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DEPARTMENT OF WATER AFFAIRS
AND FORESTRY

in association with

UMGENI WATER
Corporate Services Division

MKOMAZI/MOOI-MGENI TRANSFER SCHEME PRE-FEASIBILITY STUDY

MKOMAZI-MGENI TRANSFER SCHEME

SUPPORTING REPORT No 7

ECONOMICS

VOLUME 1

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MKOMAZI / MOOI-MGENI TRANSFER SCHEME PRE-FEASIBILITY STUDY

PREFACE

In January 1997, the Department of Water Affairs & Forestry: Directorate of Project Planning, in conjunction with Umgeni Water: Corporate Services Division, invited various firms of consulting engineers to submit proposals to undertake a Pre-Feasibility Study for a scheme to transfer water from the upper Mkomazi River to the Mgeni System. In July 1997, a multi-disciplinary team led by Ninham Shand was appointed.

This Study follows on from the Mgeni River System Analysis Study carried out between 1991 and 1994, in which the Mkomazi River was identified as a potentially viable source of water for augmentation of the Mgeni System, and the Mooi-Mgeni Transfer Feasibility Study carried out in 1995, in which the first phase scheme to augment the Mgeni System from the Mooi River was investigated in detail and possible second phase schemes were identified.

This Study comprises two distinct parts; a pre-feasibility investigation of augmentation schemes on the Mkomazi River preceded by scheme identification and reconnaissance investigations, and a pre-feasibility investigation of second phase transfer schemes from the Mooi River. A comparison of the two main augmentation options is made at the culmination of the Study. The report structure is given overleaf.

Sub-consultants employed by Ninham Shand to undertake various aspects of the Study included:

- IWR Environmental: Environmental studies and IEM co-ordination
- Scott Wilson: Social studies
- Keeve Steyn: Engineering aspects of tunnels and pumpstations, and involvement with Basin Studies
- Simmer Biggar and Associates: Infrastructure aspects.

As part of the Study Team, the following Client departments were involved:

- Council for Geoscience: Geological Survey
- Department of Water Affairs & Forestry: Project Planning (East)
- Department of Water Affairs & Forestry: Environment Studies
- Department of Water Affairs & Forestry: Hydrology
- Umgeni Water: Corporate Services Division: Water Resources Planning
- Umgeni Water: Scientific Services Division: Water Quality
- Umgeni Water: Scientific Services Division: Hydro-biology.

EXECUTIVE SUMMARY

This Report describes two distinct economic components of the Study, firstly the socio-economic impact of non-augmentation, a separate reconnaissance level study commissioned by Umgeni Water, and secondly the pre-feasibility level economic comparison of the two schemes identified for further investigation during the reconnaissance phase of this Study.

Non-Augmentation Option (Reconnaissance Level Study)

In the evaluation of the socio-economic impacts of non-augmentation, carried out by Graham Muller Associates, two scenarios were evaluated. In the first, unconstrained growth was assumed until water becomes a constraint to further growth, that is until demands in the Mgeni System exceed the system yield with augmentation from the Mooi River, whereafter no further growth in demand would be permitted. In the second, it was assumed that the Mkomazi-Mgeni Transfer Scheme would be commissioned when required and that unconstrained growth is permitted until the limit of the total system yield, including the Mkomazi, is reached.

The specific indicators used to measure the socio-economic impacts were Gross Geographic product (GGP), which was found historically to follow the pattern of water demand, and formal employment. The impacts were assessed over a 40 year time frame from 1998.

Data was obtained from a variety of sources: Water demand projections assuming effective demand management in the Durban Metro area were provided by Umgeni Water; system and scheme yields were provided by BKS; GGP and employment base data was extracted from a DBSA report and projected using figures developed by Data Research Africa; population figures were provided by Scott Wilson; and GGP and employment multipliers were obtained from a DWAF manual.

The evaluation of the non-augmentation scenario showed a dramatic impact on GGP and formal employment. The projected GGP in the study area in 2038 for constrained conditions is less than half of that for unconstrained conditions, with the cumulative difference over the analysis period being 27%. Even with a 20% increase in water productivity, the cumulative GGP in the study area is still 21% below the unconstrained equivalent. Non-augmentation would also result in a cumulative loss of 3,3 million potential new jobs in the study area by 2038.

The evaluation of the augmentation scenario showed a similarly dramatic difference in cumulative GGP within the study area of 26% compared to base (constrained) conditions. This is mainly as a result of the growth which occurs as a result of unconstrained water supply, the contribution of the construction and operation of the scheme being negligible. Potential employment levels are 34% higher within the study area than in the case of the base condition.

The consequences of water demand management targets in the Durban Metro area not being met and the impacts of a delay in implementation were also evaluated. It was found that even if losses are reduced to 20% instead of the 15% target incorporated in the evaluations, deficits will occur which may constrain economic growth. Similarly, a delay in augmentation in excess of two years beyond when it is required will result in constrained economic development and employment.

On the basis of the above analysis, it can be concluded that without augmentation, economic growth and employment, both within the study area and in the Province as a whole, will be very severely constrained. Other alternatives, such as the relocation of industry and population, would not be viable and it is therefore recommended that the proposed augmentation scheme proceed as planned.

Economic Comparison of Schemes (Pre-feasibility Level Study)

In this task, the two schemes selected for further study in the reconnaissance phase of this Study, namely the Impendle and Smithfield Schemes, were compared at pre-feasibility level with a view to identifying the most economical alternative. Three configurations of each scheme were evaluated, using their Unit Reference Values (URV's) as the main parameter for comparison. Discount rates of 6, 8 and 10% were assessed and analyses were carried out over a 50 year period. The sensitivity to various parameters, including length of analysis period, catchment development conditions and water demands, was also assessed.

It was found that for all scenario's and parameters assessed, the Smithfield Scheme has a lower URV than the Impendle Scheme. This can largely be attributed to the 20% greater yield of the Smithfield Scheme, as the costs of the two schemes are similar. For the "most likely" scenario, with a discount rate of 8%, the Smithfield Scheme has a URV 11% lower than the Impendle Scheme. Whilst this is a relatively small difference upon which to justify the elimination of a scheme at this (pre-feasibility) level of study detail, it should be noted that approximately 85% of the scheme costs are made up of cost components which are common to both schemes. It would therefore require a 60% change in the costs of the non-common components to make the Impendle Scheme more economical than the Smithfield Scheme.

The variation in URV between the different configurations within each scheme were very small and no clear preference could be identified.

In order to better assess the significance of the differences in URV between the two schemes, the Net Present Value (NPV) of the total additional cost of supply for the duration of the analysis period was determined. This amounts to approximately R140 million. It should also be noted that in the case of the Impendle Scheme, a further augmentation scheme will be required three years

earlier than the Smithfield Scheme. Assuming similar costs to the first phase Mkomazi schemes, this represents an additional cost with an NPV of approximately R40 million.

It is therefore recommended that on the basis of the economic analysis, the Impendle Scheme should be eliminated from further study and that the Smithfield Scheme be taken forward to the feasibility phase of planning. However, the preferred configuration of the Smithfield Scheme could not be determined and it is recommended that the optimisation of the scheme components, as well as determining the desirability or otherwise of the raising of Impendle Dam, be carried out during the feasibility study.

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MKOMAZI-MGENI TRANSFER SCHEME PRE-FEASIBILITY STUDY

SUPPORTING REPORT NO 7: ECONOMICS

VOLUME 1

1. INTRODUCTION

This report describes the two economic components of the Study, firstly the socio-economic impacts of non-augmentation, as described in the report by Graham Muller Associates included in Appendix A (Umgeni Water, 1998), and secondly the economic comparison of the two schemes identified for further investigation during the reconnaissance phase of this Study, in order to identify the preferred scheme for the next phase of planning.

In the first section of this report, the Graham Muller Associates report, which was produced under a separate appointment from Umgeni Water, is summarised. Their reconnaissance level report was produced as a stand alone report for wider distribution, but provides valuable background for this Study specifically.

In the second section of this report, the economic evaluation of the two schemes selected for further investigation during the reconnaissance phase of the Study (see Supporting Report No 1: Reconnaissance Investigations) is described in detail. The sources of data, methodology, assumptions and results are all addressed and conclusions and recommendations on the preferred scheme to be evaluated in the feasibility study are made.

2. SOCIO-ECONOMIC CONSEQUENCES OF NON-AUGMENTATION

2.1 Background

During the early stages of the Mkomazi-Mgeni Transfer Scheme Pre-feasibility Study, concern was expressed by environmental groups as to whether augmentation of the Mgeni System was necessary at all if appropriate measures were implemented to manage water demand through loss control and generally more efficient use of water. Against this background, Umgeni Water appointed Graham Muller Associates to assess, at reconnaissance level, the socio-economic consequences of the non-augmentation option and to determine whether or not improved water demand management represents a viable alternative to augmentation of the Mgeni System.

2.2 Scope of the Study

The area covered by this Study extends westwards from Durban, through Pietermaritzburg towards Mooi River, representing those areas which are dependent on the Mgeni River system for their water supply.

Utilising engineering aspects of the proposed augmentation scheme developed during the reconnaissance phase of the main Study (see Supporting Report No 1: Reconnaissance Investigations), two alternative scenarios were evaluated:

- **Non-Augmentation Scenario**
  Unconstrained economic growth occurs until water becomes a constraint to further growth. The proposed Mkomazi-Mgeni Transfer Scheme is not commissioned but water demand management is implemented.

- **Augmentation Scenario**
  The Mkomazi-Mgeni Transfer Scheme is commissioned when required, water demand management is implemented and unconstrained economic growth is permitted within the Study area.

The specific indicators used to measure the socio-economic impacts were gross geographic product (GGP) and formal employment. The impacts were assessed over a 40 year time frame from 1998.

2.3 Data and Assumptions

For the purposes of this Study, it was assumed that the Impendle Scheme would be implemented. The economic characteristics of the other scheme selected for further investigation during the reconnaissance phase, the Smithfield Scheme, are similar and scheme selection would therefore not materially affect the findings of this Study.

A fundamental assumption of this Study, substantiated by historical data, was that the pattern of water demand closely follows that of economic output within the Study area.

Water demand projections were provided by Umgeni Water, assuming effective demand management, as represented by the low road scenario in Supporting Report No 2: Water Demands. System yields were based on 1 in 100 assurance levels in the Mgeni System, augmented by the transfers from the Mooi River, and on the historical firm yield of the Impendle Scheme. In the case of the non-augmentation scenario (Scenario One), it was assumed that two phases of the Mooi-Mgeni Transfer Scheme

would be implemented, but not the Impendle Scheme, while in the case of the augmentation scenario (Scenario Two), both the Mooi-Mgeni Transfer Scheme and the Impendle Scheme would be implemented.

GGP and formal employment base data was obtained from a 1995 DBSA report and projected using growth rates obtained from a 1995 report produced by Data Research Africa for Eskom. Population figures were provided by Scott Wilson and GGP and employment multipliers were obtained from a Department of Water Affairs and Forestry (DWAF) manual prepared by Conningarth Consultants.

2.4 Results

2.4.1 Scenario One

Using the yield and demand assumptions described above, with the Mgeni System, augmented by transfers from the Mooi River, but without augmentation from the Mkomazi, it was found that water supply will begin to constrain economic growth from 2010 onwards. The impact on GGP in the Study area is given in **Table 2.1** below.

TABLE 2.1: PROJECTED GGP IN STUDY AREA

GGP at constant 1997 prices (R'000 000)	1998	2018	2038	Sum of projected GGP for 1998-2038
Unconstrained growth projections (Assuming water supply is unconstrained for entire period)	52 856	85 975	145 878	3 713 965
Constrained growth projections (Assuming water supply is constrained after 2009)	52 856	68 753	68 753	2 719 117
Difference (%)	0	20	53	27

As can be seen, the projected GGP in 2038 for constrained conditions is less than half of that for unconstrained conditions. The impact on per capita GGP is similar.

The above figures do not allow for any improvement in water productivity (more efficient use of water, i.e. greater GGP/m^3 of water consumed). A further analysis was therefore carried out assuming 10, 15 and 20% improvements in water productivity. Even with the 20 % improvement in water productivity, which is probably not practically achievable, the cumulative GGP is still 21% below the unconstrained equivalent.

The impact on formal employment of constrained development is also very significant. Non-Augmentation would result in a cumulative loss of 3,3 million potential new jobs in the Study area by 2038, and 5,0 million in KwaZulu-Natal as a whole.

2.4.2 Scenario Two

Scenario two is based on the assumption that augmentation from the Mkomazi does occur after the Mooi River development, thus growth remains unconstrained until 2025, when the full yield of the Mkomazi scheme will be utilised. The analysis was divided into three components, namely a determination of impact on GGP and employment of the capital expenditure on the construction of the scheme itself, the impact of its operating expenditure and the impact of the unconstrained water supply. Results are summarised in **Table 2.2** below.

TABLE 2.2: PROJECTED GGP IN STUDY AREA

GGP at constant 1997 prices (R'000 000)	2008	2018	2038	Sum of projected GGP for 1998-2038
Base case (non-augmentation) scenario	67 099	68 753	68 753	2 719 117
Base growth projections before construction and operational effects	67 099	85 975	102 898	3 432 021
Construction effect on GGP	130	66	0	854
Operational effect on GGP	0	28	6	600
Total impact of augmentation expenditure on GGP	130	94	6	1 454
Projected GGP after augmentation	67 229	86 068	102 904	3 433 474
Difference (%)	0	25	50	26

As can be seen from the above, the impact of the construction and operational expenditure is negligible and the greatest impact is as a result of the growth which occurs with the unconstrained water supply. The overall impact of the augmentation scheme is a 26% higher cumulative GGP than the non-augmentation case. The impact on per capita GGP is similar.

As in the case of the base case scenario, the impact of improved water productivity was assessed. It was found that a 10% increase in water productivity after the augmentation scheme reaches the limit of its yield in 2025 will increase the cumulative GGP by 4%.

The construction and operational effect on formal employment is negligible, but with the lifting of the water supply constraint until 2025, the potential level of employment is 34% higher in the Study area than the base case scenario and 32% higher in KwaZulu-Natal as a whole.

2.4.3 Sensitivity analysis

Two sensitivity analyses were carried out. In the first, the consequences of loss control targets in the Durban Metro area not being achieved, were assessed. It was found that even with losses reduced to 20%, instead of the target 15%, the deficits which result may result in constraint of economic growth.

In the second, the impacts of a delay in implementation of the augmentation scheme was assessed. It was found that a delay in excess of two years will result in a constraint on GGP and related growth in formal employment.

2.5 Conclusions and Recommendations

Based on the above analyses, it can be concluded that without augmentation, economic growth, measured as GGP, and employment both within the Study area and in KwaZulu-Natal as a whole, will be severely constrained.

The benefits of augmentation would be largely as a result of the unconstrained water supply, with the direct socio-economic benefits attributable to the construction and operation of the scheme being insignificant, due to its capital intensive nature.

Improved water demand management was found not to be a viable alternative to augmentation. An increase in water use productivity of 10% results in a 7% increase in cumulative GGP, compared to the 26% increase projected with the augmentation scenario. Restrictions on forestry and irrigation would also not have a significant effect, as these demands amount to only 19% of the total system demand, compared to the 49% of domestic and industrial demands.

The only other alternative would be to embark on a population and industrial relocation programme. However, there are probably no regions better endowed with water resources than the Study area and it can be concluded that such a programme would not be viable.

The recommendation of the Study was that the augmentation scheme should proceed on a phased basis, but that a fully researched demand model be set up and maintained to allow implementation planning on the basis of more refined scenario forecasts and updates.

3. ECONOMIC COMPARISON OF SCHEMES

3.1 Background

During the reconnaissance phase of the Study (see Supporting Report No. 1: Reconnaissance Investigations), two basic schemes were selected for further investigation, namely the Impendle Scheme and the Smithfield Scheme, referred to as Scheme 1 and Scheme 2 respectively in this report. These were refined at pre-feasibility level and cost estimates were prepared (see Supporting Report No 6: Engineering Design and Costing) and their yields were determined (see Supporting Report No 4: Hydrology and Water Resources). Three possible configurations of each scheme were investigated. These configurations are given in **Table 3.1** overleaf.

For the purposes of identifying the preferred scheme and configuration from an economic perspective, the Unit Reference Value (URV) was determined for each configuration. In addition, the sensitivity to a variety of parameters assumed in the economic analysis was evaluated.

TABLE 3.1: SCHEME CONFIGURATIONS FOR ECONOMIC ANALYSIS

SCHEME	DESCRIPTION		
	Phase 1	**Phase 2**	**Phase 3**
1: Impendle Scheme			
1A	1,0 MAR capacity Impendle Dam, with provision for raising Impendle tunnel and other treatment and conveyance infrastructure	Additional treatment and conveyance infrastructure	Impendle Dam raised to 1,5 MAR capacity
1B	1,0 MAR capacity Impendle Dam, without provision for raising Impendle tunnel and other treatment and conveyance infrastructure	Additional treatment and conveyance infrastructure	
1C	1,5 MAR capacity Impendle Dam, Impendle tunnel and other treatment and conveyance infrastructure	Additional treatment and conveyance infrastructure	
2: Smithfield Scheme			
2A	Smithfield Dam Smithfield Tunnel and other treatment and conveyance infrastructure	1,0 MAR capacity Impendle Dam, with provision for raising Additional treatment and conveyance infrastructure	Impendle Dam raised to 1,5 MAR capacity
2B	Smithfield Dam Smithfield Tunnel and other treatment and conveyance infrastructure	1,0 MAR capacity Impendle Dam, without provision for raising	Additional treatment and conveyance infrastructure
2C	Smithfield Dam Smithfield Tunnel and other treatment and conveyance infrastructure	1,5 MAR capacity Impendle Dam Additional treatment and conveyance infrastructure	Additional conveyance infrastructure

3.2 Approach and Methodology

3.2.1 General

The two selected schemes have different yields, that is they will deliver different volumes of water to the Mgeni System during their operational lives. For this reason, a simple comparison of actual or discounted capital and running costs will not necessarily indicate the preferable scheme from an economic perspective. It was therefore necessary to utilise a method of comparison which takes scheme yields into account, this being the Unit Reference Value (URV), which is simply the total Net Present Value (NPV) of all costs, both capital and running, for the selected analysis period, divided by the total NPV of water delivered during the same period. This yields a unit cost in cents per m^3 and the schemes can be compared on an equitable basis.

The economic model utilised calculates in annual time steps and a 50 year analysis period was assumed. Analyses were carried out at discount rates of 6, 8 and 10%, as required by the Terms of Reference, which is in line with current Government policy favouring deferment of capital expenditure, where possible. Capital intensive schemes would be less favourable with the higher discount rate, while energy intensive schemes with a lower capital cost would be less favourable with a lower discount rate. For the purposes of comparison, a discount rate of 8% was generally assumed to be most realistic.

Capital and running costs, as well as construction programmes, described in Supporting Report No 6: Engineering Design and Costing, were adapted to a format compatible with the input requirements of the economic model used. Details of the derivation of the model input are provided in Appendix B. Water demand figures were extracted from Supporting Report No 2: Mgeni System Water Demands and scheme yields, based on 99% assurance long term stochastic Mkomazi system yields, were extracted from Supporting Report No 4: Hydrology and Water Resources. These are also provided in summarised form in Appendix B. The commissioning dates of the various phases of the schemes were selected to coincide with the year when demands begin to exceed the total yield of the Mgeni System, augmented by the Mooi, and where applicable, the Mkomazi Transfer Scheme.

3.2.2 Primary comparison

The first stage of economic comparison involved the determination of the URV's of each of the six possible scheme configurations, assuming the most likely set of data and parameters, namely middle road water demands and system yields with middle road future Mkomazi catchment development conditions (See Supporting Report No 3: Reconnaissance Basin Study). It should be noted that the transfer capacities of all schemes were sized to handle the 1 in 100 year stochastic yield, with a peak factor of 1,25, assuming present day catchment development conditions, but for the purposes of the economic analysis, the 1 in 100 year yield assuming future catchment development conditions was used. This would allow a degree of flexibility in the event of the catchment not developing to the extent projected.

In the case of the Impendle Scheme, there is some doubt as to whether the proposed Stuckenberg Tunnel would be implemented as part of the Mkomazi-Mgeni Transfer Scheme, or as part of an earlier augmentation scheme. The scheme was therefore evaluated both including and excluding the tunnel costs.

3.2.3 Sensitivity analyses

In the primary comparison, the most economical configuration for each of the Impendle and Smithfield Schemes was determined. These configurations were then subjected to a further set of analyses to assess their sensitivity to a number of variables, as follows:

- Yields assuming present day catchment development conditions were used instead of yields assuming future conditions
- Low and high road demands were assumed instead of the middle road demand scenario.
- An analysis period of 25 years was assumed instead of 50 years.

3.3 Results

3.3.1 Primary Comparison

The results of the primary comparison are given in Appendix C and summarised in **Table 3.2** overleaf. Note that the figures given for the Impendle Scheme include the Stuckenberg Tunnel.

TABLE 3.2: PRIMARY ECONOMIC COMPARISON

Scheme	Capital Cost (R million)				Annual Running Costs ® million)	Unit Reference Value (c/m^3) @ Discount Rates		
	Phase 1	Phase 2	Phase 3	Total		6%	8%	10%
1A: Impendle (raised) (Commissioning date) *Yield (mcm)*	R 1 800 (2008) *157*	R 682 (2015) *119*	R 130 (2021) 38	R 2 611 *313*	R 16	83	114	152
1B: Impendle (1 MAR) (Commissioning date) *Yield (mcm)*	R 1 744 (2008) *138*	R 638 (2015) *138*		R 2 382 *275*	R 14	84	116	154
1C: Impendle (1,5 MAR) (Commissioning date) *Yield (mcm)*	R 1 870 (2008) *157*	R 682 (2015) *157*		R 2 551 *313*	R 16	83	115	154
2A: Smithfield (Impendle raised) (Commissioning date) *Yield (mcm)*	R 1 503 (2008) *147*	R 1035 (2015) *188*	R 130 (2023) *41*	R 2 667 *376*	R 25	75	103	138
2B: Smithfield (Impendle 1 MAR) (Commissioning date) *Yield (mcm)*	R 1 541 (2008) *147*	R 372 (2015) *21*	R 547 (2016) *168*	R 2 460 *335*	R 22	76	103	137
2C: Smithfield (Impendle 1,5 MAR) (Commissioning date) *Yield (mcm)*	R 1 573 (2008) *147*	R 455 (2015) *41*	R 580 (2017) *188*	R 2 607 *376*	R 25	74	102	135

Note:
1. All costs are based on June 1998 base date.
2. Costs exclude VAT.
3. Running costs and URV's given are for all phases of schemes.
4. Yields given are 1 in 100 year incremental scheme yields for future catchment development conditions.
5. In Scheme 2a, it is assumed that Impendle Dam is raised from 1 to 1,5 MAR capacity in the third phase.

As can be seen from the above, all of the Smithfield configurations for all discount rates have URV's less than those of the Impendle Scheme. The most economical Smithfield scheme (Scheme 2C) has a URV 11% lower than the most economical Impendle scheme (Scheme 1A). The costs of the schemes are very similar and the differences in URV can largely be attributed to the greater yield of the Smithfield Scheme.

Whilst this is a relatively small difference upon which to base a decision at pre-feasibility stage of planning, the schemes have a number of common components, with the common components listed in **Table 3.3**, amounting to only 15% and 16% in the case of the Impendle and Smithfield Schemes respectively. Assuming that other variables remain unchanged, it would require changes in the costs of the non-common components in the order of 60% to make the Impendle Scheme more economical than the Smithfield Scheme.

TABLE 3.3: ANALYSIS OF NON-COMMON SCHEME COMPONENTS

SCHEME	COMPONENT	COST (R MILLION)
Impendle (Scheme 1A)	Additional tunnel costs	137
	Midmar outlet modification	6
	Additional pipeline costs	190
	Modification to reservoir inlet	2
	TOTAL	335
	% OF TOTAL CAPITAL COST	15%
Smithfield (Scheme 2C)	Smithfield Dam	222
	Balancing Dam	6
	Additional pumpstation costs	49
	Additional waterworks costs	90
	Advance infrastructure	14
	TOTAL	381
	% OF TOTAL CAPITAL COST	16%

The capital cost of the Stuckenberg Tunnel amounts to only 2% of the total capital cost of Phase 1 of the cheapest Impendle Scheme. The URV's of Schemes 1A, 1B, and 1C at a discount rate of 8% are therefore only marginally lower with this tunnel excluded, at 111, 113 and 112 c/m^3 respectively. This does not materially affect the findings of the primary analysis.

In the case of the Impendle Scheme, the 1,5 MAR raised option (Scheme 1A) has the lowest URV of the three configurations, although only by a very small margin, while the Smithfield Scheme with the 1,5 MAR Impendle Dam implemented in a single phase (Scheme 2C) has the lowest URV, also by a small margin. For the purposes of the sensitivity analyses described in Section 3.3.2 below, Schemes 1A and 2C were selected.

Whilst the difference in URV between the Impendle and Smithfield Schemes is relatively small, the overall difference in cost of supply over the lifetimes of the schemes is significant. The NPV of this total additional cost of supply was determined by multiplying the difference in URV between Schemes 1A and 2C by the NPV of the total volume of water delivered during the 50 year analysis period. This amounts to approximately R140 million in 1998 prices, assuming an 8% discount rate.

It should also be noted that in the case of Scheme 1C, further augmentation from a new source, such as the Mzimkulu River, will be required some 3 years earlier than in the case of Scheme 2C. Assuming that this further scheme would have a capital cost of a similar magnitude to that of the Mkomazi Phase 1 schemes, the earlier augmentation would result in an NPV, at a discount rate of 8%, of approximately R40 million higher than would be the case with the later augmentation.

3.3.2 Sensitivity Analyses

The results of the sensitivity analysis are given in Appendix D and summarised in **Table 3.4** overleaf.

TABLE 3.4: SENSITIVITY ANALYSES

Aspect Tested	Scheme No.	Unit Reference Value (c/m³) @ Discount Rate		
		6%	8%	10%
Base case	1A	83	114	152
	2C	74	102	135
Present day Mkomazi catchment development	1A	79	109	145
	2C	70	96	128
Low road demands	1A	96	138	192
	2C	86	123	170
High road demands	1A	75	100	130
	2C	68	91	118
25 year analysis period	1A	123	153	189
	2C	113	140	172

As can be seen from the above, in no case is the URV of the Impendle Scheme (Scheme 1A) lower than that of the Smithfield Scheme (Scheme 2C). With the most likely discount rate of 8%, the minimum difference between the URV's of the two schemes is approximately 9% and in the light of the extent of common scheme cost components, it seems extremely unlikely that changes to cost estimates will bring about a material change to the outcome of this analysis.

3.4 Conclusions and Recommendations

The overall capital costs and cash flows of the Smithfield and Impendle Schemes are very similar, with the difference in URV being largely attributable to the 20% greater yield of the Smithfield Scheme. Details of the cash flows can be found on the first page of the economic model output for each case considered, included in Appendices C and D.

Based on the above results, it can be concluded that overall, the Smithfield Scheme has significant economic benefits over the Impendle Scheme. Whilst the differences in URV's are relatively small, the fact that the schemes are similar, with 85% of the total value consisting of common cost components, would make the likelihood of the

Impendle Scheme becoming more economical than the Smithfield Scheme extremely remote. The R140 million saving (1998 prices) which would be achieved over the lifetime of the Smithfield Scheme through its lower URV is significant, as is the R40 million saving (1998 prices) which would be achieved through the delay in the need for a further augmentation scheme.

The results of the sensitivity analysis confirm that for all cases evaluated, the Smithfield Scheme remains more economical than the Impendle Scheme and it is extremely unlikely that any of the variables evaluated in the sensitivity analysis could vary so far outside the ranges considered as to change this outcome.

