,499		345	
Engineering	888	0	0		0	
Total	6,805	2,071	3,499		345	
<i>4. Provisional and General (P&G)</i>						
Base cost	14,649					
Engineering services	2,197					
Total	16,847					
<i>5. Contingencies</i>	10,108					
<i>6. Raw Water Costs</i>	11,679.75					
<i>7. Purification costs</i>	11,679.75				2,803	
Total Real Costs	111,187	2,071				
B. Annual Cost						
Pipeline	4,372	0	0		19	4,391
Water Treatment	3,514	0	0		0	3,514
Pump Station	693	98	3,499		345	4,635
P&G	1,716	0	0		0	1,716
Contingencies	1,030	0	0		0	1,030
Raw water charges					0	0
Purification costs					2,803	2,803
Total	11,325	98	3,499		364	18,088
Water Research Levy					223	223
Administration fee					1,168	1,168
Total Costs	11,325	98	3,499		4,194	19,479
Total unit cost (Rand/kl)						1.67

**Table B.1-18 Calculation Table of Annualized Capital Cost
- Vaalkop tp Rustenburg 800mm diameter**

Barnardsvlei East: Vaalkop to Rustenburg Pipeline for 40Ml/Day - 0.8 m

Analysis period (Yr) 20
Discount Rate (%) 8
4.660957144 0.10185221
0.46319349

Base Cost (Initial) of Pipeline 50,530
Pump Station 4,726
Operation Cost: Energy cost 2,272

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	50,530			25		
Engineering services	7,580			0		
Total	58,110			25		
<i>2. Water Treatment Works</i>						
Base Cost	29,999					
Engineering services	4,500					
Total	34,499					
<i>3. Pump Station</i>						
Base cost						
Civil	3,072	0	0	320		
Mechanical	1,654	1,654	2,272	57		
Sub-total	4,726	1,654	2,272	377		
Engineering	709	0	0	0		
Total	5,435	1,654	2,272	377		
<i>4. Provisional and General (P&G)</i>						
Base cost	17,051					
Engineering services	2,558					
Total	19,609					
<i>5. Contingencies</i>	11,765					
<i>6. Raw Water Costs</i>	11,679.98					
<i>7. Purification costs</i>	11,679.98				2,803	
Total Real Costs	129,417	1,654				
B. Annual Cost						
Pipeline	5,919	0	0	25		5,944
Water Treatment	3,514	0	0	0		3,514
Pump Station	554	78	2,272	377		3,281
P&G	1,997	0	0	0		1,997
Contingencies	1,198	0	0	0		1,198
Raw water charges					0	0
Purification costs					2,803	2,803
Total	13,181	78	2,272	402	2,803	18,737
Water Research Levy					223	223
Administration fee					1,168	1,168
Total Costs	13,181	78	2,272	402	4,194	20,128
Total unit cost (Rand/d)						1.72

**Table B.1-19 Calculation Table of Annualized Capital Cost
- Vaalkop to Rustenburg 1,000mm diameter**

Barnardsvlle East: Vaalkop to Rustenburg Pipeline for 40MI/Day - 1.0 m

Analysis period (Yr) 20
Discount Rate (%) 8 4.660957144 0.10185221
0.46319349

Base Cost (Initial) of Pipeline 63,730
Pump Station 4,456
Operation Cost: Energy cost 2,029

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	63,730			32		
Engineering services	9,560			0		
Total	73,290			32		
<i>2. Water Treatment Works</i>						
Base Cost	30,001					
Engineering services	4,500					
Total	34,501					
<i>3. Pump Station</i>						
Base cost						
Civil	2,896	0	0	370		
Mechanical	1,560	1,560	2,029	54		
Sub-total	4,456	1,560	2,029	424		
Engineering	668	0	0	0		
Total	5,124	1,560	2,029	424		
<i>4. Provisional and General (P&G)</i>						
Base cost	19,637					
Engineering services	2,946					
Total	22,583					
<i>5. Contingencies</i>	13,550					
<i>6. Raw Water Costs</i>	11,680.25					
<i>7. Purification costs</i>	11,680.25				2,803	
Total Real Costs	149,048	1,560				
B. Annual Cost						
Pipeline	7,465	0	0	32		7,497
Water Treatment	3,514	0	0	0		3,514
Pump Station	522	74	2,029	424		3,049
P&G	2,300	0	0	0		2,300
Contingencies	1,380	0	0	0		1,380
Raw water charges					0	0
Purification costs					2,803	2,803
Total	15,181	74	2,029	456	2,803	20,543
Water Research Levy					223	223
Administration fee					1,168	1,168
Total Costs	15,181	74	2,029	456	4,194	21,934
Total unit cost (Rand/kl)						1.88