It is therefore recommended that on the basis of this economic evaluation, the Impendle Scheme should not be investigated further and that the Smithfield Scheme be selected for further investigation at feasibility level.

Of the three Smithfield Scheme configurations evaluated, Scheme 2C had only a marginally lower URV (less than 1%) than the other two schemes and at this stage of planning it would be inappropriate to make a final selection. It is therefore recommended that an optimisation of the Smithfield Scheme should be carried out in the feasibility phase in order to determine optimum component sizes and the desirability or otherwise of raising Impendle Dam.

REFERENCE

Umgeni Water (1998), **SOCIO-ECONOMIC IMPACT OF OUTCOMES RELATING TO THE MKOMAZI-MGENI AUGMENTATION SCHEME**, *Report by Graham Muller Associates, (26 October 1998).*

APPENDICES

Appendix A	Report: "Socio-economic impact of outcomes relating to the Mkomazi-Mgeni Augmentation Scheme" *(See Supporting Report No 7: Economics - Volume 2)*
Appendix B	Derivation of economic model input
Appendix C	Results of primary comparison
Appendix D	Results of sensitivity analysis

APPENDIX A

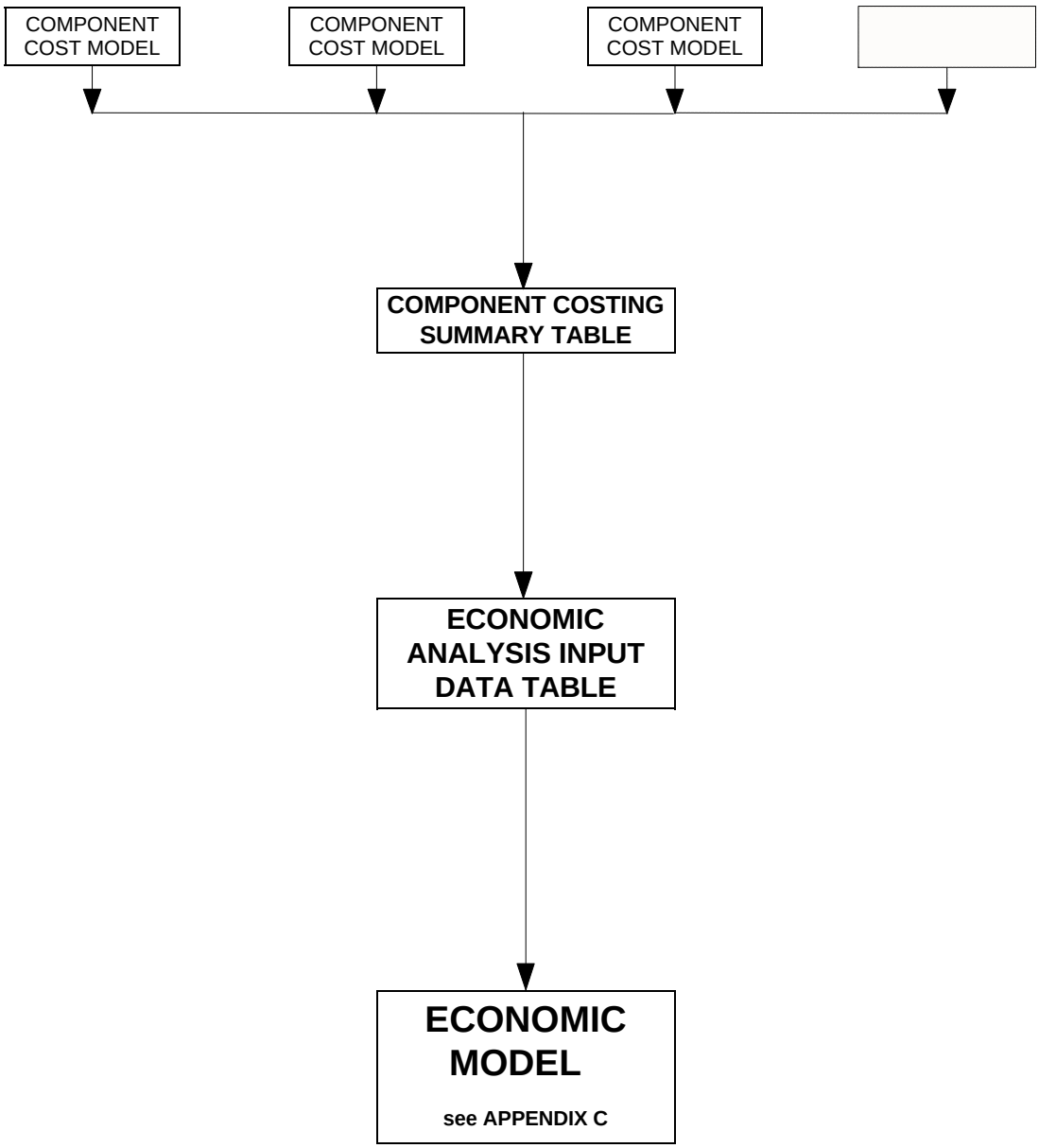
Report by Graham Muller Associates:
"Socio-economic impact of outcomes relating to the Mkomazi-Mgeni Augmentation Scheme"

(See Supporting Report No 7: Economics - Volume 2)

APPENDIX B

Derivation of economic model input

DERIVATION OF ECONOMIC MODEL INPUT



Notes

- The **ECONOMIC ANALYSIS INPUT DATA TABLE** shows how the items in the **COMPONENT COSTING SUMMARY. TABLE** are added together to obtain the input data for the **ECONOMIC MODEL.**
- The **COMPONENT COST MODELS** can be found in **SUPPORTING REPORT No. 6 : ENGINEERING DESIGN AND COSTING.**

SCHEME 1A COMPONENT COSTING SUMMARY TABLE

ITEM	COMPONENT	CIVIL COSTS R '000s	MECH COSTS R '000s	TOTAL R '000s	DURATION YEARS
	PHASE 1 Commissioning Year 2008				
1	Impendle Dam for raising FSL 1184 masl (1,0 MAR)	306 658	14 731	321 390	3
2	Tunnel from Impendle Dam to Midmar Dam 34.9 km	583 211	2 000	585 211	5
3	Additional pipework at Midmar Dam Outlet	1 739	2 001	3 740	1
4	Midmar Pumpstation upsized by 580Ml/day	7 046	12 527	19 573	1
5	Pipeline from Midmar Dam to Midmar Waterworks 1.9 km	16 409	35	16 444	1
6	Midmar Waterworks upsized by 580Ml/day	172 636	73 987	246 623	2
7	Pipeline from Midmar Waterworks to Stuckenberg Tunnel 3.0 km	26 298	326	26 624	2
8	Stuckenberg Tunnel 2.025 km	53 906	1 000	54 906	2
9	Pipeline from Stuckenberg Tunnel to Midmar Reservoir 1.1km	9 083	317	9 400	2
10	Installation of Sleeve Valves at Midmar Reservoir	0	1 868	1 868	1
11	Pipeline from Midmar Tunnel Outlet to Northern Feeder 1.4 km	9 409	381	9 790	1
12	Northern Feeder Pipeline to Umlaas Road Reservoir 37.9 km	245 876	3 128	249 004	3
13	Umlaas Road Reservoir 200Ml	38 145	1 857	40 003	1
14	Advanced Infrastructure Costs	12 947	0	12 947	1
	Total	1 483 363	114 158	1 597 521	
	PHASE 2 Commissioning Year 2015				
1	Additional pipework at Midmar Dam Outlet	1 166	1 106	2 272	1
2	Midmar Pumpstation upsized by 580Ml/day	7 046	12 527	19 573	1
3	Additional Pipeline from Midmar Dam to Midmar Waterworks 1.9 km	16 409	35	16 444	1
4	Midmar Waterworks upsized by 580Ml/day	172 636	73 987	246 623	1
5	Additional Pipeline from Midmar Waterworks to Stuckenberg Tunnel 3.0 km	23 234	326	23 560	2
6	Additional Pipeline from Stuckenberg Tunnel to Midmar Reservoir 1.1 km	10 165	317	10 482	2
7	Upgrade existing Ferncliff Tunnel 1.050 km	32 721	7 370	40 090	2
8	Additional Pipeline from Midmar Tunnel Outlet to Northern Feeder 1.4 km	8 981	381	9 362	1
9	Additional Northern Feeder Pipeline to Umlaas Road Reservoir 37.9 km	238 239	2 037	240 275	3
	Total	510 595	98 085	608 681	
	PHASE 3 Commsioning Year 2021				
1	Impendle Dam raised to FSL 1197 masl (1,5 MAR)	115 701	261	115 962	2
	Total	115 701	261	115 962	
	Scheme Total	2 109 659	212 505	2 322 164	

NOTE

- Costs include all add-on percentages, except design fees and VAT.

SCHEME 1A ECONOMIC ANALYSIS INPUT DATA TABLE

(Refer to SCHEME 1A COMPONENT COSTING SUMMARY TABLE)

PHASE 1	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks -Item 6,13		210 781	75 844	286 625	2
Tunnel-Item 2		583 211	2 000	585 211	5
Tunnel-Item 8		53 906	1 000	54 906	2
Pipeline-Item 3,5,7,9,10,11,12		308 814	8 056	316 869	3
Dam-Item 1		306 658	14 731	321 390	3
Pumpstation -Item 4	1 719	7 046	12 527	19 573	1
Advanced Infrastructure Costs-Item 14		12 947	0	12 947	1
Subtotal		**1 483 363**	**114 158**	**1 597 521**	
Engineering Fees at 12% of Subtotal		178 004	13 699	191 703	
Social and Environmental Costs		10 425	0	10 425	
Total		**1 671 792**	**127 857**	**1 799 649**	

PHASE 2	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks-Item 4		172 636	73 987	246 623	1
Tunnel-Item 7		32 721	7 370	40 090	2
Pipeline-Item 1,3,5,6,8,9		298 192	4 202	302 395	3
Pumpstation-Item 2	1 301	7 046	12 527	19 573	1
Subtotal		**510 595**	**98 085**	**608 681**	
Engineering Fees at 12% of Subtotal		61 271	11 770	73 042	
Total		**571 867**	**109 856**	**681 722**	

PHASE 3	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Dam-Item 1		115 701	261	115 962	2
Pumpstation	417	0	0	0	
Subtotal		**115 701**	**261**	**115 962**	
Engineering Fees at 12% of Subtotal		13 884	31	13 915	
Total		**129 585**	**292**	**129 877**	

NOTE

-Social and Environmental Costs are described in SUPPORTING REPORT No. 5: ENVIRONMENTAL

SCHEME 1B COMPONENT COSTING SUMMARY TABLE

ITEM	COMPONENT	CIVIL COSTS R '000s	MECH COSTS R '000s	TOTAL R '000s	DURATION YEARS
	PHASE 1 Commissioning Year 2008				
1	Impendle Dam FSL 1184 masl (1,0 MAR)	295 361	14 731	310 092	3
2	Tunnel from Impendle Dam to Midmar Dam 34.9 km	583 211	2 000	585 211	5
3	Additional pipework at Midmar Dam Outlet	1 739	2 001	3 740	1
4	Midmar Pumpstation upsized by 509Ml/day	6 163	10 956	17 118	1
5	Pipeline from Midmar Dam to Midmar Waterworks 1.9 km	13 902	35	13 937	1
6	Midmar Waterworks upsized by 509Ml/day	150 982	64 707	215 689	2
7	Pipeline from Midmar Waterworks to Stuckenberg Tunnel 3.0 km	24 247	326	24 573	2
8	Stuckenberg Tunnel 2.025 km	53 906	1 000	54 906	2
9	Pipeline from Stuckenberg Tunnel to Midmar Reservoir 1.1km	8 304	317	8 621	2
10	Installation of Sleeve Valves at Midmar Reservoir	0	1 868	1 868	1
11	Pipeline from Midmar Tunnel Outlet to Northern Feeder 1.4 km	9 409	381	9 790	1
12	Northern Feeder Pipeline to Umlaas Road Reservoir 37.9 km	245 876	3 128	249 004	3
13	Umlaas Road Reservoir 200Ml	38 145	1 857	40 003	1
14	Advanced Infrastructure Costs	12 947	0	12 947	1
	Total	1 444 191	103 306	1 547 497	
	PHASE 2 Commissioning Year 2015				
1	Additional pipework at Midmar Dam Outlet	1 166	1 106	2 272	1
2	Midmar Pumpstation upsized by 509Ml/day	6 163	10 956	17 118	1
3	Additional Pipeline from Midmar Dam to Midmar Waterworks 1.9 km	13 902	35	13 937	1
4	Midmar Waterworks upsized by 509Ml/day	150 982	64 707	215 689	1
5	Additional Pipeline from Midmar Waterworks to Stuckenberg Tunnel 3.0 km	21 183	326	21 509	2
6	Additional Pipeline from Stuckenberg Tunnel to Midmar Reservoir 1.1 km	9 289	317	9 606	2
7	Upgrade existing Ferncliff Tunnel 1.050 km	32 721	7 370	40 090	2
8	Additional Pipeline from Midmar Tunnel Outlet to Northern Feeder 1.4 km	8 981	381	9 362	1
9	Additional Northern Feeder Pipeline to Umlaas Road Reservoir 37.9 km	238 239	2 037	240 275	3
	Total	482 624	87 234	569 858	
	Scheme Total	**1 926 815**	**190 540**	**2 117 355**	

NOTE

- Costs include all add-on percentages, except design fees and VAT.

SCHEME 1B ECONOMIC ANALYSIS INPUT DATA TABLE

(Refer to SCHEME 1B COMPONENT COSTING SUMMARY TABLE)

PHASE 1	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks -Item 6,13		189 128	66 564	255 692	2
Tunnel-Item 2		583 211	2 000	585 211	5
Tunnel-Item 8		53 906	1 000	54 906	2
Pipeline-Item 3,5,7,9,10,11,12		303 477	8 055	311 532	3
Dam-Item 1		295 361	14 731	310 092	3
Pumpstation -Item 4	1 510	6 163	10 956	17 118	1
Advanced Infrastructure Costs-Item 14		12 947	0	12 947	1
Subtotal		**1 444 191**	**103 306**	**1 547 497**	
Engineering Fees at 12% of Subtotal		173 303	12 397	185 700	
Social and Environmental Costs		10 425		10 425	
Total		**1 627 919**	**115 703**	**1 743 622**	

PHASE 2	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks-Item 4		150 982	64 707	215 689	1
Tunnel-Item 7		32 721	7 370	40 090	2
Pipeline-Item 1,3,5,6,8,9		292 759	4 202	296 961	3
Pumpstation-Item 2	1 509	6 163	10 956	17 118	1
Subtotal		**482 624**	**87 234**	**569 858**	
Engineering Fees at 12% of Subtotal		57 915	10 468	68 383	
Total		**540 539**	**97 702**	**638 241**	

NOTE

-Social and Environmental Costs are described in SUPPORTING REPORT No. 5: ENVIRONMENTAL

SCHEME 1C COMPONENT COSTING SUMMARY TABLE

ITEM	COMPONENT	CIVIL COSTS R '000s	MECH COSTS R '000s	TOTAL R '000s	DURATION YEARS
	PHASE 1 Commisioning Year 2008				
1	Impendle Dam FSL 1197 masl (1,5 MAR)	369 223	14 793	384 016	3
2	Tunnel from Impendle Dam to Midmar Dam 34.9 km	583 211	2 000	585 211	5
3	Additional pipework at Midmar Dam Outlet	1 739	2 001	3 740	1
4	Midmar Pumpstation upsized by 580Ml/day	7 046	12 527	19 573	1
5	Pipeline from Midmar Dam to Midmar Waterworks 1.9 km	16 409	35	16 444	1
6	Midmar Waterworks upsized by 580Ml/day	172 636	73 987	246 623	2
7	Pipeline from Midmar Waterworks to Stuckenberg Tunnel 3.0 km	26 298	326	26 623	2
8	Stuckenberg Tunnel 2.025 km	53 906	1 000	54 906	2
9	Pipeline from Stuckenberg Tunnel to Midmar Reservoir 1.1km	9 083	317	9 400	2
10	Installation of Sleeve Valves at Midmar Reservoir	0	1 868	1 868	1
11	Pipeline from Midmar Tunnel Outlet to Northern Feeder 1.4 km	9 409	381	9 790	1
12	Northern Feeder Pipeline to Umlaas Road Reservoir 37.9 km	245 876	3 128	249 004	3
13	Umlaas Road Reservoir 200Ml	38 145	1 857	40 003	1
14	Advanced Infrastructure Costs	12 947	0	12 947	1
	Total	1 545 928	114 219	1 660 147	
	PHASE 2 Commissioning Year 2016				
1	Additional pipework at Midmar Dam Outlet	1 166	1 106	2 272	1
2	Midmar Pumpstation upsized by 580Ml/day	7 046	12 527	19 573	1
3	Additional Pipeline from Midmar Dam to Midmar Waterworks 1.9 km	16 409	35	16 444	1
4	Midmar Waterworks upsized by 580Ml/day	172 636	73 987	246 623	1
5	Additional Pipeline from Midmar Waterworks to Stuckenberg Tunnel 3.0 km	23 234	326	23 560	2
6	Additional Pipeline from Stuckenberg Tunnel to Midmar Reservoir 1.1 km	10 165	317	10 482	2
7	Upgrade existing Ferncliff Tunnel 1.050 km	32 721	7 370	40 090	2
8	Additional Pipeline from Midmar Tunnel Outlet to Northern Feeder 1.4 km	8 981	381	9 362	1
9	Additional Northern Feeder Pipeline to Umlaas Road Reservoir 37.9 km	238 239	2 037	240 275	3
	Total	510 595	98 085	608 681	
	Scheme Total	**2 056 523**	**212 304**	**2 268 828**	

NOTE

- Costs include all add-on percentages, except design fees and VAT.

SCHEME 1C ECONOMIC ANALYSIS INPUT DATA TABLE

(Refer to SCHEME 1C COMPONENT COSTING SUMMARY TABLE)

PHASE 1	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks -Item 6,13		210 781	75 844	286 625	2
Tunnel-Item 2		583 211	2 000	585 211	5
Tunnel-Item 8		53 906	1 000	54 906	2
Pipeline-Item 3,5,7,9,10,11,12		308 814	8 055	316 869	3
Dam-Item 1		369 223	14 793	384 016	3
Pumpstation -Item 4	1 719	7 046	12 527	19 573	1
Advanced Infrastructure Costs-Item 14		12 947	0	12 947	1
Subtotal		**1 545 928**	**114 219**	**1 660 147**	
Engineering Fees at 12% of Subtotal		185 511	13 706	199 218	
Social and Environmental Costs		10 425	0	10 425	
Total		**1 741 865**	**127 925**	**1 869 790**	

PHASE 2	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks-Item 4		172 636	73 987	246 623	1
Tunnel-Item 7		32 721	7 370	40 090	2
Pipeline-Item 1,3,5,6,8,9		298 192	4 202	302 395	3
Pumpstation-Item 2	1 718	7 046	12 527	19 573	1
Subtotal		**510 595**	**98 085**	**608 681**	
Engineering Fees at 12% of Subtotal		61 271	11 770	73 042	
Total		**571 867**	**109 856**	**681 722**	

NOTE

-Social and Environmental Costs are described in SUPPORTING REPORT No. 5: ENVIRONMENTAL

SCHEME 2A COMPONENT COSTING SUMMARY TABLE

ITEM	COMPONENT	CIVIL COSTS R '000s	MECH COSTS R '000s	TOTAL R '000s	DURATION YEARS
	PHASE 1 Commissioning Year 2008				
1	Smithfield Dam FSL 915 masl	210 693	10 913	221 606	3
2	Smithfield Dam Intake Tower and Pumpstation 606Ml/day	37 260	30 763	68 022	1
3	Tunnel from Smithfield Dam to Baynesfield Dam 32.9 km	541 292	2 000	543 292	6
4	Baynesfield Dam raised by 0.5m FSL 871.5masl	3 518	2 473	5 991	1
5	Pipeline from Smithfield tunnel outlet to Baynesfield Dam Outlet 2.2km and from Baynesfield Dam to Baynesfield Waterworks 3.0 km	38 691	1 382	40 073	1
6	Baynesfield Waterworks 606 Ml/day	162 551	69 664	232 215	2
7	Pipeline from Baynefield Waterworks to Umlaas Road Reservoir 21.1 km	170 331	2 037	172 368	3
8	Umlaas Road Reservoir 200Ml	38 242	2 582	40 824	1
9	Advanced Infrastructure Costs	13 860	0	13 860	1
	Total	1 216 437	121 814	1 338 251	
	PHASE 2 Commissioning Year 2015				
1	Impendle Dam for raising FSL 1184 masl (1.0 MAR)	306 658	14 731	321 390	2
2	Smithfield Dam Intake Tower and Pumpstation upsized by 794Ml/day	0	20 116	20 116	1
3	Additional Pipeline from Smithfield tunnel outlet to Baynesfield Dam Outlet 2.2 km & from Baynesfield Dam to Baynesfield Waterworks 3.0 km	38 691	1 382	40 073	1
4	Baynesfield Waterworks upsized by 794 Ml/day	245 902	105 387	351 289	1
5	Additional Pipeline from Baynefield Waterworks to Umlaas Road Reservoir 21.1 km	166 839	2 037	168 876	3
6	Advanced Infrastructure Costs	12 947	0	12 947	1
	Total	771 038	143 653	914 691	
	PHASE 3 Commissioning Year 2023				
1	Impendle Dam raised to FSL 1197masl (1.5 MAR)	115 701	261	115 962	2
	Total	115 701	261	115 962	
	Scheme Total	**2 103 176**	**265 728**	**2 368 904**	

NOTE

- Costs include all add-on percentages, except design fees and VAT.

SCHEME 2A ECONOMIC ANALYSIS INPUT DATA TABLE

(Refer to SCHEME 2A COMPONENT COSTING SUMMARY TABLE)

PHASE 1	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks - Item 6,8		200 793	72 247	273 039	2
Tunnel -Item 3		541 292	2 000	543 292	6
Pipeline - Item 5,7		209 022	3 419	212 441	3
Dam - Item 1		210 693	10 913	221 606	3
Dam - Item 4		3 518	2 473	5 991	1
Pumpstation - Item 2	3 840	37 260	30 763	68 022	1
Advanced Infrastructure Costs - Item 9		13 860	0	13 860	1
Subtotal		**1 216 437**	**121 814**	**1 338 251**	
Engineering Fees at 12% of Subtotal		145 972	14 618	160 590	
Social and Environmental Costs		3 794	0	3 794	
Total		**1 366 204**	**136 432**	**1 502 636**	

PHASE 2	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks - Item 4		245 902	105 387	351 289	1
Pipeline - Item 3,5		205 531	3 419	208 949	3
Dam - Item 1		306 658	14 731	321 390	3
Pumpstation - Item 2	4 977	0	20 116	20 116	1
Advanced Infrastructure Costs - Item 6		12 947	0	12 947	1
Subtotal		**771 038**	**143 653**	**914 691**	
Engineering Fees at 12% of Subtotal		92 525	17 238	109 763	
Social and Environmental Costs		10 425	0	10 425	
Total		**873 988**	**160 891**	**1 034 878**	

PHASE 3	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Dam - Item 1	1 103	115 701	261	115 962	2
Subtotal		**115 701**	**261**	**115 962**	
Engineering Fees at 12% of Subtotal		13 884	31	13 915	
Social and Environmental costs		0	0	0	
Total		**129 585**	**292**	**129 877**	

NOTE

-Social and Environmental Costs are described in SUPPORTING REPORT No. 5: ENVIRONMENTAL

SCHEME 2B COMPONENT COSTING SUMMARY TABLE

ITEM	COMPONENT	CIVIL COSTS R '000s	MECH COSTS R '000s	TOTAL R '000s	DURATION YEARS
	PHASE 1 Commissioning Year 2008				
1	Smithfield Dam FSL 915 masl	210 693	10 913	221 606	3
2	Smithfield Dam Intake Tower and Pumpstation 630 Ml/day	37 260	34 171	71 431	1
3	Tunnel from Smithfield Dam to Baynesfield Dam 32.9 km	541 292	2 000	543 292	5
4	Baynesfield Dam raised by 0.5m FSL 871.5 masl	3 518	2 473	5 991	1
5	Pipeline from Smithfield tunnel outlet to Baynesfield Dam Outlet 2.2km and from Baynesfield Dam to Baynesfield Waterworks 3.0 km	38 691	1 382	40 073	1
6	Baynesfield Waterworks 630 Ml/day	183 907	78 818	262 725	2
7	Pipeline from Baynefield Waterworks to Umlaas Road Reservoir 21.1 km	170 331	2 037	172 368	3
8	Umlaas Road Reservoir 200Ml	38 242	2 582	40 824	1
9	Advanced Infrastructure Costs	13 860	0	13 860	1
	Total	1 237 794	134 375	1 372 170	
	PHASE 2 Commissioning Year 2015				
1	Impendle Dam FSL 1184masl (1.0 MAR)	295 361	14 731	310 092	3
2	Advanced Infrastructure Costs	12 947	0	12 947	1
	Total	308 308	14 731	323 039	
	PHASE 3 Commissioning Year 2016				
1	Smithfield Dam Intake Tower and Pumpstation upsized by 630 Ml/day	0	16 708	16 708	1
2	Additional Pipeline from Smithfield tunnel outlet to Baynesfield Dam Outlet 2.2 km & from Baynesfield Dam to Baynesfield Waterworks 3.0 km	38 691	1 382	40 073	1
3	Baynesfield Waterworks upsized by 630 Ml/day	183 907	78 818	262 725	2
4	Additional Pipeline from Baynefield Waterworks to Umlaas Road Reservoir 21.1 km	166 839	2 037	168 876	3
	Total	389 438	98 944	488 382	
	Scheme Total	**1 935 540**	**248 050**	**2 183 591**	

NOTE

- Costs include all add-on percentages, except design fees and VAT.

SCHEME 2B ECONOMIC ANALYSIS INPUT DATA TABLE

(Refer to SCHEME 2B COMPONENT COSTING SUMMARY TABLE)

PHASE 1	**ELEC/a R '000s**	**CIVIL R '000s**	**MECH R '000s**	**TOTAL R '000s**	**Duration YEARS**
Waterworks - Item 6,8		222 150	81 400	303 549	2
Tunnel - Item 3		541 292	2 000	543 292	5
Pipeline - Item 5,7		209 022	3 419	212 441	3
Dam - Item 1		210 693	10 913	221 606	3
Dam - Item 4		3 518	2 473	5 991	1
Pumpstation - Item 2	3 841	37 260	34 171	71 431	1
Advanced Infrastructure Costs - Item 9		13 860	0	13 860	1
Subtotal		**1 237 794**	**134 375**	**1 372 170**	
Engineering Fees at 12% of Subtotal		148 535	16 125	164 660	
Social and Environmental Costs		3 794	0	3 794	
Total		**1 390 124**	**150 500**	**1 540 624**	

PHASE 2	**ELEC/a R '000s**	**CIVIL R '000s**	**MECH R '000s**	**TOTAL R '000s**	**Duration YEARS**
Dam - Item 1		295 361	14 731	310 092	3
Pumpstation	537	0	0	0	
Advanced Infrastructure Costs - Item 2		12 947	0	12 947	1
Subtotal		**308 308**	**14 731**	**323 039**	
Engineering Fees at 12% of Subtotal		36 997	1 768	38 765	
Social and Environmental Costs		10 425	0	10 425	
Total		**355 729**	**16 499**	**372 229**	

PHASE 3	**ELEC/a R '000s**	**CIVIL R '000s**	**MECH R '000s**	**TOTAL R '000s**	**Duration YEARS**
Waterworks - Item 3		183 907	78 818	262 725	2
Pipeline - Item 2,4		205 531	3 419	208 949	3
Pumpstation - Item 1	4 440	0	16 708	16 708	1
Subtotal		**389 438**	**98 944**	**488 382**	
Engineering Fees at 12% of Subtotal		46 733	11 873	58 606	
Total		**436 171**	**110 817**	**546 988**	

NOTE

-Social and Environmental Costs are described in SUPPORTING REPORT No. 5: ENVIRONMENTAL

SCHEME 2C COMPONENT COSTING SUMMARY TABLE

ITEM	COMPONENT	CIVIL COSTS R '000s	MECH COSTS R '000s	TOTAL R '000s	DURATION YEARS
	PHASE 1 Commissioning Year 2008				
1	Smithfield Dam FSL 915 masl	210 693	10 913	221 606	3
2	Smithfield Dam Intake Tower and Pumpstation 606Ml/day	37 260	30 763	68 022	1
3	Tunnel from Smithfield Dam to Baynesfield Dam 32.9 km	541 292	2 000	543 292	5
4	Baynesfield Dam raised by 0.5m FSL 871.5masl	3 518	2 473	5 991	1
5	Pipeline from Smithfield tunnel outlet to Baynesfield Dam Outlet 2.2km and from Baynesfield Dam to Baynesfield Waterworks 3.0 km	38 691	1 382	40 073	1
6	Baynesfield Waterworks 606Ml/day	162 551	69 664	232 215	2
7	Pipeline from Baynefield Waterworks to Umlaas Road Reservoir 21.1 km	170 331	2 037	172 368	3
8	Umlaas Road Reservoir 200Ml	38 242	2 582	40 824	1
9	Advanced Infrastructure Costs	13 860	0	13 860	1
	Total	1 216 437	121 814	1 338 251	
	PHASE 2 Commissioning Year 2015				
1	Impendle Dam FSL 1197 masl (1.5 MAR)	369 223	14 793	384 016	4
2	Smithfield Dam Intake Tower and Pumpstation upsized by 795Ml/day	0	20 116	20 116	1
3	Baynesfield Waterworks upsized by 795Ml/day	245 902	105 387	351 289	2
4	Advanced Infrastructure Costs	12 947	0	12 947	1
	Total	628 072	140 295	768 368	
	PHASE 3 Commissioning Year 2017				
1	Additional Pipeline from Smithfield tunnel outlet to Baynesfield Dam Outlet 2.2km & from Baynesfield Dam to Baynesfield Waterworks 3.0 km	38 691	1 382	40 073	1
2	Additional Pipeline from Baynefield Waterworks to Umlaas Road Reservoir 21.1 km	166 839	2 037	168 876	3
	Total	205 531	3 419	208 949	
	Scheme Total	**2 050 040**	**265 528**	**2 315 568**	

NOTE

- Costs include all add-on percentages, except design fees and VAT.

SCHEME 2C ECONOMIC ANALYSIS INPUT DATA TABLE

(Refer to SCHEME 2C COMPONENT COSTING SUMMARY TABLE)

PHASE 1	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks - Item 6,8		200 793	72 247	273 039	2
Tunnel-Item 3		541 292	2 000	543 292	5
Pipeline - Item 5,7		209 022	3 419	212 441	3
Dam - Item 1		210 693	10 913	221 606	3
Dam - Item 4		3 518	2 473	5 991	1
Pumpstation - Item 2	3 841	37 260	30 763	68 022	1
Advanced Infrastructure Costs -Item 9		13 860	0	13 860	1
Subtotal		**1 216 437**	**121 814**	**1 338 251**	
Engineering Fees at 12% of Subtotal		145 972	14 618	160 590	
Social and Environmental Costs		3 794	0	3 794	
Total		**1 366 204**	**136 432**	**1 502 636**	

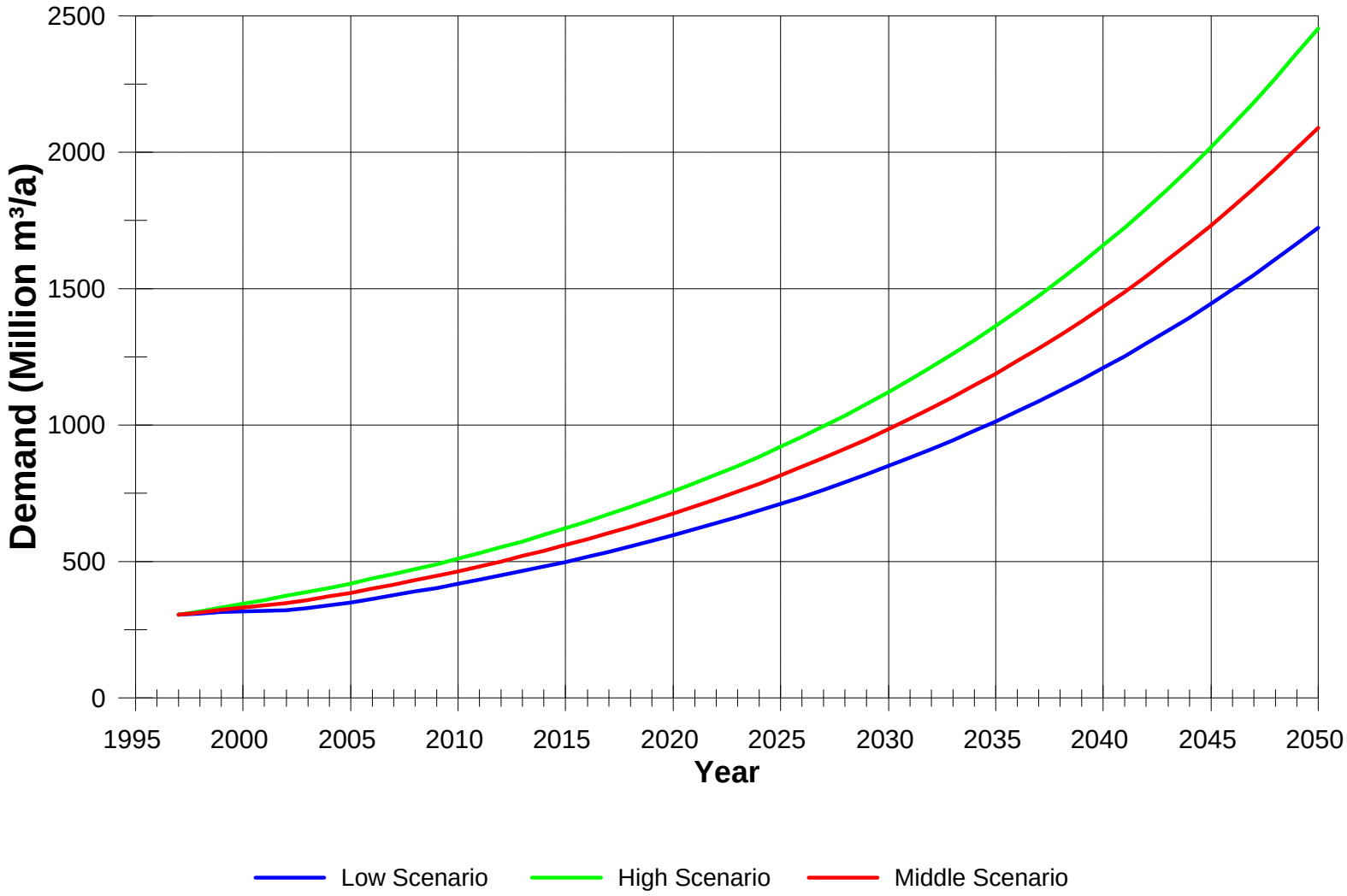
PHASE 2	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Waterworks - Item 3		245 902	105 387	351 289	2
Dam - Item 1		369 223	14 793	384 016	4
Pumpstation - Item 2	1 075	0	20 116	20 116	1
Advanced Infrastructure Costs -Item 4		12 947	0	12 947	1
Subtotal			**140 295**	**768 368**	
Engineering Fees at 12% of Subtotal		0	16 835	16 835	
Social and Environmental Costs		10 425		10 425	
Total		**10 425**	**157 131**	**167 556**	

PHASE 3	ELEC/a R '000s	CIVIL R '000s	MECH R '000s	TOTAL R '000s	Duration YEARS
Pipeline - Item 1,2	5 004	205 531	3 419	208 949	3
Subtotal		**205 531**	**3 419**	**208 949**	
Engineering Fees at 12% of Subtotal		24 664	410	25 074	
Total		**230 194**	**3 829**	**234 023**	

NOTE

-Social and Environmental Costs are described in SUPPORTING REPORT No. 5: ENVIRONMENTAL

FIGURE 3.2: MGENI SYSTEM WATER DEMANDS



Source : Umgeni Water (May 1998)

MKOMAZI RIVER: STOCHASTIC YIELD RESULTS

Scheme	Firm Yield for 1:100 yr Recurrence Interval (Mm^3/a)
PRESENT DEVELOPMENT SCENARIO	
Imp 1,0 MAR	296
Imp 1,5 MAR	336
Smith 137 Mm^3 (0,19 MAR)	177
Smith + 1 MAR Imp	369
Smith + 1,5 MAR Imp	409
FUTURE DEVELOPMENT SCENARIO	
Imp 1,0 MAR	275
Imp 1,5 MAR	313
Smith 137 Mm^3 (0,19 MAR)	147
Smith + 1 MAR Imp	335
Smith + 1,5 MAR Imp	376

The stochastic yield results were obtained from Supporting Report No 4: Hydrology and Water Resources.

APPENDIX C

Results of primary comparison

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.96

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			210 781	75 844		2006	2007	2	10.0%	115 930	41 714	94 851	34 130
			Dia.	**Length**											
Tunnel	Press. Flow	Impendle Dam to Midmar Dam		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
	Press. Flow	Stukkenberg		2025	53 906	1 000		2006	2007	2	10.0%	29 648	550	24 258	450
			Dia.	**Length**											
Pipeline		Midmar Dam to Umlaas Rd Res			308 814	8 056		2005	2007	3	10.0%	123 526	3 222	92 644	2 417
			FSL	**h**											
Dam	Rockfill	Impendle (1.0 MAR)	1184		306 658	14 731		2005	2007	3	10.0%	122 663	5 892	91 997	4 419
Dam															
			No.	**m3**											
Pump Station		Upsizing Midmar			7 046	12 527	1 719	2007	2007	1	10.0%	7 046	12 527	6 341	11 274
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 483 363	114 158	1 719								
					1 799 649										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	3.91

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Midmar			172 636	73 987		2014	2014	1	10.0%	172636.0	73987.0	155372.4	66588.3
			Dia.	**Length**											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2013	2014	2	10.0%	17996.6	4053.5	14724.5	3316.5
			Dia.	**Length**											
Pipeline		Midmar Dam to Umlaas Rd Res			298 192	4 202		2012	2014	3	10.0%	119276.8	1680.8	89457.6	1260.6
			FSL	**h**											
Dam															
Dam															
			No.	**m3**											
Pump Station		Upsizing Midmar			7 046	12 527	1 301	2014	2014	1	10.0%	7046.0	12527.0	6341.4	11274.3
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					510 595	98 086	1301								
					681 723										

Year	Cost Factors	
	Social & Environ.	Admin.
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2014	
Sensitivity		
Sensitised	2014	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2021	Output (m3/s)	1.20

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline															
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle raised (1.5 MAR)	1197		115 701	261		2019	2020	2	10.0%	63635.6	143.6	52065.5	117.5
Dam															
			No.	**m3**											
Pump Station							417								
Pump Station															
Infrastructure								2019	2018						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					115701	261	417								
					129877										

Year	Cost Factors	
	Social & Environ.	Admin.
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	245 550	32	0	0	0	0	0	0	0	0	0	0	245 550	32	0
2004	128 853	32	0	0	0	0	0	0	0	0	0	0	128 853	32	0
2005	384 476	32	0	0	0	0	0	0	0	0	0	0	384 476	32	0
2006	506 550	32	0	0	0	0	0	0	0	0	0	0	506 550	32	0
2007	490 460	32	0	0	0	0	0	0	0	0	0	0	490 460	32	0
2008	0	7 003	379	0	0	0	0	0	0	0	0	0	0	7 003	379
2009	0	7 003	560	0	0	0	0	0	0	0	0	0	0	7 003	560
2010	0	7 003	747	7 560	0	0	0	0	0	0	0	0	7 560	7 003	747
2011	0	7 003	943	8 562	0	0	0	0	0	0	0	0	8 562	7 003	943
2012	0	7 003	1 146	137 082	0	0	0	0	0	0	0	0	137 082	7 003	1 146
2013	0	7 003	1 357	127 317	0	0	0	0	0	0	0	0	127 317	7 003	1 357
2014	0	7 003	1 575	401 202	0	0	0	0	0	0	0	0	401 202	7 003	1 575
2015	0	7 003	1 719	0	5 151	83	0	0	0	0	0	0	0	12 154	1 802
2016	0	7 003	1 719	0	5 151	318	0	0	0	0	0	0	0	12 154	2 037
2017	0	7 003	1 719	0	5 151	563	2 899	0	0	0	0	0	2 899	12 154	2 282
2018	0	7 003	1 719	0	5 151	817	2 899	0	0	0	0	0	2 899	12 154	2 536
2019	0	7 003	1 719	0	5 151	1 080	68 244	0	0	0	0	0	68 244	12 154	2 799
2020	0	7 003	1 719	0	5 151	1 354	55 836	0	0	0	0	0	55 836	12 154	3 073
2021	0	7 003	1 719	0	5 151	1 301	0	300	337	0	0	0	0	12 453	3 357
2022	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2023	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2024	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2025	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2026	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2027	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2028	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2029	0	7 003	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 438	3 437
2030	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2031	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2032	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2033	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2034	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2035	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2036	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2037	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2038	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2039	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2040	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2041	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2042	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2043	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2044	0	7 003	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 438	3 437
2045	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2046	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2047	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2048	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2049	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2050	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2051	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2052	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2053	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2054	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
TOTAL	**1 799 649**	**336 284**	**75 467**	**681 723**	**212 003**	**48 448**	**129 877**	**10 190**	**14 098**	**0**	**0**	**0**	**2 611 249**	**558 477**	**138 013**
Commission date		2008			2015			2021			0				
Transfer capacity (m3/s)		4.96			3.91			1.20			0.00				

(CONTINUED.....)

Check	**1 799 649**	**681 723**	**129 877**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	183 489	24	0	167 117	22	0	152 467	20	0
2004	90 836	23	0	81 199	20	0	72 734	18	0
2005	255 698	22	0	224 338	19	0	197 297	17	0
2006	317 815	20	0	273 673	17	0	236 309	15	0
2007	290 302	19	0	245 352	16	0	208 003	14	0
2008	0	3 910	212	0	3 244	176	0	2 700	146
2009	0	3 689	295	0	3 003	240	0	2 454	196
2010	3 757	3 480	371	3 002	2 781	297	2 409	2 231	238
2011	4 014	3 283	442	3 148	2 575	347	2 480	2 028	273
2012	60 631	3 097	507	46 671	2 384	390	36 098	1 844	302
2013	53 125	2 922	566	40 136	2 208	428	30 479	1 676	325
2014	157 932	2 757	620	117 107	2 044	460	87 313	1 524	343
2015	0	4 513	669	0	3 285	487	0	2 405	356
2016	0	4 258	714	0	3 041	510	0	2 186	366
2017	958	4 017	754	672	2 816	529	474	1 987	373
2018	904	3 790	791	622	2 608	544	431	1 807	377
2019	20 074	3 575	823	13 557	2 414	556	9 222	1 642	378
2020	15 495	3 373	853	10 270	2 236	565	6 859	1 493	377
2021	0	3 260	879	0	2 121	572	0	1 391	375
2022	0	3 651	849	0	2 331	542	0	1 501	349
2023	0	2 902	801	0	1 818	502	0	1 149	317
2024	0	2 737	755	0	1 684	465	0	1 045	288
2025	0	2 582	713	0	1 559	430	0	950	262
2026	0	2 436	672	0	1 444	398	0	864	238
2027	0	2 298	634	0	1 337	369	0	785	217
2028	0	2 168	598	0	1 238	342	0	714	197
2029	0	2 536	565	0	1 421	316	0	804	179
2030	0	1 930	533	0	1 061	293	0	590	163
2031	0	1 821	502	0	982	271	0	536	148
2032	0	1 717	474	0	910	251	0	487	135
2033	0	1 620	447	0	842	232	0	443	122
2034	0	1 529	422	0	780	215	0	403	111
2035	0	1 442	398	0	722	199	0	366	101
2036	0	1 360	375	0	669	185	0	333	92
2037	0	1 523	354	0	735	171	0	359	84
2038	0	1 211	334	0	573	158	0	275	76
2039	0	1 142	315	0	531	146	0	250	69
2040	0	1 078	297	0	491	136	0	227	63
2041	0	1 017	281	0	455	126	0	207	57
2042	0	959	265	0	421	116	0	188	52
2043	0	905	250	0	390	108	0	171	47
2044	0	1 058	236	0	448	100	0	193	43
2045	0	805	222	0	334	92	0	141	39
2046	0	760	210	0	310	85	0	128	35
2047	0	717	198	0	287	79	0	117	32
2048	0	676	187	0	266	73	0	106	29
2049	0	638	176	0	246	68	0	96	27
2050	0	602	166	0	228	63	0	88	24
2051	0	568	157	0	211	58	0	80	22
2052	0	636	148	0	232	54	0	86	20
2053	0	505	139	0	181	50	0	66	18
RES+2050	0	477	132	0	167	46	0	60	17
TOTAL	**1 490 421**	**98 038**	**21 300**	**1 259 928**	**62 157**	**12 839**	**1 073 507**	**41 261**	**8 100**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 609 758**	**1 940**	**83**
8%	**1 334 924**	**1 169**	**114**
10%	**1 122 868**	**738**	**152**

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1b.WB3
Option	SCHEME 1B	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.55

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**	**Costs**	**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
							per year					**Civil**	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			189 128	66 564		2006	2007	2	10.0%	104 020	36 610	85 108	29 954
			Dia.	**Length**											
Tunnel	Press. Flow	Impendle to Midmar		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
	Press. Flow	Stukkenberg			53 906	1 000		2006	2007	2	10.0%	29 648	550	24 258	450
			Dia.	**Length**											
Pipeline		Midmar Dam to Umlaas Rd Res			303 477	8 055		2005	2007	3	10.0%	121 391	3 222	91 043	2 417
			FSL	**h**											
Dam	Rockfill	Impendle (1.0 MAR)	1184		295 361	14 731		2005	2007	3	10.0%	118 144	5 892	88 608	4 419
Dam															
			No.	**m3**											
Pump Station		Upsizing Midmar			6 163	10 956	1 510	2007	2007	1	10.0%	6 163	10 956	5 547	9 860
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 444 193	103 306	1 510								
					1 743 624										

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	**Cost**
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1b.WB3
Option	SCHEME 1B	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	4.36

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Midmar			150 982	64 707		2014	2014	1	10.0%	150982.0	64707.0	135883.8	58236.3
			Dia.	Length											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2013	2014	2	10.0%	17996.6	4053.5	14724.5	3316.5
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			292 759	4 202		2012	2014	3	10.0%	117103.6	1680.8	87827.7	1260.6
			FSL	h											
Dam															
Dam															
			No.	m3											
Pump Station		Upsizing Midmar		4.3	6 163	10 956	1 509	2014	2014	1	10.0%	6163.0	10956.0	5546.7	9860.4
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					482 625	87 235	1509								
					638 243										

Year	Cost Factors	
	Social & Environ.	Admin.
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2014	
Sensitivity		
Sensitised	2014	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1B

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	245 134	32	0	0	0	0	0	0	0	0	0	0	245 134	32	0
2004	127 664	32	0	0	0	0	0	0	0	0	0	0	127 664	32	0
2005	376 521	32	0	0	0	0	0	0	0	0	0	0	376 521	32	0
2006	482 944	32	0	0	0	0	0	0	0	0	0	0	482 944	32	0
2007	467 600	32	0	0	0	0	0	0	0	0	0	0	467 600	32	0
2008	0	6 503	379	0	0	0	0	0	0	0	0	0	0	6 503	379
2009	0	6 503	560	0	0	0	0	0	0	0	0	0	0	6 503	560
2010	0	6 503	747	7 424	0	0	0	0	0	0	0	0	7 424	6 503	747
2011	0	6 503	943	8 426	0	0	0	0	0	0	0	0	8 426	6 503	943
2012	0	6 503	1 145	133 922	0	0	0	0	0	0	0	0	133 922	6 503	1 145
2013	0	6 503	1 356	124 738	0	0	0	0	0	0	0	0	124 738	6 503	1 356
2014	0	6 503	1 575	363 733	0	0	0	0	0	0	0	0	363 733	6 503	1 575
2015	0	6 503	1 510	0	4 647	291	0	0	0	0	0	0	0	11 150	1 801
2016	0	6 503	1 510	0	4 647	527	0	0	0	0	0	0	0	11 150	2 037
2017	0	6 503	1 510	0	4 647	771	0	0	0	0	0	0	0	11 150	2 281
2018	0	6 503	1 510	0	4 647	1 025	0	0	0	0	0	0	0	11 150	2 535
2019	0	6 503	1 510	0	4 647	1 288	0	0	0	0	0	0	0	11 150	2 798
2020	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2021	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2022	0	8 597	1 510	0	4 647	1 509	0	0	0	0	0	0	0	13 244	3 019
2023	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2024	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2025	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2026	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2027	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2028	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2029	0	6 503	1 510	0	7 396	1 509	0	0	0	0	0	0	0	13 899	3 019
2030	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2031	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2032	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2033	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2034	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2035	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2036	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2037	0	8 597	1 510	0	4 647	1 509	0	0	0	0	0	0	0	13 244	3 019
2038	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2039	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2040	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2041	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2042	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2043	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2044	0	6 503	1 510	0	7 396	1 509	0	0	0	0	0	0	0	13 899	3 019
2045	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2046	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2047	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2048	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2049	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2050	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2051	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2052	0	8 597	1 510	0	4 647	1 509	0	0	0	0	0	0	0	13 244	3 019
2053	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
2054	0	6 503	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 150	3 019
TOTAL	**1 743 624**	**312 100**	**67 105**	**638 243**	**191 373**	**56 717**	**0**	**0**	**0**	**0**	**0**	**0**	**2 381 867**	**503 473**	**123 822**
Commission date		2008			2015			0			0				
Transfer capacity (m3/s)		4.55			4.36			0.00			0.15				

(CONTINUED.....)

Check	**1 743 624**	**638 243**	**0**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1B

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	183 178	24	0	166 834	22	0	152 209	20	0
2004	89 998	23	0	80 450	20	0	72 063	18	0
2005	250 408	22	0	219 696	19	0	193 215	17	0
2006	303 005	20	0	260 920	17	0	225 297	15	0
2007	276 772	19	0	233 916	16	0	198 308	14	0
2008	0	3 631	212	0	3 012	175	0	2 507	146
2009	0	3 426	295	0	2 789	240	0	2 279	196
2010	3 690	3 232	371	2 948	2 583	297	2 366	2 072	238
2011	3 951	3 049	442	3 098	2 391	347	2 441	1 884	273
2012	59 234	2 876	507	45 595	2 214	390	35 266	1 713	302
2013	52 049	2 714	566	39 323	2 050	428	29 861	1 557	325
2014	143 182	2 560	620	106 170	1 898	460	79 159	1 415	343
2015	0	4 141	669	0	3 014	487	0	2 206	356
2016	0	3 906	714	0	2 790	510	0	2 005	366
2017	0	3 685	754	0	2 584	529	0	1 823	373
2018	0	3 477	790	0	2 392	544	0	1 657	377
2019	0	3 280	823	0	2 215	556	0	1 507	378
2020	0	3 094	838	0	2 051	555	0	1 370	371
2021	0	2 919	790	0	1 899	514	0	1 245	337
2022	0	3 271	746	0	2 089	476	0	1 345	307
2023	0	2 598	703	0	1 628	441	0	1 029	279
2024	0	2 451	664	0	1 508	408	0	936	253
2025	0	2 312	626	0	1 396	378	0	851	230
2026	0	2 181	591	0	1 292	350	0	773	209
2027	0	2 058	557	0	1 197	324	0	703	190
2028	0	1 941	526	0	1 108	300	0	639	173
2029	0	2 283	496	0	1 279	278	0	724	157
2030	0	1 728	468	0	950	257	0	528	143
2031	0	1 630	441	0	880	238	0	480	130
2032	0	1 538	416	0	814	221	0	436	118
2033	0	1 451	393	0	754	204	0	397	107
2034	0	1 369	371	0	698	189	0	361	98
2035	0	1 291	350	0	647	175	0	328	89
2036	0	1 218	330	0	599	162	0	298	81
2037	0	1 365	311	0	658	150	0	322	73
2038	0	1 084	294	0	513	139	0	246	67
2039	0	1 023	277	0	475	129	0	224	61
2040	0	965	261	0	440	119	0	204	55
2041	0	910	246	0	407	110	0	185	50
2042	0	859	232	0	377	102	0	168	46
2043	0	810	219	0	349	95	0	153	41
2044	0	953	207	0	403	88	0	173	38
2045	0	721	195	0	299	81	0	126	34
2046	0	680	184	0	277	75	0	115	31
2047	0	642	174	0	257	70	0	104	28
2048	0	605	164	0	238	64	0	95	26
2049	0	571	155	0	220	60	0	86	23
2050	0	539	146	0	204	55	0	78	21
2051	0	508	138	0	189	51	0	71	19
2052	0	569	130	0	208	47	0	77	18
2053	0	452	122	0	162	44	0	59	16
RES+2050	0	427	116	0	150	41	0	54	15
TOTAL	**1 400 855**	**89 101**	**19 638**	**1 192 015**	**56 643**	**11 951**	**1 021 117**	**37 694**	**7 608**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 509 593**	**1 790**	**84**
8%	**1 260 609**	**1 089**	**116**
10%	**1 066 419**	**693**	**154**

"

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1c.wb1
Option	SCHEME 1C	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.96

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			210 781	75 844		2006	2007	2	10.0%	115 930	41 714	94 851	34 130
			Dia.	**Length**											
Tunnel	Press. Flow	Impendle to Midmar		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
	Press. Flow	Stukkenberg			53 906	1 000		2006	2007	2	10.0%	29 648	550	24 258	450
			Dia.	**Length**											
Pipeline		Midmar Dam to Umlaas Rd Res			308 814	8 055		2005	2007	3	10.0%	123 526	3 222	92 644	2 417
			FSL	**h**											
Dam	Rockfill	Impendle (1.5 MAR)	1197		369 223	14 793		2005	2007	3	10.0%	147 689	5 917	110 767	4 438
Dam															
			No.	**m3**											
Pump Station		Upsizing Midmar			7 046	12 527	1 719	2007	2007	1	10.0%	7 046	12 527	6 341	11 274
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 545 928	114 219	1 719								
					1 869 790										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm	
	Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1c.wb1
Option	SCHEME 1C	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	4.96

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
			Cap												
Waterworks		Upsizing Midmar			172 636	73 987		2014	2014	1	10.0%	172636.0	73987.0	155372.4	66588.3
			Dia.	**Length**											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2013	2014	2	10.0%	17996.6	4053.5	14724.5	3316.5
								2014	2014	1	10.0%				
			Dia.	**Length**											
Pipeline		Midmar Dam to Umlaas Rd Res			298 192	4 202		2012	2014	3	10.0%	119276.8	1680.8	89457.6	1260.6
			FSL	**h**											
Dam															
Dam															
			No.	**m3**											
Pump Station		Upsizing Midmar		4.3	7 046	12 527	1 718	2014	2014	1	10.0%	7046.0	12527.0	6341.4	11274.3
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					510 595	98 086	1718								
					681 723										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2014	
Sensitivity		
Sensitised	2014	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1C

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	247 115	32	0	0	0	0	0	0	0	0	0	0	247 115	32	0
2004	130 419	32	0	0	0	0	0	0	0	0	0	0	130 419	32	0
2005	411 280	32	0	0	0	0	0	0	0	0	0	0	411 280	32	0
2006	526 653	32	0	0	0	0	0	0	0	0	0	0	526 653	32	0
2007	510 562	32	0	0	0	0	0	0	0	0	0	0	510 562	32	0
2008	0	7 162	379	0	0	0	0	0	0	0	0	0	0	7 162	379
2009	0	7 162	560	0	0	0	0	0	0	0	0	0	0	7 162	560
2010	0	7 162	747	7 560	0	0	0	0	0	0	0	0	7 560	7 162	747
2011	0	7 162	943	8 562	0	0	0	0	0	0	0	0	8 562	7 162	943
2012	0	7 162	1 146	137 082	0	0	0	0	0	0	0	0	137 082	7 162	1 146
2013	0	7 162	1 357	127 317	0	0	0	0	0	0	0	0	127 317	7 162	1 357
2014	0	7 162	1 575	401 202	0	0	0	0	0	0	0	0	401 202	7 162	1 575
2015	0	7 162	1 719	0	5 151	83	0	0	0	0	0	0	0	12 313	1 802
2016	0	7 162	1 719	0	5 151	318	0	0	0	0	0	0	0	12 313	2 037
2017	0	7 162	1 719	0	5 151	563	0	0	0	0	0	0	0	12 313	2 282
2018	0	7 162	1 719	0	5 151	816	0	0	0	0	0	0	0	12 313	2 535
2019	0	7 162	1 719	0	5 151	1 080	0	0	0	0	0	0	0	12 313	2 799
2020	0	7 162	1 719	0	5 151	1 354	0	0	0	0	0	0	0	12 313	3 073
2021	0	7 162	1 719	0	5 151	1 638	0	0	0	0	0	0	0	12 313	3 357
2022	0	9 491	1 719	0	5 151	1 718	0	0	0	0	0	0	0	14 642	3 437
2023	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2024	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2025	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2026	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2027	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2028	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2029	0	7 162	1 719	0	8 135	1 718	0	0	0	0	0	0	0	15 297	3 437
2030	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2031	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2032	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2033	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2034	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2035	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2036	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2037	0	9 491	1 719	0	5 151	1 718	0	0	0	0	0	0	0	14 642	3 437
2038	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2039	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2040	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2041	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2042	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2043	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2044	0	7 162	1 719	0	8 135	1 718	0	0	0	0	0	0	0	15 297	3 437
2045	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2046	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2047	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2048	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2049	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2050	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2051	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2052	0	9 491	1 719	0	5 151	1 718	0	0	0	0	0	0	0	14 642	3 437
2053	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
2054	0	7 162	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 313	3 437
TOTAL	**1 869 790**	**343 750**	**75 467**	**681 723**	**212 003**	**62 545**	**0**	**0**	**0**	**0**	**0**	**0**	**2 551 512**	**555 753**	**138 012**
Commission date		2008			2015			0			0				
Transfer capacity (m3/s)		4.96			4.96			0.00			0.62				

(CONTINUED.....)