**Table B.1-20 Calculation Table of Annualized Capital Cost
- Vaalkop tp Rustenburg 1,200mm diameter**

Barnardsvlle East: Vaalkop to Rustenburg Pipeline for 40Ml/Day - 1.2 m

Analysis period (Yr) 20

Discount Rate (%) 8

4.660957144 0.10185221

0.46319349

Base Cost (Initial) of Pipeline 76,930

Pump Station 4,377

Operation Cost: Energy cost 1,961

Investment Groups	Capital Cost (R000's)		Re-current Cost (R000's)			Total (R000's)
	Initial	Replacement	Operation	Maintenance	Raw Water	
A. Real Cost						
<i>1. Pipeline</i>						
Base Cost	76,930				38	
Engineering services	11,540				0	
Total	88,470				38	
<i>2. Water Treatment Works</i>						
Base Cost	30,000					
Engineering services	4,500					
Total	34,500					
<i>3. Pump Station</i>						
Base cost						
Civil	2,845	0	0		419	
Mechanical	1,532	1,532	1,961		53	
Sub-total	4,377	1,532	1,961		472	
Engineering	657	0	0		0	
Total	5,034	1,532	1,961		472	
<i>4. Provisional and General (P&G)</i>						
Base cost	22,261					
Engineering services	3,339					
Total	25,601					
<i>5. Contingencies</i>	15,360					
<i>6. Raw Water Costs</i>	11,680.00					
<i>7. Purification costs</i>	11,680.00				2,803	
Total Real Costs	168,964	1,532				
B. Annual Cost						
Pipeline	9,011	0	0		38	9,049
Water Treatment	3,514	0	0		0	3,514
Pump Station	513	72	1,961		472	3,018
P&G	2,607	0	0		0	2,607
Contingencies	1,564	0	0		0	1,564
Raw water charges					0	0
Purification costs					2,803	2,803
Total	17,209	72	1,961		510	22,556
Water Research Levy					223	223
Administration fee					1,168	1,168
Total Costs	17,209	72	1,961		4,194	23,947
Total unit cost (Rand/kl)						2.05

DEPARTMENT OF WATER AFFAIRS AND FORESTRY

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FUTURE TREND OF AND OTHER INFORMATION REGARDING VAAL RIVER TARIFF

It has become painfully clear, from recent financial modelling undertaken for the Vaal River System, that the present level of the TCTA levy and consequently the total Vaal River tariff, is too low to provide for the cost requirements of the present Vaal River System schemes, the Lesotho Highlands Water Project Phase 1A and future augmentation schemes for the Vaal River System, the expected costs of which should also be taken into account in the Vaal River water price.

Indications from this financial modelling pointed to a required current Vaal River water price in the vicinity of R 1,14 per kl, and this is the target which was aimed at during the most recent round of tariff setting for the Vaal River System. It was of course realised within the Department of Water Affairs and Forestry that this price level could not realistically be reached in one large leap, and so it was decided to move there over a two-year period, which explains the level of R 0,86 per kl which will be reached in October this year.

According to our present insights, therefore, the Vaal River raw water tariff should arrive at R 1,14 per kl (in constant real terms) on 1 October 1997. It is important to notice the rider "in constant real terms" in the previous sentence. This means that the unit cost of Vaal River raw water has been calculated to be constant at R 1,14 per kl in 1997 price terms. The implication of this for the tariff in future price terms is that it should rise annually by only inflation if further studies show that the level of R 1,14 per kl in real terms remains relevant.

The expected trend in Vaal River tariffs for the following five years, if an inflation rate of 10% per annum is assumed, could therefore look as follows:

From 1 April 1998 to 30 September 1998: R 0,95 per kl (R 0,86 per kl plus inflation);

From 1 October 1998 to 31 March 1999: R 1,25 per kl (R 1,14 per kl plus inflation);

From 1 April 1999 to 31 March 2000: R 1,38 per kl;

From 1 April 2000 to 31 March 2001: R 1,52 per kl;

From 1 April 2001 to 31 March 2002: R 1,67 per kl;

From 1 April 2002 to 31 March 2003: R 1,84 per kl.

It is important to notice that these are just *expected* values, and at this stage no guarantee can be given that they will materialise.

A second important aspect of the projected Vaal River tariffs to notice is that no mention is made of the TCTA levy from 1998 onwards. That is because the TCTA levy will become redundant early in 1998, when the first water from the Lesotho Highlands Water Project is expected to reach the Vaal River System. There will then be no longer any need for the levy, and the LHWP costs will just be part of the total Vaal River tariff.

A third aspect to notice is that after 1998, the tradition of changing the Vaal River tariff twice a year, during April and October, will also fall away since all charges will then form part of the single Vaal River water unit cost. You will notice that only one change in the expected Vaal River tariff in 1999 and later is indicated, and logically, this will occur on 1 April of each year (the start of the Department's financial year).

I trust that this information will be of some help to you in your work.

Paul van der Merwe

JICA