Check	**1 869 790**	**681 723**	**0**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1C

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	184 659	24	0	168 183	22	0	153 439	20	0
2004	91 940	23	0	82 186	20	0	73 618	18	0
2005	273 524	22	0	239 978	19	0	211 051	17	0
2006	330 428	20	0	284 534	17	0	245 687	15	0
2007	302 201	19	0	255 408	16	0	216 528	14	0
2008	0	3 999	212	0	3 317	176	0	2 761	146
2009	0	3 773	295	0	3 072	240	0	2 510	196
2010	3 757	3 559	371	3 002	2 844	297	2 409	2 282	238
2011	4 014	3 358	442	3 148	2 633	347	2 480	2 074	273
2012	60 631	3 168	507	46 671	2 438	390	36 098	1 886	302
2013	53 125	2 988	566	40 136	2 258	428	30 479	1 714	325
2014	157 932	2 819	620	117 107	2 090	460	87 313	1 559	343
2015	0	4 572	669	0	3 328	487	0	2 436	356
2016	0	4 314	714	0	3 081	510	0	2 215	366
2017	0	4 069	754	0	2 853	529	0	2 013	373
2018	0	3 839	791	0	2 642	544	0	1 830	377
2019	0	3 622	823	0	2 446	556	0	1 664	378
2020	0	3 417	853	0	2 265	565	0	1 513	377
2021	0	3 223	879	0	2 097	572	0	1 375	375
2022	0	3 616	849	0	2 309	542	0	1 487	349
2023	0	2 869	801	0	1 798	502	0	1 136	317
2024	0	2 706	755	0	1 665	465	0	1 033	288
2025	0	2 553	713	0	1 541	430	0	939	262
2026	0	2 409	672	0	1 427	398	0	854	238
2027	0	2 272	634	0	1 321	369	0	776	217
2028	0	2 144	598	0	1 224	342	0	706	197
2029	0	2 513	565	0	1 408	316	0	797	179
2030	0	1 908	533	0	1 049	293	0	583	163
2031	0	1 800	502	0	971	271	0	530	148
2032	0	1 698	474	0	899	251	0	482	135
2033	0	1 602	447	0	833	232	0	438	122
2034	0	1 511	422	0	771	215	0	398	111
2035	0	1 426	398	0	714	199	0	362	101
2036	0	1 345	375	0	661	185	0	329	92
2037	0	1 509	354	0	728	171	0	356	84
2038	0	1 197	334	0	567	158	0	272	76
2039	0	1 129	315	0	525	146	0	247	69
2040	0	1 065	297	0	486	136	0	225	63
2041	0	1 005	281	0	450	126	0	204	57
2042	0	948	265	0	417	116	0	186	52
2043	0	895	250	0	386	108	0	169	47
2044	0	1 048	236	0	444	100	0	191	43
2045	0	796	222	0	331	92	0	140	39
2046	0	751	210	0	306	85	0	127	35
2047	0	709	198	0	284	79	0	115	32
2048	0	668	187	0	263	73	0	105	29
2049	0	631	176	0	243	68	0	95	27
2050	0	595	166	0	225	63	0	87	24
2051	0	561	157	0	208	58	0	79	22
2052	0	630	148	0	229	54	0	85	20
2053	0	499	139	0	179	50	0	65	18
RES+2050	0	471	132	0	165	46	0	59	17
TOTAL	**1 497 601**	**98 308**	**21 300**	**1 273 417**	**62 485**	**12 839**	**1 090 036**	**41 574**	**8 099**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 617 209**	**1 944**	**83**
8%	**1 348 740**	**1 172**	**115**
10%	**1 139 709**	**740**	**154**

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A WITHOUT STUKKENBERG TUNNEL	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.96

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			210 781	75 844		2006	2007	2	10.0%	115 930	41 714	94 851	34 130
			Dia.	Length											
Tunnel	Press. Flow	Impendle Dam to Midmar Dam		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
	Press. Flow	Stukkenberg		2025											
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			308 814	8 056		2005	2007	3	10.0%	123 526	3 222	92 644	2 417
			FSL	h											
Dam	Rockfill	Impendle (1.0 MAR)	1184		306 658	14 731		2005	2007	3	10.0%	122 663	5 892	91 997	4 419
Dam															
			No.	m3											
Pump Station		Upsizing Midmar			7 046	12 527	1 719	2007	2007	1	10.0%	7 046	12 527	6 341	11 274
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 429 457	113 158	1 719								
					1 738 154										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A WITHOUT STUKKENBERG TUNNEL	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	3.91

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Midmar			172 636	73 987		2014	2014	1	10.0%	172636.0	73987.0	155372.4	66588.3
			Dia.	Length											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2013	2014	2	10.0%	17996.6	4053.5	14724.5	3316.5
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			298 192	4 202		2012	2014	3	10.0%	119276.8	1680.8	89457.6	1260.6
			FSL	h											
Dam															
Dam															
			No.	m3											
Pump Station		Upsizing Midmar			7 046	12 527	1 301	2014	2014	1	10.0%	7046.0	12527.0	6341.4	11274.3
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					510 595	98 086	1301								
					681 723										

Year	Cost Factors	
	Social & Environ.	Admin.
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2014	
Sensitivity		
Sensitised	2014	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A WITHOUT STUKKENBERG TUNNEL	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2021	Output (m3/s)	1.20

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**	**Costs per year**	**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
												Civil	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline															
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle raised (1.5 MAR)	1197		115 701	261		2019	2020	2	10.0%	63635.6	143.6	52065.5	117.5
Dam															
			No.	**m3**											
Pump Station							417								
Pump Station															
Infrastructure								2019	2018						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					115701	261	417								
					129877										

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
Total		

Other Costs

Description	**Cost**
Social & Environ.	
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY
SCHEME 1A WITHOUT STUKKENBERG TUNNEL

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	245 550	32	0	0	0	0	0	0	0	0	0	0	245 550	32	0
2004	127 480	32	0	0	0	0	0	0	0	0	0	0	127 480	32	0
2005	383 103	32	0	0	0	0	0	0	0	0	0	0	383 103	32	0
2006	474 237	32	0	0	0	0	0	0	0	0	0	0	474 237	32	0
2007	464 022	32	0	0	0	0	0	0	0	0	0	0	464 022	32	0
2008	0	6 909	379	0	0	0	0	0	0	0	0	0	0	6 909	379
2009	0	6 909	560	0	0	0	0	0	0	0	0	0	0	6 909	560
2010	0	6 909	747	7 560	0	0	0	0	0	0	0	0	7 560	6 909	747
2011	0	6 909	943	8 562	0	0	0	0	0	0	0	0	8 562	6 909	943
2012	0	6 909	1 146	137 082	0	0	0	0	0	0	0	0	137 082	6 909	1 146
2013	0	6 909	1 357	127 317	0	0	0	0	0	0	0	0	127 317	6 909	1 357
2014	0	6 909	1 575	401 202	0	0	0	0	0	0	0	0	401 202	6 909	1 575
2015	0	6 909	1 719	0	5 151	83	0	0	0	0	0	0	0	12 060	1 802
2016	0	6 909	1 719	0	5 151	318	0	0	0	0	0	0	0	12 060	2 037
2017	0	6 909	1 719	0	5 151	563	2 899	0	0	0	0	0	2 899	12 060	2 282
2018	0	6 909	1 719	0	5 151	817	2 899	0	0	0	0	0	2 899	12 060	2 536
2019	0	6 909	1 719	0	5 151	1 080	68 244	0	0	0	0	0	68 244	12 060	2 799
2020	0	6 909	1 719	0	5 151	1 354	55 836	0	0	0	0	0	55 836	12 060	3 073
2021	0	6 909	1 719	0	5 151	1 301	0	300	337	0	0	0	0	12 360	3 357
2022	0	9 088	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 539	3 437
2023	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2024	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2025	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2026	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2027	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2028	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2029	0	6 909	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 344	3 437
2030	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2031	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2032	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2033	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2034	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2035	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2036	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2037	0	9 088	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 539	3 437
2038	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2039	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2040	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2041	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2042	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2043	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2044	0	6 909	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 344	3 437
2045	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2046	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2047	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2048	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2049	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2050	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2051	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2052	0	9 088	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 539	3 437
2053	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
2054	0	6 909	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 360	3 437
TOTAL	**1 738 154**	**331 421**	**75 467**	**681 723**	**212 003**	**48 448**	**129 877**	**10 190**	**14 098**	**0**	**0**	**0**	**2 549 754**	**553 613**	**138 013**
Commission date		2008			2015			2021			0				
Transfer capacity (m3/s)		4.96			3.91			1.20			0.00				

(CONTINUED.....)

Check	**1 738 154**	**681 723**	**129 877**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A WITHOUT STUKKENBERG TUNNEL

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	183 489	24	0	167 117	22	0	152 467	20	0
2004	89 869	23	0	80 334	20	0	71 959	18	0
2005	254 785	22	0	223 537	19	0	196 592	17	0
2006	297 542	20	0	256 216	17	0	221 235	15	0
2007	274 654	19	0	232 127	16	0	196 791	14	0
2008	0	3 858	212	0	3 200	176	0	2 664	146
2009	0	3 640	295	0	2 963	240	0	2 422	196
2010	3 757	3 434	371	3 002	2 744	297	2 409	2 201	238
2011	4 014	3 239	442	3 148	2 540	347	2 480	2 001	273
2012	60 631	3 056	507	46 671	2 352	390	36 098	1 819	302
2013	53 125	2 883	566	40 136	2 178	428	30 479	1 654	325
2014	157 932	2 720	620	117 107	2 017	460	87 313	1 504	343
2015	0	4 479	669	0	3 259	487	0	2 386	356
2016	0	4 225	714	0	3 018	510	0	2 169	366
2017	958	3 986	754	672	2 794	529	474	1 972	373
2018	904	3 760	791	622	2 587	544	431	1 793	377
2019	20 074	3 547	823	13 557	2 396	556	9 222	1 630	378
2020	15 495	3 347	853	10 270	2 218	565	6 859	1 482	377
2021	0	3 236	879	0	2 105	572	0	1 380	375
2022	0	3 591	849	0	2 293	542	0	1 476	349
2023	0	2 880	801	0	1 805	502	0	1 141	317
2024	0	2 717	755	0	1 671	465	0	1 037	288
2025	0	2 563	713	0	1 547	430	0	943	262
2026	0	2 418	672	0	1 433	398	0	857	238
2027	0	2 281	634	0	1 327	369	0	779	217
2028	0	2 152	598	0	1 228	342	0	708	197
2029	0	2 520	565	0	1 412	316	0	799	179
2030	0	1 915	533	0	1 053	293	0	585	163
2031	0	1 807	502	0	975	271	0	532	148
2032	0	1 705	474	0	903	251	0	484	135
2033	0	1 608	447	0	836	232	0	440	122
2034	0	1 517	422	0	774	215	0	400	111
2035	0	1 431	398	0	717	199	0	363	101
2036	0	1 350	375	0	664	185	0	330	92
2037	0	1 498	354	0	723	171	0	353	84
2038	0	1 202	334	0	569	158	0	273	76
2039	0	1 134	315	0	527	146	0	248	69
2040	0	1 069	297	0	488	136	0	226	63
2041	0	1 009	281	0	452	126	0	205	57
2042	0	952	265	0	418	116	0	187	52
2043	0	898	250	0	387	108	0	170	47
2044	0	1 052	236	0	445	100	0	191	43
2045	0	799	222	0	332	92	0	140	39
2046	0	754	210	0	307	85	0	127	35
2047	0	711	198	0	285	79	0	116	32
2048	0	671	187	0	264	73	0	105	29
2049	0	633	176	0	244	68	0	96	27
2050	0	597	166	0	226	63	0	87	24
2051	0	563	157	0	209	58	0	79	22
2052	0	625	148	0	228	54	0	85	20
2053	0	501	139	0	179	50	0	65	18
RES+2050	0	473	132	0	166	46	0	59	17
TOTAL	**1 452 619**	**97 112**	**21 300**	**1 227 580**	**61 552**	**12 839**	**1 045 742**	**40 848**	**8 100**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 571 031**	**1 940**	**81**
8%	**1 301 971**	**1 169**	**111**
10%	**1 094 690**	**738**	**148**

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1b.WB3
Option	SCHEME 1B WITHOUT STUKKENBERG	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.55

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			189 128	66 564		2006	2007	2	10.0%	104 020	36 610	85 108	29 954
			Dia.	Length											
Tunnel	Press. Flow	Impendle to Midmar		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			303 477	8 055		2005	2007	3	10.0%	121 391	3 222	91 043	2 417
			FSL	h											
Dam	Rockfill	Impendle (1.0 MAR)	1184		295 361	14 731		2005	2007	3	10.0%	118 144	5 892	88 608	4 419
Dam															
			No.	m3											
Pump Station		Upsizing Midmar			6 163	10 956	1 510	2007	2007	1	10.0%	6 163	10 956	5 547	9 860
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 390 287	102 306	1 510								
					1 682 129										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1b.WB3
Option	SCHEME 1B WITHOUT STUKKENBERG	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	4.36

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Midmar			150 982	64 707		2014	2014	1	10.0%	150982.0	64707.0	135883.8	58236.3
			Dia.	Length											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2013	2014	2	10.0%	17996.6	4053.5	14724.5	3316.5
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			292 759	4 202		2012	2014	3	10.0%	117103.6	1680.8	87827.7	1260.6
			FSL	h											
Dam															
Dam															
			No.	m3											
Pump Station		Upsizing Midmar		4.3	6 163	10 956	1 509	2014	2014	1	10.0%	6163.0	10956.0	5546.7	9860.4
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					482 625	87 235	1509								
					638 243										

Year	Cost Factors	
	Social & Environ.	Admin.
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2014	
Sensitivity		
Sensitised	2014	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1b.WB3
Option	SCHEME 1B WITHOUT STUKKENBERG	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**		Output (m3/s)	0.00

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**	**Costs per year**	**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
												Civil	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline															
Pipeline															
			FSL	**h**											
Dam								2020	2021	2					
Dam															
			No.	**m3**											
Pump Station															
Pump Station															
Infrastructure															
Infrastructure															
Advance Infr.															
Advance Infr.															
Total															

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
1	0.3000	
2	0.5000	
3	0.2000	
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
Total	1.0000	

Other Costs

Description	**Cost**
Social & Environ.	
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY
SCHEME 1B WITHOUT STUKKENBERG

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	245 134	32	0	0	0	0	0	0	0	0	0	0	245 134	32	0
2004	126 291	32	0	0	0	0	0	0	0	0	0	0	126 291	32	0
2005	375 148	32	0	0	0	0	0	0	0	0	0	0	375 148	32	0
2006	450 632	32	0	0	0	0	0	0	0	0	0	0	450 632	32	0
2007	441 162	32	0	0	0	0	0	0	0	0	0	0	441 162	32	0
2008	0	6 409	379	0	0	0	0	0	0	0	0	0	0	6 409	379
2009	0	6 409	560	0	0	0	0	0	0	0	0	0	0	6 409	560
2010	0	6 409	747	7 424	0	0	0	0	0	0	0	0	7 424	6 409	747
2011	0	6 409	943	8 426	0	0	0	0	0	0	0	0	8 426	6 409	943
2012	0	6 409	1 145	133 922	0	0	0	0	0	0	0	0	133 922	6 409	1 145
2013	0	6 409	1 356	124 738	0	0	0	0	0	0	0	0	124 738	6 409	1 356
2014	0	6 409	1 575	363 733	0	0	0	0	0	0	0	0	363 733	6 409	1 575
2015	0	6 409	1 510	0	4 647	291	0	0	0	0	0	0	0	11 056	1 801
2016	0	6 409	1 510	0	4 647	527	0	0	0	0	0	0	0	11 056	2 037
2017	0	6 409	1 510	0	4 647	771	0	0	0	0	0	0	0	11 056	2 281
2018	0	6 409	1 510	0	4 647	1 025	0	0	0	0	0	0	0	11 056	2 535
2019	0	6 409	1 510	0	4 647	1 288	0	0	0	0	0	0	0	11 056	2 798
2020	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2021	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2022	0	8 353	1 510	0	4 647	1 509	0	0	0	0	0	0	0	13 000	3 019
2023	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2024	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2025	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2026	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2027	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2028	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2029	0	6 409	1 510	0	7 396	1 509	0	0	0	0	0	0	0	13 805	3 019
2030	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2031	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2032	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2033	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2034	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2035	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2036	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2037	0	8 353	1 510	0	4 647	1 509	0	0	0	0	0	0	0	13 000	3 019
2038	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2039	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2040	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2041	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2042	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2043	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2044	0	6 409	1 510	0	7 396	1 509	0	0	0	0	0	0	0	13 805	3 019
2045	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2046	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2047	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2048	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2049	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2050	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2051	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2052	0	8 353	1 510	0	4 647	1 509	0	0	0	0	0	0	0	13 000	3 019
2053	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
2054	0	6 409	1 510	0	4 647	1 509	0	0	0	0	0	0	0	11 056	3 019
TOTAL	**1 682 129**	**307 236**	**67 105**	**638 243**	**191 373**	**56 717**	**0**	**0**	**0**	**0**	**0**	**0**	**2 320 372**	**498 609**	**123 822**
Commission date		2008			2015			0			0				
Transfer capacity (m3/s)		4.55			4.36			0.00			0.15				

(CONTINUED.....)

Check	**1 682 129**	**638 243**	**0**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1B WITHOUT STUKKENBERG

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	183 178	24	0	166 834	22	0	152 209	20	0
2004	89 030	23	0	79 585	20	0	71 288	18	0
2005	249 495	22	0	218 896	19	0	192 510	17	0
2006	282 732	20	0	243 463	17	0	210 223	15	0
2007	261 123	19	0	220 691	16	0	187 096	14	0
2008	0	3 579	212	0	2 969	175	0	2 471	146
2009	0	3 376	295	0	2 749	240	0	2 246	196
2010	3 690	3 185	371	2 948	2 545	297	2 366	2 042	238
2011	3 951	3 005	442	3 098	2 357	347	2 441	1 857	273
2012	59 234	2 835	507	45 595	2 182	390	35 266	1 688	302
2013	52 049	2 674	566	39 323	2 021	428	29 861	1 534	325
2014	143 182	2 523	620	106 170	1 871	460	79 159	1 395	343
2015	0	4 106	669	0	2 988	487	0	2 187	356
2016	0	3 874	714	0	2 767	510	0	1 989	366
2017	0	3 654	754	0	2 562	529	0	1 808	373
2018	0	3 447	790	0	2 372	544	0	1 643	377
2019	0	3 252	823	0	2 196	556	0	1 494	378
2020	0	3 068	838	0	2 034	555	0	1 358	371
2021	0	2 895	790	0	1 883	514	0	1 235	337
2022	0	3 211	746	0	2 050	476	0	1 320	307
2023	0	2 576	703	0	1 614	441	0	1 020	279
2024	0	2 430	664	0	1 495	408	0	928	253
2025	0	2 293	626	0	1 384	378	0	843	230
2026	0	2 163	591	0	1 282	350	0	767	209
2027	0	2 041	557	0	1 187	324	0	697	190
2028	0	1 925	526	0	1 099	300	0	634	173
2029	0	2 268	496	0	1 270	278	0	719	157
2030	0	1 713	468	0	942	257	0	524	143
2031	0	1 616	441	0	872	238	0	476	130
2032	0	1 525	416	0	808	221	0	433	118
2033	0	1 438	393	0	748	204	0	393	107
2034	0	1 357	371	0	692	189	0	358	98
2035	0	1 280	350	0	641	175	0	325	89
2036	0	1 208	330	0	594	162	0	296	81
2037	0	1 340	311	0	646	150	0	316	73
2038	0	1 075	294	0	509	139	0	244	67
2039	0	1 014	277	0	471	129	0	222	61
2040	0	957	261	0	436	119	0	202	55
2041	0	903	246	0	404	110	0	184	50
2042	0	851	232	0	374	102	0	167	46
2043	0	803	219	0	346	95	0	152	41
2044	0	946	207	0	400	88	0	172	38
2045	0	715	195	0	297	81	0	125	34
2046	0	674	184	0	275	75	0	114	31
2047	0	636	174	0	255	70	0	104	28
2048	0	600	164	0	236	64	0	94	26
2049	0	566	155	0	218	60	0	86	23
2050	0	534	146	0	202	55	0	78	21
2051	0	504	138	0	187	51	0	71	19
2052	0	559	130	0	204	47	0	76	18
2053	0	449	122	0	160	44	0	58	16
RES+2050	0	423	116	0	149	41	0	53	15
TOTAL	**1 363 053**	**88 176**	**19 638**	**1 159 667**	**56 038**	**11 951**	**993 352**	**37 281**	**7 608**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 470 866**	**1 790**	**82**
8%	**1 227 655**	**1 089**	**113**
10%	**1 038 240**	**693**	**150**

"

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1c.wb1
Option	SCHEME 1C WITHOUT STUKKENBERG	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.96

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**	**Costs**	**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
							per year					**Civil**	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			210 781	75 844		2006	2007	2	10.0%	115 930	41 714	94 851	34 130
			Dia.	**Length**											
Tunnel	Press. Flow	Impendle to Midmar		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
	Press. Flow	Stukkenberg													
			Dia.	**Length**											
Pipeline		Midmar Dam to Umlaas Rd Res			308 814	8 055		2005	2007	3	10.0%	123 526	3 222	92 644	2 417
			FSL	**h**											
Dam	Rockfill	Impendle (1.5 MAR)	1197		369 223	14 793		2005	2007	3	10.0%	147 689	5 917	110 767	4 438
Dam															
			No.	**m3**											
Pump Station		Upsizing Midmar			7 046	12 527	1 719	2007	2007	1	10.0%	7 046	12 527	6 341	11 274
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 492 022	113 219	1 719								
					1 808 295										

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	**Cost**
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1c.wb1
Option	SCHEME 1C WITHOUT STUKKENBERG	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	4.96

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Midmar			172 636	73 987		2014	2014	1	10.0%	172636.0	73987.0	155372.4	66588.3
			Dia.	Length											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2013	2014	2	10.0%	17996.6	4053.5	14724.5	3316.5
								2014	2014	1	10.0%				
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			298 192	4 202		2012	2014	3	10.0%	119276.8	1680.8	89457.6	1260.6
			FSL	h											
Dam															
Dam															
			No.	m3											
Pump Station		Upsizing Midmar		4.3	7 046	12 527	1 718	2014	2014	1	10.0%	7046.0	12527.0	6341.4	11274.3
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					510 595	98 086	1718								
					681 723										

Year	Cost Factors	
	Social & Environ.	Admin.
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2014	
Sensitivity		
Sensitised	2014	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ecosch1c.wb1
Option	SCHEME 1C WITHOUT STUKKENBERG	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**		Output (m3/s)	0.00

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**	**Costs per year**	**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
												Civil	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline															
Pipeline															
			FSL	**h**											
Dam															
Dam															
			No.	**m3**											
Pump Station															
Pump Station															
Infrastructure															
Infrastructure															
Advance Infr.															
Advance Infr.															
Total															

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
Total		

Other Costs

Description	**Cost**
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm	
	Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY
SCHEME 1C WITHOUT STUKKENBERG

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	247 115	32	0	0	0	0	0	0	0	0	0	0	247 115	32	0
2004	129 046	32	0	0	0	0	0	0	0	0	0	0	129 046	32	0
2005	409 907	32	0	0	0	0	0	0	0	0	0	0	409 907	32	0
2006	494 340	32	0	0	0	0	0	0	0	0	0	0	494 340	32	0
2007	484 125	32	0	0	0	0	0	0	0	0	0	0	484 125	32	0
2008	0	7 068	379	0	0	0	0	0	0	0	0	0	0	7 068	379
2009	0	7 068	560	0	0	0	0	0	0	0	0	0	0	7 068	560
2010	0	7 068	747	7 560	0	0	0	0	0	0	0	0	7 560	7 068	747
2011	0	7 068	943	8 562	0	0	0	0	0	0	0	0	8 562	7 068	943
2012	0	7 068	1 146	137 082	0	0	0	0	0	0	0	0	137 082	7 068	1 146
2013	0	7 068	1 357	127 317	0	0	0	0	0	0	0	0	127 317	7 068	1 357
2014	0	7 068	1 575	401 202	0	0	0	0	0	0	0	0	401 202	7 068	1 575
2015	0	7 068	1 719	0	5 151	83	0	0	0	0	0	0	0	12 219	1 802
2016	0	7 068	1 719	0	5 151	318	0	0	0	0	0	0	0	12 219	2 037
2017	0	7 068	1 719	0	5 151	563	0	0	0	0	0	0	0	12 219	2 282
2018	0	7 068	1 719	0	5 151	816	0	0	0	0	0	0	0	12 219	2 535
2019	0	7 068	1 719	0	5 151	1 080	0	0	0	0	0	0	0	12 219	2 799
2020	0	7 068	1 719	0	5 151	1 354	0	0	0	0	0	0	0	12 219	3 073
2021	0	7 068	1 719	0	5 151	1 638	0	0	0	0	0	0	0	12 219	3 357
2022	0	9 247	1 719	0	5 151	1 718	0	0	0	0	0	0	0	14 398	3 437
2023	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2024	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2025	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2026	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2027	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2028	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2029	0	7 068	1 719	0	8 135	1 718	0	0	0	0	0	0	0	15 203	3 437
2030	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2031	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2032	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2033	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2034	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2035	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2036	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2037	0	9 247	1 719	0	5 151	1 718	0	0	0	0	0	0	0	14 398	3 437
2038	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2039	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2040	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2041	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2042	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2043	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2044	0	7 068	1 719	0	8 135	1 718	0	0	0	0	0	0	0	15 203	3 437
2045	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2046	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2047	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2048	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2049	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2050	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2051	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2052	0	9 247	1 719	0	5 151	1 718	0	0	0	0	0	0	0	14 398	3 437
2053	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
2054	0	7 068	1 719	0	5 151	1 718	0	0	0	0	0	0	0	12 219	3 437
TOTAL	**1 808 295**	**338 887**	**75 467**	**681 723**	**212 003**	**62 545**	**0**	**0**	**0**	**0**	**0**	**0**	**2 490 018**	**550 890**	**138 012**
Commission date		2008			2015			0			0				
Transfer capacity (m3/s)		4.96			4.96			0.00			0.62				

(CONTINUED.....)

Check	**1 808 295**	**681 723**	**0**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1C WITHOUT STUKKENBERG

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	184 659	24	0	168 183	22	0	153 439	20	0
2004	90 972	23	0	81 321	20	0	72 843	18	0
2005	272 611	22	0	239 177	19	0	210 347	17	0
2006	310 155	20	0	267 077	17	0	230 613	15	0
2007	286 553	19	0	242 183	16	0	205 316	14	0
2008	0	3 947	212	0	3 274	176	0	2 725	146
2009	0	3 723	295	0	3 031	240	0	2 477	196
2010	3 757	3 512	371	3 002	2 807	297	2 409	2 252	238
2011	4 014	3 314	442	3 148	2 599	347	2 480	2 047	273
2012	60 631	3 126	507	46 671	2 406	390	36 098	1 861	302
2013	53 125	2 949	566	40 136	2 228	428	30 479	1 692	325
2014	157 932	2 782	620	117 107	2 063	460	87 313	1 538	343
2015	0	4 538	669	0	3 302	487	0	2 417	356
2016	0	4 281	714	0	3 058	510	0	2 198	366
2017	0	4 038	754	0	2 831	529	0	1 998	373
2018	0	3 810	791	0	2 621	544	0	1 816	377
2019	0	3 594	823	0	2 427	556	0	1 651	378
2020	0	3 391	853	0	2 248	565	0	1 501	377
2021	0	3 199	879	0	2 081	572	0	1 365	375
2022	0	3 556	849	0	2 271	542	0	1 462	349
2023	0	2 847	801	0	1 784	502	0	1 128	317
2024	0	2 686	755	0	1 652	465	0	1 025	288
2025	0	2 534	713	0	1 530	430	0	932	262
2026	0	2 390	672	0	1 416	398	0	847	238
2027	0	2 255	634	0	1 311	369	0	770	217
2028	0	2 127	598	0	1 214	342	0	700	197
2029	0	2 497	565	0	1 399	316	0	792	179
2030	0	1 893	533	0	1 041	293	0	579	163
2031	0	1 786	502	0	964	271	0	526	148
2032	0	1 685	474	0	893	251	0	478	135
2033	0	1 590	447	0	826	232	0	435	122
2034	0	1 500	422	0	765	215	0	395	111
2035	0	1 415	398	0	709	199	0	359	101
2036	0	1 335	375	0	656	185	0	327	92
2037	0	1 484	354	0	716	171	0	350	84
2038	0	1 188	334	0	562	158	0	270	76
2039	0	1 121	315	0	521	146	0	245	69
2040	0	1 057	297	0	482	136	0	223	63
2041	0	997	281	0	446	126	0	203	57
2042	0	941	265	0	413	116	0	184	52
2043	0	888	250	0	383	108	0	168	47
2044	0	1 042	236	0	441	100	0	190	43
2045	0	790	222	0	328	92	0	139	39
2046	0	745	210	0	304	85	0	126	35
2047	0	703	198	0	281	79	0	114	32
2048	0	663	187	0	261	73	0	104	29
2049	0	626	176	0	241	68	0	95	27
2050	0	590	166	0	223	63	0	86	24
2051	0	557	157	0	207	58	0	78	22
2052	0	619	148	0	226	54	0	84	20
2053	0	496	139	0	177	50	0	65	18
RES+2050	0	468	132	0	164	46	0	59	17
TOTAL	**1 459 799**	**97 383**	**21 300**	**1 241 068**	**61 880**	**12 839**	**1 062 271**	**41 160**	**8 099**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 578 482**	**1 944**	**81**
8%	**1 315 787**	**1 172**	**112**
10%	**1 111 530**	**740**	**150**

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2A.WB3
Option	SCHEME 2A	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.66

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Baynesfield & Umlaas Rd Res.			200 793	72 247		2006	2007	2	10.0%	110436.2	39735.9	90356.9	32511.2
			Dia.	Length											
Tunnel		Smithfield to Baynesfield			541 292	2 000		2002	2007	6	20.0%	180430.7	666.7	72172.3	266.7
			Dia.	Length											
Pipeline		Baynesfield to Umlaas Rd Res.			209 022	3 419		2005	2007	3	10.0%	83608.8	1367.6	62706.6	1025.7
			FSL	h											
Dam	composite	Smithfield dam			210 693	10 913		2005	2007	3	10.0%	84277.2	4365.2	63207.9	3273.9
Dam	Earthfill	Baynesfield dam.			3 518	2 473		2007	2007	1	10.0%	3518.0	2473.0	3166.2	2225.7
			No.	m3											
Pump Station		Smithfield dam intake tower		3.2	37 260	30 763	3840	2007	2007	1	10.0%	37260.0	30763.0	33534.0	27686.7
Infrastructure			N/A	N/A				2002	2001						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	13 860			2001	2001	1	10.0%	13860.0		12474.0	
Advance Infr.			N/A	N/A											
Total					1 216 438	121 815	3840								
					1 502 637										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2002	0.4000	
2003	0.4000	
2004	0.2000	
2005		
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	3794
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2A.WB3
Option	SCHEME 2A	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	5.96

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Baynesfield			245 902	105 387		2014	2014	1	10.0%	245902.0	105387.0	221311.8	94848.3
			Dia.	**Length**											
Tunnel															
			Dia.	**Length**											
Pipeline		Baynesfield to Umlaas Rd Res.			205 531	3 419		2012	2014	3	10.0%	82212.4	1367.6	61659.3	1025.7
			FSL	**h**											
Dam	Rockfill	Impendle (1.0 MAR)for raising	1184		306 658	14 731		2012	2014	3	10.0%	122663.2	5892.4	91997.4	4419.3
Dam															
			No.	**m3**											
Pump Station		Smithfield Additional Pumps				20 116	4977	2014	2014	1			20116.0		20116.0
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2011	2011	1	10.0%	12947.0		11652.3	
Advance Infr.			N/A	N/A											
Total					771 038	143 653	4977								
					1 034 879										

Year	Cost Factors	
	Social & Environ.	Admin.
2012	0.4000	
2013	0.4000	
2014	0.2000	
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total	0.6000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2A.WB3
Option	SCHEME 2A	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2023	Output (m3/s)	1.30

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	Length											
Tunnel															
Tunnel															
			Dia.	Length											
Pipeline															
Pipeline															
			FSL	h											
Dam	Rockfill	Impendle (1.5 MAR) raised	1197		115 701	261		2021	2022	2	10.0%	63635.6	143.6	52065.5	117.5
Dam															
			No.	m3											
Pump Station							1103								
Pump Station															
Infrastructure								2021	2020						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					115 701	261	1103								
					129 877										

Year	Cost Factors	
	Social & Environ.	Admin.
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
2036		
2037		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2A

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	14 275	0	0	0	0	0	0	0	0	0	0	0	14 275	0	0
2001	28 413	0	0	0	0	0	0	0	0	0	0	0	28 413	0	0
2002	195 292	35	0	0	0	0	0	0	0	0	0	0	195 292	35	0
2003	89 878	35	0	0	0	0	0	0	0	0	0	0	89 878	35	0
2004	95 946	35	0	0	0	0	0	0	0	0	0	0	95 946	35	0
2005	271 958	35	0	0	0	0	0	0	0	0	0	0	271 958	35	0
2006	379 373	35	0	0	0	0	0	0	0	0	0	0	379 373	35	0
2007	427 502	35	0	0	0	0	0	0	0	0	0	0	427 502	35	0
2008	0	6 801	901	0	0	0	0	0	0	0	0	0	0	6 801	901
2009	0	6 801	1 332	0	0	0	0	0	0	0	0	0	0	6 801	1 332
2010	0	6 801	1 778	13 906	0	0	0	0	0	0	0	0	13 906	6 801	1 778
2011	0	6 801	2 243	27 112	0	0	0	0	0	0	0	0	27 112	6 801	2 243
2012	0	6 801	2 725	240 440	32	0	0	0	0	0	0	0	240 440	6 833	2 725
2013	0	6 801	3 226	183 694	32	0	0	0	0	0	0	0	183 694	6 833	3 226
2014	0	6 801	3 746	569 727	32	0	0	0	0	0	0	0	569 727	6 833	3 746
2015	0	6 801	3 840	0	7 674	451	0	0	0	0	0	0	0	14 474	4 291
2016	0	6 801	3 840	0	7 674	1 019	0	0	0	0	0	0	0	14 474	4 859
2017	0	6 801	3 840	0	7 674	1 608	0	0	0	0	0	0	0	14 474	5 448
2018	0	6 801	3 840	0	7 674	2 220	0	0	0	0	0	0	0	14 474	6 060
2019	0	6 801	3 840	0	7 674	2 856	2 899	0	0	0	0	0	2 899	14 474	6 696
2020	0	6 801	3 840	0	7 674	3 516	2 899	0	0	0	0	0	2 899	14 474	7 356
2021	0	6 801	3 840	0	7 674	4 201	68 244	0	0	0	0	0	68 244	14 474	8 041
2022	0	11 715	3 840	0	7 674	4 912	55 836	0	0	0	0	0	55 836	19 389	8 752
2023	0	6 801	3 840	0	7 674	4 977	0	300	685	0	0	0	0	14 774	9 502
2024	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2025	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2026	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2027	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2028	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2029	0	6 801	3 840	0	10 691	4 977	0	300	1 103	0	0	0	0	17 791	9 920
2030	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2031	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2032	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2033	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2034	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2035	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2036	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2037	0	11 715	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	19 688	9 920
2038	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2039	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2040	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2041	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2042	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2043	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2044	0	6 801	3 840	0	10 691	4 977	0	300	1 103	0	0	0	0	17 791	9 920
2045	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2046	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2047	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2048	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2049	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2050	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2051	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2052	0	11 715	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	19 688	9 920
2053	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
2054	0	6 801	3 840	0	7 674	4 977	0	300	1 103	0	0	0	0	14 774	9 920
TOTAL	**1 502 637**	**334 578**	**169 550**	**1 034 879**	**313 081**	**180 048**	**129 877**	**9 590**	**34 878**	**0**	**0**	**0**	**2 667 394**	**657 249**	**384 476**
Commission date		2008			2015			2023			0				
Transfer capacity (m3/s)		4.66			5.96			1.30			0.00				

(CONTINUED.....)

Check	**1 502 637**	**1 034 879**	**129 877**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2A

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	12 705	0	0	12 239	0	0	11 798	0	0
2001	23 856	0	0	22 555	0	0	21 347	0	0
2002	154 689	27	0	143 545	25	0	133 387	24	0
2003	67 162	26	0	61 170	24	0	55 807	22	0
2004	67 638	24	0	60 462	22	0	54 159	20	0
2005	180 868	23	0	158 685	20	0	139 558	18	0
2006	238 023	22	0	204 964	19	0	176 980	16	0
2007	253 038	21	0	213 858	17	0	181 303	15	0
2008	0	3 797	503	0	3 150	417	0	2 622	347
2009	0	3 582	702	0	2 917	571	0	2 384	467
2010	6 911	3 380	883	5 522	2 701	706	4 431	2 167	566
2011	12 711	3 188	1 051	9 969	2 501	825	7 853	1 970	650
2012	106 347	3 022	1 205	81 861	2 326	928	63 315	1 799	717
2013	76 649	2 851	1 346	57 908	2 154	1 017	43 975	1 636	772
2014	224 271	2 690	1 475	166 298	1 994	1 093	123 989	1 487	815
2015	0	5 375	1 594	0	3 912	1 160	0	2 864	849
2016	0	5 071	1 702	0	3 622	1 216	0	2 603	874
2017	0	4 784	1 801	0	3 354	1 262	0	2 367	891
2018	0	4 513	1 890	0	3 105	1 300	0	2 152	901
2019	853	4 258	1 970	576	2 875	1 330	392	1 956	905
2020	805	4 017	2 041	533	2 662	1 353	356	1 778	904
2021	17 866	3 789	2 105	11 623	2 465	1 369	7 621	1 616	898
2022	13 790	4 789	2 162	8 805	3 058	1 380	5 669	1 968	889
2023	0	3 442	2 214	0	2 157	1 387	0	1 364	877
2024	0	3 247	2 181	0	1 997	1 341	0	1 240	832
2025	0	3 064	2 057	0	1 850	1 242	0	1 127	757
2026	0	2 890	1 941	0	1 713	1 150	0	1 024	688
2027	0	2 727	1 831	0	1 586	1 065	0	931	625
2028	0	2 572	1 727	0	1 468	986	0	847	569
2029	0	2 922	1 629	0	1 637	913	0	927	517
2030	0	2 289	1 537	0	1 259	845	0	700	470
2031	0	2 160	1 450	0	1 166	783	0	636	427
2032	0	2 038	1 368	0	1 079	725	0	578	388
2033	0	1 922	1 291	0	999	671	0	526	353
2034	0	1 813	1 218	0	925	621	0	478	321
2035	0	1 711	1 149	0	857	575	0	434	292
2036	0	1 614	1 084	0	793	533	0	395	265
2037	0	2 029	1 022	0	979	493	0	479	241
2038	0	1 436	964	0	680	457	0	326	219
2039	0	1 355	910	0	630	423	0	297	199
2040	0	1 278	858	0	583	391	0	270	181
2041	0	1 206	810	0	540	362	0	245	165
2042	0	1 138	764	0	500	336	0	223	150
2043	0	1 073	721	0	463	311	0	203	136
2044	0	1 219	680	0	516	288	0	222	124
2045	0	955	641	0	397	266	0	168	112
2046	0	901	605	0	367	247	0	152	102
2047	0	850	571	0	340	228	0	138	93
2048	0	802	539	0	315	212	0	126	85
2049	0	757	508	0	292	196	0	114	77
2050	0	714	479	0	270	181	0	104	70
2051	0	673	452	0	250	168	0	95	63
2052	0	847	427	0	309	155	0	115	58
2053	0	599	402	0	214	144	0	78	52
RES+2050	0	565	380	0	199	133	0	71	48
TOTAL	**1 458 182**	**112 061**	**56 838**	**1 220 572**	**70 252**	**33 756**	**1 031 940**	**46 114**	**21 001**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 627 081**	**2 160**	**75**
8%	**1 324 580**	**1 284**	**103**
10%	**1 099 054**	**799**	**138**

"

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2B.WB3
Option	SCHEME 2B	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.66

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Baynesfield & Umlaas Rd Res.			222 150	81 400		2006	2007	2	10.0%	122182.5	44770.0	99967.5	36630.0
			Dia.	Length											
Tunnel		Smithfield to Baynesfield			541 292	2 000		2003	2007	5	20.0%	194865.1	720.0	86606.7	320.0
			Dia.	Length											
Pipeline		Baynesfield to Umlaas Rd Res.			209 022	3 419		2005	2007	3	10.0%	83608.8	1367.6	62706.6	1025.7
			FSL	h											
Dam	composite	Smithfield dam			210 693	10 913		2005	2007	3	10.0%	84277.2	4365.2	63207.9	3273.9
Dam	Earthfill	Baynesfield dam.			3 518	2 473		2007	2007	1	10.0%	3518.0	2473.0	3166.2	2225.7
			No.	m3											
Pump Station		Smithfield dam intake tower		3.2	37 260	34 171	3841	2007	2007	1	10.0%	37260.0	34171.0	33534.0	30753.9
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	13 860			2002	2002	1	10.0%	13860.0		12474.0	
Advance Infr.			N/A	N/A											
Total					1 237 795	134 376	3841								
					1 540 626										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	3794
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2B.WB3
Option	SCHEME 2B	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	0.65

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
			Dia.	**Length**											
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle (1.0 MAR)	1184		295 361	14 731		2012	2014	3	10.0%	118144.4	5892.4	88608.3	4419.3
Dam															
			No.	**m3**											
Pump Station							537								
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2011	2011	1	10.0%	12947.0		11652.3	
Advance Infr.			N/A	N/A											
Total					308 308	14 731	537								
					372 229										

Year	Cost Factors	
	Social & Environ.	Admin.
2012	0.4000	
2013	0.4000	
2014	0.2000	
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total	0.6000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2B.WB3
Option	SCHEME 2B	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2016	Output (m3/s)	5.31

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Baynesfield			183 908	78 818		2014	2015	2	10.0%	101149.4	43349.9	82758.6	35468.1
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline		Baynesfield to Umlaas Rd Res.			205 531	3 419		2013	2015	3	10.0%	82212.4	1367.6	61659.3	1025.7
Pipeline															
			FSL	**h**											
Dam															
Dam															
			No.	**m3**											
Pump Station		Smithfield Additional Pumps				16 708	4440	2015	2015	1	10.0%		16708.0		15037.2
Pump Station															
Infrastructure								2013	2012						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					389 439	98 945	4440								
					546 990										

Year	Cost Factors	
	Social & Environ.	Admin.
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2B

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	14 275	0	0	0	0	0	0	0	0	0	0	0	14 275	0	0
2002	28 412	0	0	0	0	0	0	0	0	0	0	0	28 412	0	0
2003	221 645	35	0	0	0	0	0	0	0	0	0	0	221 645	35	0
2004	112 969	35	0	0	0	0	0	0	0	0	0	0	112 969	35	0
2005	289 067	35	0	0	0	0	0	0	0	0	0	0	289 067	35	0
2006	412 915	35	0	0	0	0	0	0	0	0	0	0	412 915	35	0
2007	461 342	35	0	0	0	0	0	0	0	0	0	0	461 342	35	0
2008	0	7 324	901	0	0	0	0	0	0	0	0	0	0	7 324	901
2009	0	7 324	1 333	0	0	0	0	0	0	0	0	0	0	7 324	1 333
2010	0	7 324	1 778	8 400	0	0	0	0	0	0	0	0	8 400	7 324	1 778
2011	0	7 324	2 243	21 606	0	0	5 224	0	0	0	0	0	26 829	7 324	2 243
2012	0	7 324	2 725	136 889	32	0	11 792	0	0	0	0	0	148 681	7 357	2 725
2013	0	7 324	3 227	103 710	32	0	96 416	0	0	0	0	0	200 126	7 357	3 227
2014	0	7 324	3 747	101 625	32	0	222 105	0	0	0	0	0	323 729	7 357	3 747
2015	0	7 324	3 841	0	1 360	447	211 453	0	0	0	0	0	211 453	8 684	4 288
2016	0	7 324	3 841	0	1 360	537	0	4 931	477	0	0	0	0	13 616	4 855
2017	0	7 324	3 841	0	1 360	537	0	4 931	1 067	0	0	0	0	13 616	5 445
2018	0	7 324	3 841	0	1 360	537	0	4 931	1 680	0	0	0	0	13 616	6 058
2019	0	7 324	3 841	0	1 360	537	0	4 931	2 316	0	0	0	0	13 616	6 694
2020	0	7 324	3 841	0	1 360	537	0	4 931	2 977	0	0	0	0	13 616	7 355
2021	0	7 324	3 841	0	1 360	537	0	4 931	3 663	0	0	0	0	13 616	8 041
2022	0	12 750	3 841	0	1 360	537	0	4 931	4 375	0	0	0	0	19 041	8 753
2023	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2024	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2025	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2026	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2027	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2028	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2029	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2030	0	7 324	3 841	0	1 360	537	0	7 438	4 440	0	0	0	0	16 122	8 818
2031	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2032	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2033	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2034	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2035	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2036	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2037	0	12 750	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	19 041	8 818
2038	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2039	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2040	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2041	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2042	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2043	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2044	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2045	0	7 324	3 841	0	1 360	537	0	7 438	4 440	0	0	0	0	16 122	8 818
2046	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2047	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2048	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2049	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2050	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2051	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2052	0	12 750	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	19 041	8 818
2053	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
2054	0	7 324	3 841	0	1 360	537	0	4 931	4 440	0	0	0	0	13 616	8 818
TOTAL	**1 540 626**	**360 695**	**169 595**	**372 229**	**54 498**	**21 390**	**546 990**	**197 337**	**158 635**	**0**	**0**	**0**	**2 459 844**	**612 530**	**349 619**
Commission date		2008			2015			2016			0				
Transfer capacity (m3/s)		4.66			0.65			5.31			0.00				

(CONTINUED.....)

Check	**1 540 626**	**372 229**	**546 990**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2B

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	11 986	0	0	11 332	0	0	10 725	0	0
2002	22 505	0	0	20 884	0	0	19 406	0	0
2003	165 626	26	0	150 848	24	0	137 624	22	0
2004	79 639	24	0	71 190	22	0	63 768	20	0
2005	192 246	23	0	168 668	20	0	148 337	18	0
2006	259 068	22	0	223 085	19	0	192 628	16	0
2007	273 067	21	0	230 786	17	0	195 654	15	0
2008	0	4 090	503	0	3 393	418	0	2 824	348
2009	0	3 858	702	0	3 141	572	0	2 567	467
2010	4 174	3 640	884	3 336	2 909	706	2 676	2 334	567
2011	12 579	3 434	1 052	9 865	2 693	825	7 772	2 122	650
2012	65 762	3 254	1 205	50 620	2 505	928	39 152	1 937	718
2013	83 506	3 070	1 346	63 088	2 319	1 017	47 909	1 761	773
2014	127 435	2 896	1 475	94 494	2 147	1 094	70 453	1 601	815
2015	78 526	3 225	1 592	57 149	2 347	1 159	41 835	1 718	848
2016	0	4 770	1 701	0	3 407	1 215	0	2 449	873
2017	0	4 500	1 800	0	3 155	1 262	0	2 226	890
2018	0	4 245	1 889	0	2 921	1 300	0	2 024	900
2019	0	4 005	1 969	0	2 705	1 330	0	1 840	905
2020	0	3 778	2 041	0	2 504	1 353	0	1 673	904
2021	0	3 565	2 105	0	2 319	1 369	0	1 521	898
2022	0	4 703	2 162	0	3 003	1 380	0	1 933	889
2023	0	3 172	2 055	0	1 988	1 288	0	1 257	814
2024	0	2 993	1 938	0	1 841	1 192	0	1 142	740
2025	0	2 823	1 829	0	1 705	1 104	0	1 039	673
2026	0	2 664	1 725	0	1 578	1 022	0	944	611
2027	0	2 513	1 627	0	1 461	946	0	858	556
2028	0	2 371	1 535	0	1 353	876	0	780	505
2029	0	2 236	1 448	0	1 253	811	0	709	459
2030	0	2 498	1 366	0	1 374	751	0	764	418
2031	0	1 990	1 289	0	1 074	696	0	586	380
2032	0	1 878	1 216	0	995	644	0	533	345
2033	0	1 771	1 147	0	921	596	0	485	314
2034	0	1 671	1 082	0	853	552	0	440	285
2035	0	1 577	1 021	0	790	511	0	400	259
2036	0	1 487	963	0	731	473	0	364	236
2037	0	1 962	909	0	947	438	0	463	214
2038	0	1 324	857	0	627	406	0	301	195
2039	0	1 249	809	0	580	376	0	273	177
2040	0	1 178	763	0	537	348	0	249	161
2041	0	1 111	720	0	498	322	0	226	146
2042	0	1 049	679	0	461	298	0	205	133
2043	0	989	641	0	427	276	0	187	121
2044	0	933	604	0	395	256	0	170	110
2045	0	1 042	570	0	433	237	0	183	100
2046	0	831	538	0	339	219	0	140	91
2047	0	784	507	0	314	203	0	128	83
2048	0	739	479	0	290	188	0	116	75
2049	0	697	452	0	269	174	0	105	68
2050	0	658	426	0	249	161	0	96	62
2051	0	621	402	0	230	149	0	87	56
2052	0	819	379	0	298	138	0	111	51
2053	0	552	358	0	198	128	0	72	47
RES+2053	0	521	337	0	183	118	0	65	42
TOTAL	**1 376 119**	**105 854**	**53 099**	**1 155 344**	**66 759**	**31 828**	**977 939**	**44 098**	**19 972**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 535 072**	**2 021**	**76**
8%	**1 253 931**	**1 212**	**103**
10%	**1 042 010**	**761**	**137**

"

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.66

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Baynesfield & Umlaas Rd Res.			200 793	72 247		2006	2007	2	10.0%	110436.2	39735.9	90356.9	32511.2
			Dia.	Length											
Tunnel		Smithfield to Baynesfield			541 292	2 000		2003	2007	5	20.0%	194865.1	720.0	86606.7	320.0
			Dia.	Length											
Pipeline		Baynesfield to Umlaas Rd Res.			209 022	3 419		2005	2007	3	10.0%	83608.8	1367.6	62706.6	1025.7
			FSL	h											
Dam	composite	Smithfield dam			210 693	10 913		2005	2007	3	10.0%	84277.2	4365.2	63207.9	3273.9
Dam	Earthfill	Baynesfield dam.			3 518	2 473		2007	2007	1	10.0%	3518.0	2473.0	3166.2	2225.7
			No.	m3											
Pump Station		Smithfield dam intake tower		3.2	37 260	30 763	3841	2007	2007	1	10.0%	37260.0	30763.0	33534.0	27686.7
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	13 860			2002	2002	1	10.0%	13860.0		12474.0	
Advance Infr.			N/A	N/A											
Total					1 216 438	121 815	3841								
					1 502 637										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	3794
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	1.30

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity Costs per year**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**		**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
												Civil	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks		Upsizing Baynesfield			245 902	105 387		2013	2014	2	10.0%	135246.1	57962.9	110655.9	47424.2
			Dia.	**Length**											
Tunnel															
			Dia.	**Length**											
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle (1.5 MAR)	1197		369 223	14 793		2011	2014	4	10.0%	119997.5	4807.7	83075.2	3328.4
Dam															
			No.	**m3**											
Pump Station		Smithfield Additional Pumps				20 116	1 075	2014	2014	1	10.0%		20116.0		18104.4
Infrastructure			N/A	N/A				2011	2010						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2010	2010	1	10.0%	12947.0		11652.3	
Advance Infr.			N/A	N/A											
Total					628 072	140 296	1 075								
					870 997										

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
2011	0.4000	
2012	0.4000	
2013	0.2000	
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
Total	0.6000	

Other Costs

Description	**Cost**
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2017	Output (m3/s)	5.96

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline		Baynesfield to Umlaas Rd Res.			205 531	3 419		2014	2016	3	10.0%	82212.4	1367.6	61659.3	1025.7
Pipeline															
			FSL	**h**											
Dam															
Dam															
			No.	**m3**											
Pump Station							5 004								
Pump Station															
Infrastructure								2014	2013						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					205 531	3 419	5 004								
					234 024										

Year	Cost Factors	
	Social & Environ.	Admin.
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	14 275	0	0	0	0	0	0	0	0	0	0	0	14 275	0	0
2002	28 412	0	0	0	0	0	0	0	0	0	0	0	28 412	0	0
2003	221 645	35	0	0	0	0	0	0	0	0	0	0	221 645	35	0
2004	112 206	35	0	0	0	0	0	0	0	0	0	0	112 206	35	0
2005	288 219	35	0	0	0	0	0	0	0	0	0	0	288 219	35	0
2006	394 875	35	0	0	0	0	0	0	0	0	0	0	394 875	35	0
2007	443 004	35	0	0	0	0	0	0	0	0	0	0	443 004	35	0
2008	0	6 801	901	0	0	0	0	0	0	0	0	0	0	6 801	901
2009	0	6 801	1 333	10 248	0	0	0	0	0	0	0	0	10 248	6 801	1 333
2010	0	6 801	1 778	23 454	0	0	0	0	0	0	0	0	23 454	6 801	1 778
2011	0	6 801	2 243	146 494	32	0	0	0	0	0	0	0	146 494	6 833	2 243
2012	0	6 801	2 725	105 907	32	0	5 224	0	0	0	0	0	111 131	6 833	2 725
2013	0	6 801	3 227	301 773	32	0	5 224	0	0	0	0	0	306 997	6 833	3 227
2014	0	6 801	3 747	283 122	32	0	89 431	0	0	0	0	0	372 552	6 833	3 747
2015	0	6 801	3 841	0	7 182	447	67 073	0	0	0	0	0	67 073	13 983	4 288
2016	0	6 801	3 841	0	7 182	1 009	67 073	0	0	0	0	0	67 073	13 983	4 850
2017	0	6 801	3 841	0	7 182	1 075	0	651	526	0	0	0	0	14 633	5 442
2018	0	6 801	3 841	0	7 182	1 075	0	651	1 141	0	0	0	0	14 633	6 057
2019	0	6 801	3 841	0	7 182	1 075	0	651	1 780	0	0	0	0	14 633	6 696
2020	0	6 801	3 841	0	7 182	1 075	0	651	2 443	0	0	0	0	14 633	7 359
2021	0	6 801	3 841	0	7 182	1 075	0	651	3 132	0	0	0	0	14 633	8 048
2022	0	11 715	3 841	0	7 182	1 075	0	651	3 847	0	0	0	0	19 548	8 763
2023	0	6 801	3 841	0	7 182	1 075	0	651	4 590	0	0	0	0	14 633	9 506
2024	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2025	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2026	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2027	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2028	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2029	0	6 801	3 841	0	10 199	1 075	0	651	5 004	0	0	0	0	17 651	9 920
2030	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2031	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2032	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2033	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2034	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2035	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2036	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2037	0	11 715	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	19 548	9 920
2038	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2039	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2040	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2041	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2042	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2043	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2044	0	6 801	3 841	0	10 199	1 075	0	651	5 004	0	0	0	0	17 651	9 920
2045	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2046	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2047	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2048	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2049	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2050	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2051	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2052	0	11 715	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	19 548	9 920
2053	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2054	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
TOTAL	**1 502 637**	**334 543**	**169 595**	**870 997**	**293 445**	**42 306**	**234 024**	**24 722**	**172 584**	**0**	**0**	**0**	**2 607 659**	**652 711**	**384 485**
Commission date		2008			2015			2017			0				
Transfer capacity (m3/s)		4.66			1.30			5.96			0.00				

(CONTINUED.....)

Check	**1 502 637**	**870 997**	**234 024**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	11 986	0	0	11 332	0	0	10 725	0	0
2002	22 505	0	0	20 884	0	0	19 406	0	0
2003	165 626	26	0	150 848	24	0	137 624	22	0
2004	79 101	24	0	70 709	22	0	63 338	20	0
2005	191 682	23	0	168 173	20	0	147 902	18	0
2006	247 750	22	0	213 339	19	0	184 212	16	0
2007	262 214	21	0	221 613	17	0	187 877	15	0
2008	0	3 797	503	0	3 150	418	0	2 622	348
2009	5 398	3 582	702	4 395	2 917	572	3 592	2 384	467
2010	11 656	3 380	884	9 314	2 701	706	7 473	2 167	567
2011	68 682	3 204	1 052	53 865	2 512	825	42 434	1 979	650
2012	49 153	3 022	1 205	37 836	2 326	928	29 264	1 799	718
2013	128 099	2 851	1 346	96 778	2 154	1 017	73 493	1 636	773
2014	146 654	2 690	1 475	108 744	1 994	1 094	81 078	1 487	815
2015	24 909	5 193	1 592	18 128	3 779	1 159	13 270	2 766	848
2016	23 499	4 899	1 699	16 785	3 499	1 214	12 064	2 515	872
2017	0	4 836	1 799	0	3 391	1 261	0	2 393	890
2018	0	4 563	1 889	0	3 140	1 300	0	2 175	900
2019	0	4 304	1 970	0	2 907	1 330	0	1 977	905
2020	0	4 061	2 042	0	2 692	1 354	0	1 798	904
2021	0	3 831	2 107	0	2 492	1 371	0	1 634	899
2022	0	4 828	2 164	0	3 083	1 382	0	1 985	890
2023	0	3 410	2 215	0	2 137	1 388	0	1 351	877
2024	0	3 217	2 181	0	1 978	1 341	0	1 228	832
2025	0	3 034	2 057	0	1 832	1 242	0	1 116	757
2026	0	2 863	1 941	0	1 696	1 150	0	1 015	688
2027	0	2 701	1 831	0	1 571	1 065	0	922	625
2028	0	2 548	1 727	0	1 454	986	0	839	569
2029	0	2 899	1 629	0	1 624	913	0	920	517
2030	0	2 268	1 537	0	1 247	845	0	693	470
2031	0	2 139	1 450	0	1 154	783	0	630	427
2032	0	2 018	1 368	0	1 069	725	0	573	388
2033	0	1 904	1 291	0	990	671	0	521	353
2034	0	1 796	1 218	0	916	621	0	473	321
2035	0	1 694	1 149	0	849	575	0	430	292
2036	0	1 599	1 084	0	786	533	0	391	265
2037	0	2 014	1 022	0	972	493	0	475	241
2038	0	1 423	964	0	674	457	0	323	219
2039	0	1 342	910	0	624	423	0	294	199
2040	0	1 266	858	0	577	391	0	267	181
2041	0	1 195	810	0	535	362	0	243	165
2042	0	1 127	764	0	495	336	0	221	150
2043	0	1 063	721	0	458	311	0	201	136
2044	0	1 210	680	0	512	288	0	220	124
2045	0	946	641	0	393	266	0	166	112
2046	0	893	605	0	364	247	0	151	102
2047	0	842	571	0	337	228	0	137	93
2048	0	794	539	0	312	212	0	125	85
2049	0	749	508	0	289	196	0	113	77
2050	0	707	479	0	267	181	0	103	70
2051	0	667	452	0	248	168	0	94	63
2052	0	841	427	0	306	155	0	114	58
2053	0	594	402	0	212	144	0	77	52
RES+2053	0	560	380	0	197	133	0	70	48
TOTAL	**1 438 913**	**111 477**	**56 840**	**1 202 743**	**69 912**	**33 757**	**1 013 752**	**45 902**	**21 001**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 607 230**	**2 160**	**74**
8%	**1 306 412**	**1 284**	**102**
10%	**1 080 655**	**799**	**135**

"

APPENDIX D

Results of sensitivity analysis

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A PRESENT DEVELOPMENT SCENARIO	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	5.33

Element	Type	Name	Characteristics		Capital Costs		Electricity	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.	Costs per year	Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			210 781	75 844		2006	2007	2	10.0%	115 930	41 714	94 851	34 130
			Dia.	**Length**											
Tunnel	Press. Flow	Impendle Dam to Midmar Dam		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
	Press. Flow	Stukkenberg		2025	53 906	1 000		2006	2007	2	10.0%	29 648	550	24 258	450
			Dia.	**Length**											
Pipeline		Midmar Dam to Umlaas Rd Res			308 814	8 056		2005	2007	3	10.0%	123 526	3 222	92 644	2 417
			FSL	**h**											
Dam	Rockfill	Impendle (1.0 MAR)	1184		306 658	14 731		2005	2007	3	10.0%	122 663	5 892	91 997	4 419
Dam															
			No.	**m3**											
Pump Station		Upsizing Midmar			7 046	12 527	1 719	2007	2007	1	10.0%	7 046	12 527	6 341	11 274
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 483 363	114 158	1 719								
					1 799 649										

Year	Cost Factors	
	Social & Environ.	Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A PRESENT DEVELOPMENT SCENARIO	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2016	**Output (m3/s)**	4.06

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Midmar			172 636	73 987		2015	2015	1	10.0%	172636.0	73987.0	155372.4	66588.3
			Dia.	Length											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2014	2015	2	10.0%	17996.6	4053.5	14724.5	3316.5
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			298 192	4 202		2013	2015	3	10.0%	119276.8	1680.8	89457.6	1260.6
			FSL	h											
Dam															
Dam															
			No.	m3											
Pump Station		Upsizing Midmar			7 046	12 527	1 301	2015	2015	1	10.0%	7046.0	12527.0	6341.4	11274.3
Infrastructure			N/A	N/A				2013	2012						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					510 595	98 086	1301								
					681 723										

Year	Cost Factors	
	Social & Environ.	Admin.
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2015	
Sensitivity		
Sensitised	2015	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A PRESENT DEVELOPMENT SCENARIO	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2021	Output (m3/s)	1.27

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	Length											
Tunnel															
Tunnel															
			Dia.	Length											
Pipeline															
Pipeline															
			FSL	h											
Dam	Rockfill	Impendle raised (1.5 MAR)	1197		115 701	261		2019	2020	2	10.0%	63635.6	143.6	52065.5	117.5
Dam															
			No.	m3											
Pump Station							417								
Pump Station															
Infrastructure								2019	2018						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					115701	261	417								
					129877										

Year	Cost Factors	
	Social & Environ.	Admin.
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A PRESENT DEVELOPMENT SCENARIO

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	245 550	32	0	0	0	0	0	0	0	0	0	0	245 550	32	0
2004	128 853	32	0	0	0	0	0	0	0	0	0	0	128 853	32	0
2005	384 476	32	0	0	0	0	0	0	0	0	0	0	384 476	32	0
2006	506 550	32	0	0	0	0	0	0	0	0	0	0	506 550	32	0
2007	490 460	32	0	0	0	0	0	0	0	0	0	0	490 460	32	0
2008	0	7 003	353	0	0	0	0	0	0	0	0	0	0	7 003	353
2009	0	7 003	522	0	0	0	0	0	0	0	0	0	0	7 003	522
2010	0	7 003	696	0	0	0	0	0	0	0	0	0	0	7 003	696
2011	0	7 003	878	7 560	0	0	0	0	0	0	0	0	7 560	7 003	878
2012	0	7 003	1 067	8 562	0	0	0	0	0	0	0	0	8 562	7 003	1 067
2013	0	7 003	1 264	137 082	0	0	0	0	0	0	0	0	137 082	7 003	1 264
2014	0	7 003	1 467	127 317	0	0	0	0	0	0	0	0	127 317	7 003	1 467
2015	0	7 003	1 679	401 202	0	0	0	0	0	0	0	0	401 202	7 003	1 679
2016	0	7 003	1 719	0	5 151	178	0	0	0	0	0	0	0	12 154	1 897
2017	0	7 003	1 719	0	5 151	404	2 899	0	0	0	0	0	2 899	12 154	2 123
2018	0	7 003	1 719	0	5 151	639	2 899	0	0	0	0	0	2 899	12 154	2 358
2019	0	7 003	1 719	0	5 151	883	68 244	0	0	0	0	0	68 244	12 154	2 602
2020	0	7 003	1 719	0	5 151	1 136	55 836	0	0	0	0	0	55 836	12 154	2 855
2021	0	7 003	1 719	0	5 151	1 301	0	300	101	0	0	0	0	12 453	3 121
2022	0	9 332	1 719	0	5 151	1 301	0	300	381	0	0	0	0	14 782	3 401
2023	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2024	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2025	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2026	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2027	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2028	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2029	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2030	0	7 003	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 438	3 437
2031	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2032	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2033	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2034	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2035	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2036	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2037	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2038	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2039	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2040	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2041	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2042	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2043	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2044	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2045	0	7 003	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 438	3 437
2046	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2047	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2048	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2049	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2050	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2051	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2052	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2053	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2054	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
TOTAL	**1 799 649**	**336 284**	**74 967**	**681 723**	**206 852**	**47 474**	**129 877**	**10 190**	**13 826**	**0**	**0**	**0**	**2 611 249**	**553 326**	**136 268**
Commission date		2008			2016			2021			0				
Transfer capacity (m3/s)		5.33			4.06			1.27			0.00				

(CONTINUED.....)

Check	**1 799 649**	**681 723**	**129 877**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A PRESENT DEVELOPMENT SCENARIO

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	183 489	24	0	167 117	22	0	152 467	20	0
2004	90 836	23	0	81 199	20	0	72 734	18	0
2005	255 698	22	0	224 338	19	0	197 297	17	0
2006	317 815	20	0	273 673	17	0	236 309	15	0
2007	290 302	19	0	245 352	16	0	208 003	14	0
2008	0	3 910	197	0	3 244	164	0	2 700	136
2009	0	3 689	275	0	3 003	224	0	2 454	183
2010	0	3 480	346	0	2 781	277	0	2 231	222
2011	3 544	3 283	412	2 780	2 575	323	2 190	2 028	254
2012	3 787	3 097	472	2 915	2 384	363	2 255	1 844	281
2013	57 199	2 922	527	43 214	2 208	398	32 816	1 676	303
2014	50 118	2 757	578	37 163	2 044	428	27 708	1 524	319
2015	148 992	2 601	623	108 432	1 893	454	79 376	1 385	332
2016	0	4 258	665	0	3 041	475	0	2 186	341
2017	958	4 017	702	672	2 816	492	474	1 987	347
2018	904	3 790	735	622	2 608	506	431	1 807	351
2019	20 074	3 575	765	13 557	2 414	517	9 222	1 642	352
2020	15 495	3 373	792	10 270	2 236	525	6 859	1 493	351
2021	0	3 260	817	0	2 121	532	0	1 391	349
2022	0	3 651	840	0	2 331	536	0	1 501	345
2023	0	2 902	801	0	1 818	502	0	1 149	317
2024	0	2 737	755	0	1 684	465	0	1 045	288
2025	0	2 582	713	0	1 559	430	0	950	262
2026	0	2 436	672	0	1 444	398	0	864	238
2027	0	2 298	634	0	1 337	369	0	785	217
2028	0	2 168	598	0	1 238	342	0	714	197
2029	0	2 046	565	0	1 146	316	0	649	179
2030	0	2 392	533	0	1 315	293	0	731	163
2031	0	1 821	502	0	982	271	0	536	148
2032	0	1 717	474	0	910	251	0	487	135
2033	0	1 620	447	0	842	232	0	443	122
2034	0	1 529	422	0	780	215	0	403	111
2035	0	1 442	398	0	722	199	0	366	101
2036	0	1 360	375	0	669	185	0	333	92
2037	0	1 523	354	0	735	171	0	359	84
2038	0	1 211	334	0	573	158	0	275	76
2039	0	1 142	315	0	531	146	0	250	69
2040	0	1 078	297	0	491	136	0	227	63
2041	0	1 017	281	0	455	126	0	207	57
2042	0	959	265	0	421	116	0	188	52
2043	0	905	250	0	390	108	0	171	47
2044	0	854	236	0	361	100	0	155	43
2045	0	998	222	0	415	92	0	175	39
2046	0	760	210	0	310	85	0	128	35
2047	0	717	198	0	287	79	0	117	32
2048	0	676	187	0	266	73	0	106	29
2049	0	638	176	0	246	68	0	96	27
2050	0	602	166	0	228	63	0	88	24
2051	0	568	157	0	211	58	0	80	22
2052	0	636	148	0	232	54	0	86	20
2053	0	505	139	0	181	50	0	66	18
RES+2050	0	477	132	0	167	46	0	60	17
TOTAL	**1 474 602**	**96 085**	**20 702**	**1 244 368**	**60 738**	**12 411**	**1 059 073**	**40 225**	**7 789**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 591 389**	**2 024**	**79**
8%	**1 317 517**	**1 214**	**109**
10%	**1 107 087**	**762**	**145**

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A LOW DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	5.04

Element	Type	Name	Characteristics		Capital Costs		Electricity	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.	Costs per year	Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			210 781	75 844		2006	2007	2	10.0%	115 930	41 714	94 851	34 130
			Dia.	Length											
Tunnel	Press. Flow	Impendle Dam to Midmar Dam		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
	Press. Flow	Stukkenberg		2025	53 906	1 000		2006	2007	2	10.0%	29 648	550	24 258	450
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			308 814	8 056		2005	2007	3	10.0%	123 526	3 222	92 644	2 417
			FSL	h											
Dam	Rockfill	Impendle (1.0 MAR)	1184		306 658	14 731		2005	2007	3	10.0%	122 663	5 892	91 997	4 419
Dam															
			No.	m3											
Pump Station		Upsizing Midmar			7 046	12 527	1 719	2007	2007	1	10.0%	7 046	12 527	6 341	11 274
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 483 363	114 158	1 719								
					1 799 649										

Year	Cost Factors	
	Social & Environ.	Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A LOW DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2019	**Output (m3/s)**	3.76

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Midmar			172 636	73 987		2018	2018	1	10.0%	172636.0	73987.0	155372.4	66588.3
			Dia.	Length											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2017	2018	2	10.0%	17996.6	4053.5	14724.5	3316.5
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			298 192	4 202		2016	2018	3	10.0%	119276.8	1680.8	89457.6	1260.6
			FSL	h											
Dam															
Dam															
			No.	m3											
Pump Station		Upsizing Midmar			7 046	12 527	1 301	2018	2018	1	10.0%	7046.0	12527.0	6341.4	11274.3
Infrastructure			N/A	N/A				2016	2015						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					510 595	98 086	1301								
					681 723										

Year	Cost Factors	
	Social & Environ.	Admin.
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2018	
Sensitivity		
Sensitised	2018	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A LOW DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2024	Output (m3/s)	1.20

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity Costs per year**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**		**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
												Civil	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline															
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle raised (1.5 MAR)	1197		115 701	261		2022	2023	2	10.0%	63635.6	143.6	52065.5	117.5
Dam															
			No.	**m3**											
Pump Station							417								
Pump Station															
Infrastructure								2022	2021						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					115701	261	417								
					129877										

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
2036		
2037		
2038		
Total		

Other Costs

Description	**Cost**
Social & Environ.	
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A LOW DEMAND

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	245 550	32	0	0	0	0	0	0	0	0	0	0	245 550	32	0
2004	128 853	32	0	0	0	0	0	0	0	0	0	0	128 853	32	0
2005	384 476	32	0	0	0	0	0	0	0	0	0	0	384 476	32	0
2006	506 550	32	0	0	0	0	0	0	0	0	0	0	506 550	32	0
2007	490 460	32	0	0	0	0	0	0	0	0	0	0	490 460	32	0
2008	0	7 003	33	0	0	0	0	0	0	0	0	0	0	7 003	33
2009	0	7 003	81	0	0	0	0	0	0	0	0	0	0	7 003	81
2010	0	7 003	241	0	0	0	0	0	0	0	0	0	0	7 003	241
2011	0	7 003	406	0	0	0	0	0	0	0	0	0	0	7 003	406
2012	0	7 003	578	0	0	0	0	0	0	0	0	0	0	7 003	578
2013	0	7 003	756	0	0	0	0	0	0	0	0	0	0	7 003	756
2014	0	7 003	939	7 560	0	0	0	0	0	0	0	0	7 560	7 003	939
2015	0	7 003	1 130	8 562	0	0	0	0	0	0	0	0	8 562	7 003	1 130
2016	0	7 003	1 328	137 082	0	0	0	0	0	0	0	0	137 082	7 003	1 328
2017	0	7 003	1 533	127 317	0	0	0	0	0	0	0	0	127 317	7 003	1 533
2018	0	7 003	1 745	401 202	0	0	0	0	0	0	0	0	401 202	7 003	1 745
2019	0	7 003	1 719	0	5 151	246	0	0	0	0	0	0	0	12 154	1 965
2020	0	7 003	1 719	0	5 151	473	2 899	0	0	0	0	0	2 899	12 154	2 192
2021	0	7 003	1 719	0	5 151	709	2 899	0	0	0	0	0	2 899	12 154	2 428
2022	0	9 332	1 719	0	5 151	953	68 244	0	0	0	0	0	68 244	14 483	2 672
2023	0	7 003	1 719	0	5 151	1 206	55 836	0	0	0	0	0	55 836	12 154	2 925
2024	0	7 003	1 719	0	5 151	1 301	0	300	167	0	0	0	0	12 453	3 187
2025	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2026	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2027	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2028	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2029	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2030	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2031	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2032	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2033	0	7 003	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 438	3 437
2034	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2035	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2036	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2037	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2038	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2039	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2040	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2041	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2042	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2043	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2044	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2045	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2046	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2047	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2048	0	7 003	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 438	3 437
2049	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2050	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2051	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2052	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2053	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2054	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
TOTAL	**1 799 649**	**336 284**	**70 654**	**681 723**	**191 400**	**43 918**	**129 877**	**9 290**	**12 677**	**0**	**0**	**0**	**2 611 249**	**536 974**	**127 249**
Commission date		2008			2019			2024			0				
Transfer capacity (m3/s)		5.04			3.76			1.20			0.00				

(CONTINUED.....)

Check	**1 799 649**	**681 723**	**129 877**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A LOW DEMAND

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	183 489	24	0	167 117	22	0	152 467	20	0
2004	90 836	23	0	81 199	20	0	72 734	18	0
2005	255 698	22	0	224 338	19	0	197 297	17	0
2006	317 815	20	0	273 673	17	0	236 309	15	0
2007	290 302	19	0	245 352	16	0	208 003	14	0
2008	0	3 910	18	0	3 244	15	0	2 700	13
2009	0	3 689	43	0	3 003	35	0	2 454	28
2010	0	3 480	120	0	2 781	96	0	2 231	77
2011	0	3 283	191	0	2 575	149	0	2 028	118
2012	0	3 097	256	0	2 384	197	0	1 844	152
2013	0	2 922	315	0	2 208	238	0	1 676	181
2014	2 976	2 757	370	2 207	2 044	274	1 645	1 524	204
2015	3 180	2 601	420	2 314	1 893	305	1 694	1 385	224
2016	48 026	2 453	465	34 305	1 752	332	24 655	1 260	239
2017	42 080	2 315	507	29 501	1 623	355	20 817	1 145	251
2018	125 097	2 184	544	86 077	1 502	374	59 636	1 041	259
2019	0	3 575	578	0	2 414	390	0	1 642	265
2020	805	3 373	608	533	2 236	403	356	1 493	269
2021	759	3 182	636	494	2 070	414	324	1 357	271
2022	16 855	3 577	660	10 762	2 284	421	6 928	1 470	271
2023	13 010	2 832	682	8 153	1 775	427	5 153	1 122	270
2024	0	2 737	701	0	1 684	431	0	1 045	267
2025	0	2 582	713	0	1 559	430	0	950	262
2026	0	2 436	672	0	1 444	398	0	864	238
2027	0	2 298	634	0	1 337	369	0	785	217
2028	0	2 168	598	0	1 238	342	0	714	197
2029	0	2 046	565	0	1 146	316	0	649	179
2030	0	1 930	533	0	1 061	293	0	590	163
2031	0	1 821	502	0	982	271	0	536	148
2032	0	1 717	474	0	910	251	0	487	135
2033	0	2 009	447	0	1 044	232	0	549	122
2034	0	1 529	422	0	780	215	0	403	111
2035	0	1 442	398	0	722	199	0	366	101
2036	0	1 360	375	0	669	185	0	333	92
2037	0	1 523	354	0	735	171	0	359	84
2038	0	1 211	334	0	573	158	0	275	76
2039	0	1 142	315	0	531	146	0	250	69
2040	0	1 078	297	0	491	136	0	227	63
2041	0	1 017	281	0	455	126	0	207	57
2042	0	959	265	0	421	116	0	188	52
2043	0	905	250	0	390	108	0	171	47
2044	0	854	236	0	361	100	0	155	43
2045	0	805	222	0	334	92	0	141	39
2046	0	760	210	0	310	85	0	128	35
2047	0	717	198	0	287	79	0	117	32
2048	0	838	187	0	329	73	0	132	29
2049	0	638	176	0	246	68	0	96	27
2050	0	602	166	0	228	63	0	88	24
2051	0	568	157	0	211	58	0	80	22
2052	0	636	148	0	232	54	0	86	20
2053	0	505	139	0	181	50	0	66	18
RES+2050	0	477	132	0	167	46	0	60	17
TOTAL	**1 426 316**	**90 645**	**17 511**	**1 199 088**	**56 939**	**10 089**	**1 018 953**	**37 555**	**6 079**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 534 472**	**1 595**	**96**
8%	**1 266 117**	**919**	**138**
10%	**1 062 587**	**554**	**192**

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A HIGH DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.96

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			210 781	75 844		2006	2007	2	10.0%	115 930	41 714	94 851	34 130
			Dia.	**Length**											
Tunnel	Press. Flow	Impendle Dam to Midmar Dam		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
	Press. Flow	Stukkenberg		2025	53 906	1 000		2006	2007	2	10.0%	29 648	550	24 258	450
			Dia.	**Length**											
Pipeline		Midmar Dam to Umlaas Rd Res			308 814	8 056		2005	2007	3	10.0%	123 526	3 222	92 644	2 417
			FSL	**h**											
Dam	Rockfill	Impendle (1.0 MAR)	1184		306 658	14 731		2005	2007	3	10.0%	122 663	5 892	91 997	4 419
Dam															
			No.	**m3**											
Pump Station		Upsizing Midmar			7 046	12 527	1 719	2007	2007	1	10.0%	7 046	12 527	6 341	11 274
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 483 363	114 158	1 719								
					1 799 649										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm	
	Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A HIGH DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2013	**Output (m3/s)**	3.79

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Midmar			172 636	73 987		2012	2012	1	10.0%	172636.0	73987.0	155372.4	66588.3
			Dia.	**Length**											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2011	2012	2	10.0%	17996.6	4053.5	14724.5	3316.5
			Dia.	**Length**											
Pipeline		Midmar Dam to Umlaas Rd Res			298 192	4 202		2010	2012	3	10.0%	119276.8	1680.8	89457.6	1260.6
			FSL	**h**											
Dam															
Dam															
			No.	**m3**											
Pump Station		Upsizing Midmar			7 046	12 527	1 301	2012	2012	1	10.0%	7046.0	12527.0	6341.4	11274.3
Infrastructure			N/A	N/A				2010	2009						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					510 595	98 086	1301								
					681 723										

Year	Cost Factors	
	Social & Environ.	Admin.
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2012	
Sensitivity		
Sensitised	2012	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A HIGH DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2018	Output (m3/s)	1.20

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline															
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle raised (1.5 MAR)	1197		115 701	261		2016	2017	2	10.0%	63635.6	143.6	52065.5	117.5
Dam															
			No.	**m3**											
Pump Station							417								
Pump Station															
Infrastructure								2016	2015						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					115701	261	417								
					129877										

Year	Cost Factors	
	Social & Environ.	Admin.
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A HIGH DEMAND

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	245 550	32	0	0	0	0	0	0	0	0	0	0	245 550	32	0
2004	128 853	32	0	0	0	0	0	0	0	0	0	0	128 853	32	0
2005	384 476	32	0	0	0	0	0	0	0	0	0	0	384 476	32	0
2006	506 550	32	0	0	0	0	0	0	0	0	0	0	506 550	32	0
2007	490 460	32	0	0	0	0	0	0	0	0	0	0	490 460	32	0
2008	0	7 003	831	7 560	0	0	0	0	0	0	0	0	7 560	7 003	831
2009	0	7 003	1 039	8 562	0	0	0	0	0	0	0	0	8 562	7 003	1 039
2010	0	7 003	1 254	137 082	0	0	0	0	0	0	0	0	137 082	7 003	1 254
2011	0	7 003	1 480	127 317	0	0	0	0	0	0	0	0	127 317	7 003	1 480
2012	0	7 003	1 714	401 202	0	0	0	0	0	0	0	0	401 202	7 003	1 714
2013	0	7 003	1 719	0	5 151	238	0	0	0	0	0	0	0	12 154	1 957
2014	0	7 003	1 719	0	4 237	492	2 899	0	0	0	0	0	2 899	11 240	2 211
2015	0	7 003	1 719	0	5 151	754	2 899	0	0	0	0	0	2 899	12 154	2 473
2016	0	7 003	1 719	0	5 151	1 027	68 244	0	0	0	0	0	68 244	12 154	2 746
2017	0	7 003	1 719	0	5 151	1 312	55 836	0	0	0	0	0	55 836	12 154	3 031
2018	0	7 003	1 719	0	5 151	1 301	0	300	306	0	0	0	0	12 453	3 326
2019	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2020	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2021	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2022	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2023	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2024	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2025	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2026	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2027	0	7 003	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 438	3 437
2028	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2029	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2030	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2031	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2032	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2033	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2034	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2035	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2036	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2037	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2038	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2039	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2040	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2041	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2042	0	7 003	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 438	3 437
2043	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2044	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2045	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2046	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2047	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2048	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2049	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2050	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2051	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2052	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2053	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2054	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
TOTAL	**1 799 649**	**336 284**	**78 516**	**681 723**	**221 391**	**51 961**	**129 877**	**11 089**	**15 318**	**0**	**0**	**0**	**2 611 249**	**568 764**	**145 795**
Commission date		2008			2013			2018			0				
Transfer capacity (m3/s)		4.96			3.79			1.20			0.00				

(CONTINUED.....)

Check	**1 799 649**	**681 723**	**129 877**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A HIGH DEMAND

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	183 489	24	0	167 117	22	0	152 467	20	0
2004	90 836	23	0	81 199	20	0	72 734	18	0
2005	255 698	22	0	224 338	19	0	197 297	17	0
2006	317 815	20	0	273 673	17	0	236 309	15	0
2007	290 302	19	0	245 352	16	0	208 003	14	0
2008	4 221	3 910	464	3 502	3 244	385	2 915	2 700	321
2009	4 510	3 689	547	3 672	3 003	446	3 001	2 454	364
2010	68 125	3 480	623	54 437	2 781	498	43 678	2 231	400
2011	59 691	3 283	694	46 814	2 575	544	36 879	2 028	429
2012	177 452	3 097	758	136 594	2 384	583	105 649	1 844	451
2013	0	5 071	817	0	3 831	617	0	2 910	469
2014	1 141	4 425	870	846	3 281	645	631	2 446	481
2015	1 077	4 513	918	784	3 285	668	574	2 405	489
2016	23 909	4 258	962	17 078	3 041	687	12 274	2 186	494
2017	18 454	4 017	1 002	12 938	2 816	702	9 130	1 987	496
2018	0	3 883	1 037	0	2 672	714	0	1 851	494
2019	0	3 663	1 011	0	2 474	683	0	1 683	464
2020	0	3 456	954	0	2 291	632	0	1 530	422
2021	0	3 260	900	0	2 121	585	0	1 391	384
2022	0	3 651	849	0	2 331	542	0	1 501	349
2023	0	2 902	801	0	1 818	502	0	1 149	317
2024	0	2 737	755	0	1 684	465	0	1 045	288
2025	0	2 582	713	0	1 559	430	0	950	262
2026	0	2 436	672	0	1 444	398	0	864	238
2027	0	2 849	634	0	1 657	369	0	973	217
2028	0	2 168	598	0	1 238	342	0	714	197
2029	0	2 046	565	0	1 146	316	0	649	179
2030	0	1 930	533	0	1 061	293	0	590	163
2031	0	1 821	502	0	982	271	0	536	148
2032	0	1 717	474	0	910	251	0	487	135
2033	0	1 620	447	0	842	232	0	443	122
2034	0	1 529	422	0	780	215	0	403	111
2035	0	1 442	398	0	722	199	0	366	101
2036	0	1 360	375	0	669	185	0	333	92
2037	0	1 523	354	0	735	171	0	359	84
2038	0	1 211	334	0	573	158	0	275	76
2039	0	1 142	315	0	531	146	0	250	69
2040	0	1 078	297	0	491	136	0	227	63
2041	0	1 017	281	0	455	126	0	207	57
2042	0	1 189	265	0	522	116	0	233	52
2043	0	905	250	0	390	108	0	171	47
2044	0	854	236	0	361	100	0	155	43
2045	0	805	222	0	334	92	0	141	39
2046	0	760	210	0	310	85	0	128	35
2047	0	717	198	0	287	79	0	117	32
2048	0	676	187	0	266	73	0	106	29
2049	0	638	176	0	246	68	0	96	27
2050	0	602	166	0	228	63	0	88	24
2051	0	568	157	0	211	58	0	80	22
2052	0	636	148	0	232	54	0	86	20
2053	0	505	139	0	181	50	0	66	18
RES+2050	0	477	132	0	167	46	0	60	17
TOTAL	**1 532 112**	**102 205**	**24 362**	**1 301 407**	**65 256**	**15 131**	**1 112 473**	**43 579**	**9 831**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 658 679**	**2 218**	**75**
8%	**1 381 794**	**1 378**	**100**
10%	**1 165 883**	**895**	**130**

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A LESS 25 YEARS	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.96

Element	Type	Name	Characteristics		Capital Costs		Electricity	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.	Costs per year	Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsize Midmar & Umlaas Rd Res			210 781	75 844		2006	2007	2	10.0%	115 930	41 714	94 851	34 130
			Dia.	Length											
Tunnel	Press. Flow	Impendle Dam to Midmar Dam		34900	583 211	2 000		2003	2007	5	20.0%	209 956	720	93 314	320
	Press. Flow	Stukkenberg		2025	53 906	1 000		2006	2007	2	10.0%	29 648	550	24 258	450
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			308 814	8 056		2005	2007	3	10.0%	123 526	3 222	92 644	2 417
			FSL	h											
Dam	Rockfill	Impendle (1.0 MAR)	1184		306 658	14 731		2005	2007	3	10.0%	122 663	5 892	91 997	4 419
Dam															
			No.	m3											
Pump Station		Upsizing Midmar			7 046	12 527	1 719	2007	2007	1	10.0%	7 046	12 527	6 341	11 274
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2002	2002	1	10.0%	12 947		11 652	
Advance Infr.			N/A	N/A											
Total					1 483 363	114 158	1 719								
					1 799 649										

Year	Cost Factors	
	Social & Environ.	Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A LESS 25 YEARS	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	3.91

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Midmar			172 636	73 987		2014	2014	1	10.0%	172636.0	73987.0	155372.4	66588.3
			Dia.	Length											
Tunnel		Upgrade ex. Ferncliff			32 721	7 370		2013	2014	2	10.0%	17996.6	4053.5	14724.5	3316.5
			Dia.	Length											
Pipeline		Midmar Dam to Umlaas Rd Res			298 192	4 202		2012	2014	3	10.0%	119276.8	1680.8	89457.6	1260.6
			FSL	h											
Dam															
Dam															
			No.	m3											
Pump Station		Upsizing Midmar			7 046	12 527	1 301	2014	2014	1	10.0%	7046.0	12527.0	6341.4	11274.3
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A											
Advance Infr.			N/A	N/A											
Total					510 595	98 086	1301								
					681 723										

Year	Cost Factors	
	Social & Environ.	Admin.
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original	2014	
Sensitivity		
Sensitised	2014	

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	EC0SCH1A.WB3
Option	SCHEME 1A LESS 25 YEARS	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2021	Output (m3/s)	1.20

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	Length											
Tunnel															
Tunnel															
			Dia.	Length											
Pipeline															
Pipeline															
			FSL	h											
Dam	Rockfill	Impendle raised (1.5 MAR)	1197		115 701	261		2019	2020	2	10.0%	63635.6	143.6	52065.5	117.5
Dam															
			No.	m3											
Pump Station							417								
Pump Station															
Infrastructure								2019	2018						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					115701	261	417								
					129877										

Year	Cost Factors	
	Social & Environ.	Admin.
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost
(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A LESS 25 YEARS

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	15 278	0	0	0	0	0	0	0	0	0	0	0	15 278	0	0
2002	28 484	0	0	0	0	0	0	0	0	0	0	0	28 484	0	0
2003	245 550	32	0	0	0	0	0	0	0	0	0	0	245 550	32	0
2004	128 853	32	0	0	0	0	0	0	0	0	0	0	128 853	32	0
2005	384 476	32	0	0	0	0	0	0	0	0	0	0	384 476	32	0
2006	506 550	32	0	0	0	0	0	0	0	0	0	0	506 550	32	0
2007	490 460	32	0	0	0	0	0	0	0	0	0	0	490 460	32	0
2008	0	7 003	379	0	0	0	0	0	0	0	0	0	0	7 003	379
2009	0	7 003	560	0	0	0	0	0	0	0	0	0	0	7 003	560
2010	0	7 003	747	7 560	0	0	0	0	0	0	0	0	7 560	7 003	747
2011	0	7 003	943	8 562	0	0	0	0	0	0	0	0	8 562	7 003	943
2012	0	7 003	1 146	137 082	0	0	0	0	0	0	0	0	137 082	7 003	1 146
2013	0	7 003	1 357	127 317	0	0	0	0	0	0	0	0	127 317	7 003	1 357
2014	0	7 003	1 575	401 202	0	0	0	0	0	0	0	0	401 202	7 003	1 575
2015	0	7 003	1 719	0	5 151	83	0	0	0	0	0	0	0	12 154	1 802
2016	0	7 003	1 719	0	5 151	318	0	0	0	0	0	0	0	12 154	2 037
2017	0	7 003	1 719	0	5 151	563	2 899	0	0	0	0	0	2 899	12 154	2 282
2018	0	7 003	1 719	0	5 151	817	2 899	0	0	0	0	0	2 899	12 154	2 536
2019	0	7 003	1 719	0	5 151	1 080	68 244	0	0	0	0	0	68 244	12 154	2 799
2020	0	7 003	1 719	0	5 151	1 354	55 836	0	0	0	0	0	55 836	12 154	3 073
2021	0	7 003	1 719	0	5 151	1 301	0	300	337	0	0	0	0	12 453	3 357
2022	0	9 332	1 719	0	5 151	1 301	0	300	417	0	0	0	0	14 782	3 437
2023	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2024	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2025	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2026	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2027	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2028	0	7 003	1 719	0	5 151	1 301	0	300	417	0	0	0	0	12 453	3 437
2029	0	7 003	1 719	0	8 135	1 301	0	300	417	0	0	0	0	15 438	3 437
2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**1 799 649**	**156 554**	**32 492**	**681 723**	**80 247**	**15 923**	**129 877**	**2 697**	**3 673**	**0**	**0**	**0**	**2 611 249**	**239 499**	**52 088**
Commission date		2008			2015			2021			0				
Transfer capacity (m3/s)		4.96			3.91			1.20			0.00				

(CONTINUED.....)

Check	**1 799 649**	**681 723**	**129 877**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 1A LESS 25 YEARS

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	12 827	0	0	12 128	0	0	11 478	0	0
2002	22 562	0	0	20 936	0	0	19 455	0	0
2003	183 489	24	0	167 117	22	0	152 467	20	0
2004	90 836	23	0	81 199	20	0	72 734	18	0
2005	255 698	22	0	224 338	19	0	197 297	17	0
2006	317 815	20	0	273 673	17	0	236 309	15	0
2007	290 302	19	0	245 352	16	0	208 003	14	0
2008	0	3 910	212	0	3 244	176	0	2 700	146
2009	0	3 689	295	0	3 003	240	0	2 454	196
2010	3 757	3 480	371	3 002	2 781	297	2 409	2 231	238
2011	4 014	3 283	442	3 148	2 575	347	2 480	2 028	273
2012	60 631	3 097	507	46 671	2 384	390	36 098	1 844	302
2013	53 125	2 922	566	40 136	2 208	428	30 479	1 676	325
2014	157 932	2 757	620	117 107	2 044	460	87 313	1 524	343
2015	0	4 513	669	0	3 285	487	0	2 405	356
2016	0	4 258	714	0	3 041	510	0	2 186	366
2017	958	4 017	754	672	2 816	529	474	1 987	373
2018	904	3 790	791	622	2 608	544	431	1 807	377
2019	20 074	3 575	823	13 557	2 414	556	9 222	1 642	378
2020	15 495	3 373	853	10 270	2 236	565	6 859	1 493	377
2021	0	3 260	879	0	2 121	572	0	1 391	375
2022	0	3 651	849	0	2 331	542	0	1 501	349
2023	0	2 902	801	0	1 818	502	0	1 149	317
2024	0	2 737	755	0	1 684	465	0	1 045	288
2025	0	2 582	713	0	1 559	430	0	950	262
2026	0	2 436	672	0	1 444	398	0	864	238
2027	0	2 298	634	0	1 337	369	0	785	217
2028	0	2 168	598	0	1 238	342	0	714	197
2029	0	2 536	565	0	1 421	316	0	804	179
2030	0	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0	0
2044	0	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0	0
2052	0	0	0	0	0	0	0	0	0
2053	0	0	0	0	0	0	0	0	0
RES+2050	0	0	0	0	0	0	0	0	0
TOTAL	**1 490 421**	**71 344**	**14 083**	**1 259 928**	**49 685**	**9 463**	**1 073 507**	**35 265**	**6 474**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 575 848**	**1 282**	**123**
8%	**1 319 077**	**862**	**153**
10%	**1 115 246**	**590**	**189**

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C PRESENT DEVELOPMENT SCENARI	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	5.61

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Baynesfield & Umlaas Rd Res.			200 793	72 247		2006	2007	2	10.0%	110436.2	39735.9	90356.9	32511.2
			Dia.	**Length**											
Tunnel		Smithfield to Baynesfield			541 292	2 000		2003	2007	5	20.0%	194865.1	720.0	86606.7	320.0
			Dia.	**Length**											
Pipeline		Baynesfield to Umlaas Rd Res.			209 022	3 419		2005	2007	3	10.0%	83608.8	1367.6	62706.6	1025.7
			FSL	**h**											
Dam	composite	Smithfield dam			210 693	10 913		2005	2007	3	10.0%	84277.2	4365.2	63207.9	3273.9
Dam	Earthfill	Baynesfield dam.			3 518	2 473		2007	2007	1	10.0%	3518.0	2473.0	3166.2	2225.7
			No.	**m3**											
Pump Station		Smithfield dam intake tower		3.2	37 260	30 763	3841	2007	2007	1	10.0%	37260.0	30763.0	33534.0	27686.7
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	13 860			2002	2002	1	10.0%	13860.0		12474.0	
Advance Infr.			N/A	N/A											
Total					1 216 438	121 815	3841								
					1 502 637										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	3794
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C PRESENT DEVELOPMENT SCENARI	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2016	**Output (m3/s)**	0.98

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Baynesfield			245 902	105 387		2014	2015	2	10.0%	135246.1	57962.9	110655.9	47424.2
			Dia.	**Length**											
Tunnel															
			Dia.	**Length**											
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle (1.5 MAR)	1197		369 223	14 793		2012	2015	4	10.0%	119997.5	4807.7	83075.2	3328.4
Dam															
			No.	**m3**											
Pump Station		Smithfield Additional Pumps				20 116	1 075	2015	2015	1	10.0%		20116.0		18104.4
Infrastructure			N/A	N/A				2012	2011						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2011	2011	1	10.0%	12947.0		11652.3	
Advance Infr.			N/A	N/A											
Total					628 072	140 296	1 075								
					870 997										

Year	Cost Factors	
	Social & Environ.	Admin.
2012	0.4000	
2013	0.4000	
2014	0.2000	
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
Total	0.6000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C PRESENT DEVELOPMENT SCENARI	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2018	Output (m3/s)	6.48

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline		Baynesfield to Umlaas Rd Res.			205 531	3 419		2015	2017	3	10.0%	82212.4	1367.6	61659.3	1025.7
Pipeline															
			FSL	**h**											
Dam															
Dam															
			No.	**m3**											
Pump Station							5 004								
Pump Station															
Infrastructure								2015	2014						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					205 531	3 419	5 004								
					234 024										

Year	Cost Factors	
	Social & Environ.	Admin.
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C PRESENT DEVELOPMENT SCENARIO

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	14 275	0	0	0	0	0	0	0	0	0	0	0	14 275	0	0
2002	28 412	0	0	0	0	0	0	0	0	0	0	0	28 412	0	0
2003	221 645	35	0	0	0	0	0	0	0	0	0	0	221 645	35	0
2004	112 206	35	0	0	0	0	0	0	0	0	0	0	112 206	35	0
2005	288 219	35	0	0	0	0	0	0	0	0	0	0	288 219	35	0
2006	394 875	35	0	0	0	0	0	0	0	0	0	0	394 875	35	0
2007	443 004	35	0	0	0	0	0	0	0	0	0	0	443 004	35	0
2008	0	6 801	749	0	0	0	0	0	0	0	0	0	0	6 801	749
2009	0	6 801	1 107	0	0	0	0	0	0	0	0	0	0	6 801	1 107
2010	0	6 801	1 477	10 248	0	0	0	0	0	0	0	0	10 248	6 801	1 477
2011	0	6 801	1 863	23 454	0	0	0	0	0	0	0	0	23 454	6 801	1 863
2012	0	6 801	2 263	146 494	32	0	0	0	0	0	0	0	146 494	6 833	2 263
2013	0	6 801	2 680	105 907	32	0	5 224	0	0	0	0	0	111 131	6 833	2 680
2014	0	6 801	3 112	301 773	32	0	5 224	0	0	0	0	0	306 997	6 833	3 112
2015	0	6 801	3 560	283 122	32	0	89 431	0	0	0	0	0	372 552	6 833	3 560
2016	0	6 801	3 841	0	7 182	332	67 073	0	0	0	0	0	67 073	13 983	4 173
2017	0	6 801	3 841	0	7 182	1 202	67 073	0	0	0	0	0	67 073	13 983	5 043
2018	0	6 801	3 841	0	7 182	1 075	0	651	645	0	0	0	0	14 633	5 561
2019	0	6 801	3 841	0	7 182	1 075	0	651	1 233	0	0	0	0	14 633	6 149
2020	0	6 801	3 841	0	7 182	1 075	0	651	1 843	0	0	0	0	14 633	6 759
2021	0	6 801	3 841	0	7 182	1 075	0	651	2 476	0	0	0	0	14 633	7 392
2022	0	11 715	3 841	0	7 182	1 075	0	651	3 133	0	0	0	0	19 548	8 049
2023	0	6 801	3 841	0	7 182	1 075	0	651	3 816	0	0	0	0	14 633	8 732
2024	0	6 801	3 841	0	7 182	1 075	0	651	4 525	0	0	0	0	14 633	9 441
2025	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2026	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2027	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2028	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2029	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2030	0	6 801	3 841	0	10 199	1 075	0	651	5 004	0	0	0	0	17 651	9 920
2031	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2032	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2033	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2034	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2035	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2036	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2037	0	11 715	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	19 548	9 920
2038	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2039	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2040	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2041	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2042	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2043	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2044	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2045	0	6 801	3 841	0	10 199	1 075	0	651	5 004	0	0	0	0	17 651	9 920
2046	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2047	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2048	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2049	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2050	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2051	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2052	0	11 715	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	19 548	9 920
2053	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2054	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
TOTAL	**1 502 637**	**334 543**	**166 609**	**870 997**	**286 263**	**41 309**	**234 024**	**24 072**	**167 791**	**0**	**0**	**0**	**2 607 659**	**644 878**	**375 709**
Commission date		2008			2016			2018			0				
Transfer capacity (m3/s)		5.61			0.98			6.48			0.00				

(CONTINUED.....)

Check	**1 502 637**	**870 997**	**234 024**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C PRESENT DEVELOPMENT SCENARIO

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	11 986	0	0	11 332	0	0	10 725	0	0
2002	22 505	0	0	20 884	0	0	19 406	0	0
2003	165 626	26	0	150 848	24	0	137 624	22	0
2004	79 101	24	0	70 709	22	0	63 338	20	0
2005	191 682	23	0	168 173	20	0	147 902	18	0
2006	247 750	22	0	213 339	19	0	184 212	16	0
2007	262 214	21	0	221 613	17	0	187 877	15	0
2008	0	3 797	418	0	3 150	347	0	2 622	289
2009	0	3 582	583	0	2 917	475	0	2 384	388
2010	5 093	3 380	734	4 070	2 701	586	3 265	2 167	471
2011	10 996	3 188	873	8 624	2 501	685	6 794	1 970	540
2012	64 794	3 022	1 001	49 875	2 326	771	38 576	1 799	596
2013	46 371	2 851	1 118	35 033	2 154	845	26 604	1 636	642
2014	120 848	2 690	1 225	89 610	1 994	908	66 812	1 487	677
2015	138 353	2 538	1 322	100 689	1 847	962	73 707	1 352	704
2016	23 499	4 899	1 462	16 785	3 499	1 044	12 064	2 515	751
2017	22 168	4 621	1 667	15 542	3 240	1 169	10 967	2 286	825
2018	0	4 563	1 734	0	3 140	1 193	0	2 175	827
2019	0	4 304	1 809	0	2 907	1 221	0	1 977	831
2020	0	4 061	1 876	0	2 692	1 243	0	1 798	830
2021	0	3 831	1 935	0	2 492	1 259	0	1 634	826
2022	0	4 828	1 988	0	3 083	1 269	0	1 985	817
2023	0	3 410	2 035	0	2 137	1 275	0	1 351	806
2024	0	3 217	2 075	0	1 978	1 276	0	1 228	792
2025	0	3 034	2 057	0	1 832	1 242	0	1 116	757
2026	0	2 863	1 941	0	1 696	1 150	0	1 015	688
2027	0	2 701	1 831	0	1 571	1 065	0	922	625
2028	0	2 548	1 727	0	1 454	986	0	839	569
2029	0	2 404	1 629	0	1 346	913	0	762	517
2030	0	2 735	1 537	0	1 504	845	0	836	470
2031	0	2 139	1 450	0	1 154	783	0	630	427
2032	0	2 018	1 368	0	1 069	725	0	573	388
2033	0	1 904	1 291	0	990	671	0	521	353
2034	0	1 796	1 218	0	916	621	0	473	321
2035	0	1 694	1 149	0	849	575	0	430	292
2036	0	1 599	1 084	0	786	533	0	391	265
2037	0	2 014	1 022	0	972	493	0	475	241
2038	0	1 423	964	0	674	457	0	323	219
2039	0	1 342	910	0	624	423	0	294	199
2040	0	1 266	858	0	577	391	0	267	181
2041	0	1 195	810	0	535	362	0	243	165
2042	0	1 127	764	0	495	336	0	221	150
2043	0	1 063	721	0	458	311	0	201	136
2044	0	1 003	680	0	424	288	0	183	124
2045	0	1 141	641	0	474	266	0	200	112
2046	0	893	605	0	364	247	0	151	102
2047	0	842	571	0	337	228	0	137	93
2048	0	794	539	0	312	212	0	125	85
2049	0	749	508	0	289	196	0	113	77
2050	0	707	479	0	267	181	0	103	70
2051	0	667	452	0	248	168	0	94	63
2052	0	841	427	0	306	155	0	114	58
2053	0	594	402	0	212	144	0	77	52
RES+2053	0	560	380	0	197	133	0	70	48
TOTAL	**1 412 985**	**108 552**	**53 869**	**1 177 124**	**67 790**	**31 628**	**989 873**	**44 354**	**19 456**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 575 407**	**2 263**	**70**
8%	**1 276 543**	**1 336**	**96**
10%	**1 053 683**	**826**	**128**

"

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C LOW DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.66

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Baynesfield & Umlaas Rd Res.			200 793	72 247		2006	2007	2	10.0%	110436.2	39735.9	90356.9	32511.2
			Dia.	Length											
Tunnel		Smithfield to Baynesfield			541 292	2 000		2003	2007	5	20.0%	194865.1	720.0	86606.7	320.0
			Dia.	Length											
Pipeline		Baynesfield to Umlaas Rd Res.			209 022	3 419		2005	2007	3	10.0%	83608.8	1367.6	62706.6	1025.7
			FSL	h											
Dam	composite	Smithfield dam			210 693	10 913		2005	2007	3	10.0%	84277.2	4365.2	63207.9	3273.9
Dam	Earthfill	Baynesfield dam.			3 518	2 473		2007	2007	1	10.0%	3518.0	2473.0	3166.2	2225.7
			No.	m3											
Pump Station		Smithfield dam intake tower		3.2	37 260	30 763	3841	2007	2007	1	10.0%	37260.0	30763.0	33534.0	27686.7
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	13 860			2002	2002	1	10.0%	13860.0		12474.0	
Advance Infr.			N/A	N/A											
Total					1 216 438	121 815	3841								
					1 502 637										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	3794
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C LOW DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2018	**Output (m3/s)**	1.30

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity Costs per year**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**		**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
												Civil	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks		Upsizing Baynesfield			245 902	105 387		2013	2014	2	10.0%	135246.1	57962.9	110655.9	47424.2
			Dia.	**Length**											
Tunnel															
			Dia.	**Length**											
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle (1.5 MAR)	1197		369 223	14 793		2014	2017	4	10.0%	119997.5	4807.7	83075.2	3328.4
Dam															
			No.	**m3**											
Pump Station		Smithfield Additional Pumps				20 116	1 075	2014	2014	1	10.0%		20116.0		18104.4
Infrastructure			N/A	N/A				2014	2013						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2013	2013	1	10.0%	12947.0		11652.3	
Advance Infr.			N/A	N/A											
Total					628 072	140 296	1 075								
					870 997										

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
2014	0.4000	
2015	0.4000	
2016	0.2000	
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
Total	0.6000	

Other Costs

Description	**Cost**
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C LOW DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2020	Output (m3/s)	5.96

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline		Baynesfield to Umlaas Rd Res.			205 531	3 419		2017	2019	3	10.0%	82212.4	1367.6	61659.3	1025.7
Pipeline															
			FSL	**h**											
Dam															
Dam															
			No.	**m3**											
Pump Station							5 004								
Pump Station															
Infrastructure								2017	2016						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					205 531	3 419	5 004								
					234 024										

Year	Cost Factors	
	Social & Environ.	Admin.
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C LOW DEMAND

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	14 275	0	0	0	0	0	0	0	0	0	0	0	14 275	0	0
2002	28 412	0	0	0	0	0	0	0	0	0	0	0	28 412	0	0
2003	221 645	35	0	0	0	0	0	0	0	0	0	0	221 645	35	0
2004	112 206	35	0	0	0	0	0	0	0	0	0	0	112 206	35	0
2005	288 219	35	0	0	0	0	0	0	0	0	0	0	288 219	35	0
2006	394 875	35	0	0	0	0	0	0	0	0	0	0	394 875	35	0
2007	443 004	35	0	0	0	0	0	0	0	0	0	0	443 004	35	0
2008	0	6 801	78	0	0	0	0	0	0	0	0	0	0	6 801	78
2009	0	6 801	193	0	0	0	0	0	0	0	0	0	0	6 801	193
2010	0	6 801	572	0	0	0	0	0	0	0	0	0	0	6 801	572
2011	0	6 801	967	8 782	0	0	0	0	0	0	0	0	8 782	6 801	967
2012	0	6 801	1 374	19 533	0	0	0	0	0	0	0	0	19 533	6 801	1 374
2013	0	6 801	1 798	230 690	0	0	0	0	0	0	0	0	230 690	6 801	1 798
2014	0	6 801	2 234	328 381	32	0	0	0	0	0	0	0	328 381	6 833	2 234
2015	0	6 801	2 689	96 622	5 667	0	5 224	0	0	0	0	0	101 846	12 468	2 689
2016	0	6 801	3 159	94 537	5 667	0	5 224	0	0	0	0	0	99 761	12 468	3 159
2017	0	6 801	3 646	92 452	5 667	0	89 431	0	0	0	0	0	181 882	12 468	3 646
2018	0	6 801	3 841	0	7 182	311	67 073	0	0	0	0	0	67 073	13 983	4 152
2019	0	6 801	3 841	0	7 182	836	67 073	0	0	0	0	0	67 073	13 983	4 677
2020	0	6 801	3 841	0	7 182	1 075	0	651	309	0	0	0	0	14 633	5 225
2021	0	6 801	3 841	0	7 182	1 075	0	651	880	0	0	0	0	14 633	5 796
2022	0	11 715	3 841	0	7 182	1 075	0	651	1 473	0	0	0	0	19 548	6 389
2023	0	6 801	3 841	0	7 182	1 075	0	651	2 086	0	0	0	0	14 633	7 002
2024	0	6 801	3 841	0	7 182	1 075	0	651	2 722	0	0	0	0	14 633	7 638
2025	0	6 801	3 841	0	7 182	1 075	0	651	3 380	0	0	0	0	14 633	8 296
2026	0	6 801	3 841	0	7 182	1 075	0	651	4 063	0	0	0	0	14 633	8 979
2027	0	6 801	3 841	0	7 182	1 075	0	651	4 769	0	0	0	0	14 633	9 685
2028	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2029	0	6 801	3 841	0	10 199	1 075	0	651	5 004	0	0	0	0	17 651	9 920
2030	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2031	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2032	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2033	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2034	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2035	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2036	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2037	0	11 715	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	19 548	9 920
2038	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2039	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2040	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2041	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2042	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2043	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2044	0	6 801	3 841	0	10 199	1 075	0	651	5 004	0	0	0	0	17 651	9 920
2045	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2046	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2047	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2048	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2049	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2050	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2051	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2052	0	11 715	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	19 548	9 920
2053	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2054	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
TOTAL	**1 502 637**	**334 543**	**158 828**	**870 997**	**288 804**	**38 771**	**234 024**	**22 771**	**154 790**	**0**	**0**	**0**	**2 607 659**	**646 117**	**352 389**
Commission date		2008			2018			2020			0				
Transfer capacity (m3/s)		4.66			1.30			5.96			0.00				

(CONTINUED.....)

Check	**1 502 637**	**870 997**	**234 024**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C LOW DEMAND

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	11 986	0	0	11 332	0	0	10 725	0	0
2002	22 505	0	0	20 884	0	0	19 406	0	0
2003	165 626	26	0	150 848	24	0	137 624	22	0
2004	79 101	24	0	70 709	22	0	63 338	20	0
2005	191 682	23	0	168 173	20	0	147 902	18	0
2006	247 750	22	0	213 339	19	0	184 212	16	0
2007	262 214	21	0	221 613	17	0	187 877	15	0
2008	0	3 797	44	0	3 150	36	0	2 622	30
2009	0	3 582	102	0	2 917	83	0	2 384	68
2010	0	3 380	284	0	2 701	227	0	2 167	182
2011	4 117	3 188	453	3 229	2 501	355	2 544	1 970	280
2012	8 639	3 008	608	6 650	2 315	468	5 144	1 791	362
2013	96 259	2 838	750	72 723	2 144	567	55 225	1 628	430
2014	129 266	2 690	879	95 851	1 994	652	71 465	1 487	486
2015	37 822	4 630	998	27 526	3 370	727	20 150	2 467	532
2016	34 951	4 368	1 107	24 965	3 120	791	17 943	2 242	568
2017	60 115	4 121	1 205	42 144	2 889	845	29 739	2 039	596
2018	20 914	4 360	1 295	14 390	3 000	891	9 970	2 078	617
2019	19 730	4 113	1 376	13 324	2 778	929	9 064	1 889	632
2020	0	4 061	1 450	0	2 692	961	0	1 798	642
2021	0	3 831	1 517	0	2 492	987	0	1 634	647
2022	0	4 828	1 578	0	3 083	1 007	0	1 985	649
2023	0	3 410	1 632	0	2 137	1 022	0	1 351	646
2024	0	3 217	1 679	0	1 978	1 033	0	1 228	641
2025	0	3 034	1 720	0	1 832	1 039	0	1 116	633
2026	0	2 863	1 756	0	1 696	1 041	0	1 015	623
2027	0	2 701	1 788	0	1 571	1 040	0	922	611
2028	0	2 548	1 727	0	1 454	986	0	839	569
2029	0	2 899	1 629	0	1 624	913	0	920	517
2030	0	2 268	1 537	0	1 247	845	0	693	470
2031	0	2 139	1 450	0	1 154	783	0	630	427
2032	0	2 018	1 368	0	1 069	725	0	573	388
2033	0	1 904	1 291	0	990	671	0	521	353
2034	0	1 796	1 218	0	916	621	0	473	321
2035	0	1 694	1 149	0	849	575	0	430	292
2036	0	1 599	1 084	0	786	533	0	391	265
2037	0	2 014	1 022	0	972	493	0	475	241
2038	0	1 423	964	0	674	457	0	323	219
2039	0	1 342	910	0	624	423	0	294	199
2040	0	1 266	858	0	577	391	0	267	181
2041	0	1 195	810	0	535	362	0	243	165
2042	0	1 127	764	0	495	336	0	221	150
2043	0	1 063	721	0	458	311	0	201	136
2044	0	1 210	680	0	512	288	0	220	124
2045	0	946	641	0	393	266	0	166	112
2046	0	893	605	0	364	247	0	151	102
2047	0	842	571	0	337	228	0	137	93
2048	0	794	539	0	312	212	0	125	85
2049	0	749	508	0	289	196	0	113	77
2050	0	707	479	0	267	181	0	103	70
2051	0	667	452	0	248	168	0	94	63
2052	0	841	427	0	306	155	0	114	58
2053	0	594	402	0	212	144	0	77	52
RES+2053	0	560	380	0	197	133	0	70	48
TOTAL	**1 392 676**	**109 231**	**46 407**	**1 157 701**	**68 320**	**26 343**	**972 328**	**44 765**	**15 652**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 548 314**	**1 764**	**88**
8%	**1 252 364**	**1 002**	**125**
10%	**1 032 745**	**596**	**173**

"

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C HIGH DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.95

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**	**Costs**	**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
							per year					**Civil**	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks		Baynesfield & Umlaas Rd Res.			200 793	72 247		2006	2007	2	10.0%	110436.2	39735.9	90356.9	32511.2
			Dia.	**Length**											
Tunnel		Smithfield to Baynesfield			541 292	2 000		2003	2007	5	20.0%	194865.1	720.0	86606.7	320.0
			Dia.	**Length**											
Pipeline		Baynesfield to Umlaas Rd Res.			209 022	3 419		2005	2007	3	10.0%	83608.8	1367.6	62706.6	1025.7
			FSL	**h**											
Dam	composite	Smithfield dam			210 693	10 913		2005	2007	3	10.0%	84277.2	4365.2	63207.9	3273.9
Dam	Earthfill	Baynesfield dam.			3 518	2 473		2007	2007	1	10.0%	3518.0	2473.0	3166.2	2225.7
			No.	**m3**											
Pump Station		Smithfield dam intake tower		3.2	37 260	30 763	3841	2007	2007	1	10.0%	37260.0	30763.0	33534.0	27686.7
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	13 860			2002	2002	1	10.0%	13860.0		12474.0	
Advance Infr.			N/A	N/A											
Total					1 216 438	121 815	3841								
					1 502 637										

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	**Cost**
Social & Environ.	3794
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C HIGH DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2013	**Output (m3/s)**	1.30

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks		Upsizing Baynesfield			245 902	105 387		2013	2014	2	10.0%	135246.1	57962.9	110655.9	47424.2
			Dia.	**Length**											
Tunnel															
			Dia.	**Length**											
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle (1.5 MAR)	1197		369 223	14 793		2009	2012	4	10.0%	119997.5	4807.7	83075.2	3328.4
Dam															
			No.	**m3**											
Pump Station		Smithfield Additional Pumps				20 116	1 075	2014	2014	1	10.0%		20116.0		18104.4
Infrastructure			N/A	N/A				2009	2008						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2008	2008	1	10.0%	12947.0		11652.3	
Advance Infr.			N/A	N/A											
Total					628 072	140 296	1 075								
					870 997										

Year	Cost Factors	
	Social & Environ.	Admin.
2009	0.4000	
2010	0.4000	
2011	0.2000	
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
Total	0.6000	

Other Costs

Description	Cost
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C HIGH DEMAND	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2014	Output (m3/s)	5.96

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	Length											
Tunnel															
Tunnel															
			Dia.	Length											
Pipeline		Baynesfield to Umlaas Rd Res.			205 531	3 419		2011	2013	3	10.0%	82212.4	1367.6	61659.3	1025.7
Pipeline															
			FSL	h											
Dam															
Dam															
			No.	m3											
Pump Station							5 004								
Pump Station															
Infrastructure								2011	2010						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					205 531	3 419	5 004								
					234 024										

Year	Cost Factors	
	Social & Environ.	Admin.
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C HIGH DEMAND

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	14 275	0	0	0	0	0	0	0	0	0	0	0	14 275	0	0
2002	28 412	0	0	0	0	0	0	0	0	0	0	0	28 412	0	0
2003	221 645	35	0	0	0	0	0	0	0	0	0	0	221 645	35	0
2004	112 206	35	0	0	0	0	0	0	0	0	0	0	112 206	35	0
2005	288 219	35	0	0	0	0	0	0	0	0	0	0	288 219	35	0
2006	394 875	35	0	0	0	0	0	0	0	0	0	0	394 875	35	0
2007	443 004	35	0	10 248	0	0	0	0	0	0	0	0	453 252	35	0
2008	0	6 801	1 978	23 454	0	0	0	0	0	0	0	0	23 454	6 801	1 978
2009	0	6 801	2 472	137 712	32	0	5 224	0	0	0	0	0	142 935	6 833	2 472
2010	0	6 801	2 984	96 622	32	0	5 224	0	0	0	0	0	101 846	6 833	2 984
2011	0	6 801	3 520	103 319	32	0	89 431	0	0	0	0	0	192 750	6 833	3 520
2012	0	6 801	4 076	101 737	32	0	67 073	0	0	0	0	0	168 810	6 833	4 076
2013	0	6 801	3 841	207 236	1 547	0	67 073	0	0	0	0	0	274 309	8 348	3 841
2014	0	6 801	3 841	190 670	1 547	0	0	651	354	0	0	0	190 670	8 998	4 195
2015	0	6 801	3 841	0	7 182	1 075	0	651	990	0	0	0	0	14 633	5 906
2016	0	6 801	3 841	0	7 182	1 075	0	651	1 653	0	0	0	0	14 633	6 569
2017	0	6 801	3 841	0	7 182	1 075	0	651	2 342	0	0	0	0	14 633	7 258
2018	0	6 801	3 841	0	7 182	1 075	0	651	3 058	0	0	0	0	14 633	7 974
2019	0	6 801	3 841	0	7 182	1 075	0	651	3 803	0	0	0	0	14 633	8 719
2020	0	6 801	3 841	0	7 182	1 075	0	651	4 578	0	0	0	0	14 633	9 494
2021	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2022	0	11 715	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	19 548	9 920
2023	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2024	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2025	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2026	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2027	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2028	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2029	0	6 801	3 841	0	10 199	1 075	0	651	5 004	0	0	0	0	17 651	9 920
2030	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2031	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2032	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2033	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2034	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2035	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2036	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2037	0	11 715	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	19 548	9 920
2038	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2039	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2040	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2041	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2042	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2043	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2044	0	6 801	3 841	0	10 199	1 075	0	651	5 004	0	0	0	0	17 651	9 920
2045	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2046	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2047	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2048	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2049	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2050	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2051	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2052	0	11 715	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	19 548	9 920
2053	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2054	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
TOTAL	**1 502 637**	**334 543**	**176 352**	**870 997**	**296 539**	**43 000**	**234 024**	**26 674**	**186 914**	**0**	**0**	**0**	**2 607 659**	**657 757**	**406 265**
Commission date		2008			2013			2014			0				
Transfer capacity (m3/s)		4.95			1.30			5.96			0.00				

(CONTINUED.....)

Check	**1 502 637**	**870 997**	**234 024**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C HIGH DEMAND

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	11 986	0	0	11 332	0	0	10 725	0	0
2002	22 505	0	0	20 884	0	0	19 406	0	0
2003	165 626	26	0	150 848	24	0	137 624	22	0
2004	79 101	24	0	70 709	22	0	63 338	20	0
2005	191 682	23	0	168 173	20	0	147 902	18	0
2006	247 750	22	0	213 339	19	0	184 212	16	0
2007	268 279	21	0	226 739	17	0	192 223	15	0
2008	13 096	3 797	1 104	10 864	3 150	916	9 042	2 622	763
2009	75 297	3 600	1 302	61 303	2 931	1 060	50 098	2 395	866
2010	50 614	3 396	1 483	40 444	2 713	1 185	32 451	2 177	951
2011	90 369	3 204	1 650	70 874	2 512	1 294	55 833	1 979	1 020
2012	74 665	3 022	1 803	57 473	2 326	1 388	44 453	1 799	1 073
2013	114 460	3 483	1 603	86 474	2 632	1 211	65 667	1 998	920
2014	75 056	3 542	1 651	55 655	2 627	1 224	41 495	1 958	913
2015	0	5 434	2 193	0	3 955	1 596	0	2 895	1 169
2016	0	5 127	2 301	0	3 662	1 644	0	2 632	1 181
2017	0	4 836	2 399	0	3 391	1 682	0	2 393	1 187
2018	0	4 563	2 486	0	3 140	1 711	0	2 175	1 185
2019	0	4 304	2 565	0	2 907	1 732	0	1 977	1 178
2020	0	4 061	2 635	0	2 692	1 746	0	1 798	1 166
2021	0	3 831	2 597	0	2 492	1 690	0	1 634	1 108
2022	0	4 828	2 450	0	3 083	1 564	0	1 985	1 007
2023	0	3 410	2 311	0	2 137	1 448	0	1 351	916
2024	0	3 217	2 181	0	1 978	1 341	0	1 228	832
2025	0	3 034	2 057	0	1 832	1 242	0	1 116	757
2026	0	2 863	1 941	0	1 696	1 150	0	1 015	688
2027	0	2 701	1 831	0	1 571	1 065	0	922	625
2028	0	2 548	1 727	0	1 454	986	0	839	569
2029	0	2 899	1 629	0	1 624	913	0	920	517
2030	0	2 268	1 537	0	1 247	845	0	693	470
2031	0	2 139	1 450	0	1 154	783	0	630	427
2032	0	2 018	1 368	0	1 069	725	0	573	388
2033	0	1 904	1 291	0	990	671	0	521	353
2034	0	1 796	1 218	0	916	621	0	473	321
2035	0	1 694	1 149	0	849	575	0	430	292
2036	0	1 599	1 084	0	786	533	0	391	265
2037	0	2 014	1 022	0	972	493	0	475	241
2038	0	1 423	964	0	674	457	0	323	219
2039	0	1 342	910	0	624	423	0	294	199
2040	0	1 266	858	0	577	391	0	267	181
2041	0	1 195	810	0	535	362	0	243	165
2042	0	1 127	764	0	495	336	0	221	150
2043	0	1 063	721	0	458	311	0	201	136
2044	0	1 210	680	0	512	288	0	220	124
2045	0	946	641	0	393	266	0	166	112
2046	0	893	605	0	364	247	0	151	102
2047	0	842	571	0	337	228	0	137	93
2048	0	794	539	0	312	212	0	125	85
2049	0	749	508	0	289	196	0	113	77
2050	0	707	479	0	267	181	0	103	70
2051	0	667	452	0	248	168	0	94	63
2052	0	841	427	0	306	155	0	114	58
2053	0	594	402	0	212	144	0	77	52
RES+2053	0	560	380	0	197	133	0	70	48
TOTAL	**1 480 486**	**113 464**	**64 729**	**1 245 109**	**71 387**	**39 532**	**1 054 470**	**47 003**	**25 281**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 658 679**	**2 488**	**67**
8%	**1 356 029**	**1 524**	**89**
10%	**1 126 754**	**978**	**115**

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Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C LESS 25 YEARS	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	1	**Commission Year**	2008	**Output (m3/s)**	4.66

Element	Type	Name	Characteristics		Capital Costs Civil	Capital Costs Mech. & Elec.	Electricity Costs per year	Timing Start	Timing End	Timing Duration	Construction Cash Flow 1st year %	Year 1 Civil	Year 1 M & E	Annual Civil	Annual M & E
				Cap											
Waterworks		Baynesfield & Umlaas Rd Res.			200 793	72 247		2006	2007	2	10.0%	110436.2	39735.9	90356.9	32511.2
			Dia.	Length											
Tunnel		Smithfield to Baynesfield			541 292	2 000		2003	2007	5	20.0%	194865.1	720.0	86606.7	320.0
			Dia.	Length											
Pipeline		Baynesfield to Umlaas Rd Res.			209 022	3 419		2005	2007	3	10.0%	83608.8	1367.6	62706.6	1025.7
			FSL	h											
Dam	composite	Smithfield dam			210 693	10 913		2005	2007	3	10.0%	84277.2	4365.2	63207.9	3273.9
Dam	Earthfill	Baynesfield dam.			3 518	2 473		2007	2007	1	10.0%	3518.0	2473.0	3166.2	2225.7
			No.	m3											
Pump Station		Smithfield dam intake tower		3.2	37 260	30 763	3841	2007	2007	1	10.0%	37260.0	30763.0	33534.0	27686.7
Infrastructure			N/A	N/A				2003	2002						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	13 860			2002	2002	1	10.0%	13860.0		12474.0	
Advance Infr.			N/A	N/A											
Total					1 216 438	121 815	3841								
					1 502 637										

Year	Cost Factors Social & Environ.	Cost Factors Admin.
2003	0.4000	
2004	0.4000	
2005	0.2000	
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
Total	1.0000	

Other Costs

Description	Cost
Social & Environ.	3794
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C LESS 25 YEARS	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	2	**Commission Year**	2015	**Output (m3/s)**	1.30

Element	**Type**	**Name**	**Characteristics**		**Capital Costs**		**Electricity Costs per year**	**Timing**			**Construction Cash Flow**				
					Civil	**Mech. & Elec.**		**Start**	**End**	**Duration**	**1st year %**	**Year 1**		**Annual**	
												Civil	**M & E**	**Civil**	**M & E**
				Cap											
Waterworks		Upsizing Baynesfield			245 902	105 387		2013	2014	2	10.0%	135246.1	57962.9	110655.9	47424.2
			Dia.	**Length**											
Tunnel															
			Dia.	**Length**											
Pipeline															
			FSL	**h**											
Dam	Rockfill	Impendle (1.5 MAR)	1197		369 223	14 793		2011	2014	4	10.0%	119997.5	4807.7	83075.2	3328.4
Dam															
			No.	**m3**											
Pump Station		Smithfield Additional Pumps				20 116	1 075	2014	2014	1	10.0%		20116.0		18104.4
Infrastructure			N/A	N/A				2011	2010						
Infrastructure			N/A	N/A											
Advance Infr.			N/A	N/A	12 947			2010	2010	1	10.0%	12947.0		11652.3	
Advance Infr.			N/A	N/A											
Total					628 072	140 296	1 075								
					870 997										

Year	**Cost Factors**	
	Social & Environ.	**Admin.**
2011	0.4000	
2012	0.4000	
2013	0.2000	
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
Total	0.6000	

Other Costs

Description	**Cost**
Social & Environ.	10425
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

Project Name	MKOMAZI-MGENI TRANSFER STUDY	**File Name**	ECOSCH2C.WB3
Option	SCHEME 2C LESS 25 YEARS	**Date**	06-Nov-98
Base Year	1998	**Component Life**	50

Phase	3	**Commission Year**	2017	Output (m3/s)	5.96

Element	Type	Name	Characteristics		Capital Costs		Electricity Costs per year	Timing			Construction Cash Flow				
					Civil	Mech. & Elec.		Start	End	Duration	1st year %	Year 1		Annual	
												Civil	M & E	Civil	M & E
				Cap											
Waterworks															
			Dia.	**Length**											
Tunnel															
Tunnel															
			Dia.	**Length**											
Pipeline		Baynesfield to Umlaas Rd Res.			205 531	3 419		2014	2016	3	10.0%	82212.4	1367.6	61659.3	1025.7
Pipeline															
			FSL	**h**											
Dam															
Dam															
			No.	**m3**											
Pump Station							5 004								
Pump Station															
Infrastructure								2014	2013						
Infrastructure															
Advance Infr.															
Advance Infr.															
Total					205 531	3 419	5 004								
					234 024										

Year	Cost Factors	
	Social & Environ.	Admin.
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
Total		

Other Costs

Description	Cost
Social & Environ.	
Administration	

Maintenance as % of Construction Cost

(after Commissioning)

ANNUAL	Civil	Mech & Elec
Waterworks	0.25%	4.00%
Tunnel	0.10%	4.00%
Pipeline	0.25%	4.00%
Dam	0.25%	4.00%
Pump Station	0.25%	4.00%
Other	0.25%	4.00%
PERIODIC	Period (Yrs)	%
Pump Station (M & E)	15.0	15.00%

Sensitivity

	Comm Date	
Original		
Sensitivity		
Sensitised		

Engineering as % of Construction Cost

Pre - Engineering	5.00%
Construction	7.00%

Discount Rates

Low	6.0%
Medium	8.0%
High	10.0%

Note: 1st year's costs are not discounted.

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C LESS 25 YEARS

YEAR	PHASE 1			PHASE 2			PHASE 3			PHASE 4			TOTAL ANNUAL COST (EXCL. VAT)		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	14 275	0	0	0	0	0	0	0	0	0	0	0	14 275	0	0
2002	28 412	0	0	0	0	0	0	0	0	0	0	0	28 412	0	0
2003	221 645	35	0	0	0	0	0	0	0	0	0	0	221 645	35	0
2004	112 206	35	0	0	0	0	0	0	0	0	0	0	112 206	35	0
2005	288 219	35	0	0	0	0	0	0	0	0	0	0	288 219	35	0
2006	394 875	35	0	0	0	0	0	0	0	0	0	0	394 875	35	0
2007	443 004	35	0	0	0	0	0	0	0	0	0	0	443 004	35	0
2008	0	6 801	901	0	0	0	0	0	0	0	0	0	0	6 801	901
2009	0	6 801	1 333	10 248	0	0	0	0	0	0	0	0	10 248	6 801	1 333
2010	0	6 801	1 778	23 454	0	0	0	0	0	0	0	0	23 454	6 801	1 778
2011	0	6 801	2 243	146 494	32	0	0	0	0	0	0	0	146 494	6 833	2 243
2012	0	6 801	2 725	105 907	32	0	5 224	0	0	0	0	0	111 131	6 833	2 725
2013	0	6 801	3 227	301 773	32	0	5 224	0	0	0	0	0	306 997	6 833	3 227
2014	0	6 801	3 747	283 122	32	0	89 431	0	0	0	0	0	372 552	6 833	3 747
2015	0	6 801	3 841	0	7 182	447	67 073	0	0	0	0	0	67 073	13 983	4 288
2016	0	6 801	3 841	0	7 182	1 009	67 073	0	0	0	0	0	67 073	13 983	4 850
2017	0	6 801	3 841	0	7 182	1 075	0	651	526	0	0	0	0	14 633	5 442
2018	0	6 801	3 841	0	7 182	1 075	0	651	1 141	0	0	0	0	14 633	6 057
2019	0	6 801	3 841	0	7 182	1 075	0	651	1 780	0	0	0	0	14 633	6 696
2020	0	6 801	3 841	0	7 182	1 075	0	651	2 443	0	0	0	0	14 633	7 359
2021	0	6 801	3 841	0	7 182	1 075	0	651	3 132	0	0	0	0	14 633	8 048
2022	0	11 715	3 841	0	7 182	1 075	0	651	3 847	0	0	0	0	19 548	8 763
2023	0	6 801	3 841	0	7 182	1 075	0	651	4 590	0	0	0	0	14 633	9 506
2024	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2025	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2026	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2027	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2028	0	6 801	3 841	0	7 182	1 075	0	651	5 004	0	0	0	0	14 633	9 920
2029	0	6 801	3 841	0	10 199	1 075	0	651	5 004	0	0	0	0	17 651	9 920
2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**1 502 637**	**154 700**	**73 570**	**870 997**	**110 877**	**15 431**	**234 024**	**8 458**	**47 484**	**0**	**0**	**0**	**2 607 659**	**274 035**	**136 485**
Commission date		2008			2015			2017			0				
Transfer capacity (m3/s)		4.66			1.30			5.96			0.00				

(CONTINUED.....)

Check	**1 502 637**	**870 997**	**234 024**	**0**

MKOMAZI-MGENI TRANSFER STUDY

SCHEME 2C LESS 25 YEARS

YEAR	NET PRESENT COST (1994) AT 6%			NET PRESENT COST (1994) AT 8%			NET PRESENT COST (1994) AT 10%		
	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY	CAPITAL	MAINTENANCE & OPERATION	ELECTRICITY
SHADOW									
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0
2001	11 986	0	0	11 332	0	0	10 725	0	0
2002	22 505	0	0	20 884	0	0	19 406	0	0
2003	165 626	26	0	150 848	24	0	137 624	22	0
2004	79 101	24	0	70 709	22	0	63 338	20	0
2005	191 682	23	0	168 173	20	0	147 902	18	0
2006	247 750	22	0	213 339	19	0	184 212	16	0
2007	262 214	21	0	221 613	17	0	187 877	15	0
2008	0	3 797	503	0	3 150	418	0	2 622	348
2009	5 398	3 582	702	4 395	2 917	572	3 592	2 384	467
2010	11 656	3 380	884	9 314	2 701	706	7 473	2 167	567
2011	68 682	3 204	1 052	53 865	2 512	825	42 434	1 979	650
2012	49 153	3 022	1 205	37 836	2 326	928	29 264	1 799	718
2013	128 099	2 851	1 346	96 778	2 154	1 017	73 493	1 636	773
2014	146 654	2 690	1 475	108 744	1 994	1 094	81 078	1 487	815
2015	24 909	5 193	1 592	18 128	3 779	1 159	13 270	2 766	848
2016	23 499	4 899	1 699	16 785	3 499	1 214	12 064	2 515	872
2017	0	4 836	1 799	0	3 391	1 261	0	2 393	890
2018	0	4 563	1 889	0	3 140	1 300	0	2 175	900
2019	0	4 304	1 970	0	2 907	1 330	0	1 977	905
2020	0	4 061	2 042	0	2 692	1 354	0	1 798	904
2021	0	3 831	2 107	0	2 492	1 371	0	1 634	899
2022	0	4 828	2 164	0	3 083	1 382	0	1 985	890
2023	0	3 410	2 215	0	2 137	1 388	0	1 351	877
2024	0	3 217	2 181	0	1 978	1 341	0	1 228	832
2025	0	3 034	2 057	0	1 832	1 242	0	1 116	757
2026	0	2 863	1 941	0	1 696	1 150	0	1 015	688
2027	0	2 701	1 831	0	1 571	1 065	0	922	625
2028	0	2 548	1 727	0	1 454	986	0	839	569
2029	0	2 899	1 629	0	1 624	913	0	920	517
2030	0	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0	0
2044	0	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0	0
2052	0	0	0	0	0	0	0	0	0
2053	0	0	0	0	0	0	0	0	0
RES+2053	0	0	0	0	0	0	0	0	0
TOTAL	**1 438 913**	**79 827**	**36 010**	**1 202 743**	**55 130**	**24 013**	**1 013 752**	**38 796**	**16 310**

DISCOUNT RATE	PRESENT WORTH OF COSTS @ R1,00 / m3	NPV OF WATER DELIVERED	UNIT REFERENCE VALUE (cents/m3)
6%	**1 554 750**	**1 370**	**113**
8%	**1 281 886**	**914**	**140**
10%	**1 068 858**	**621**	**172**

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