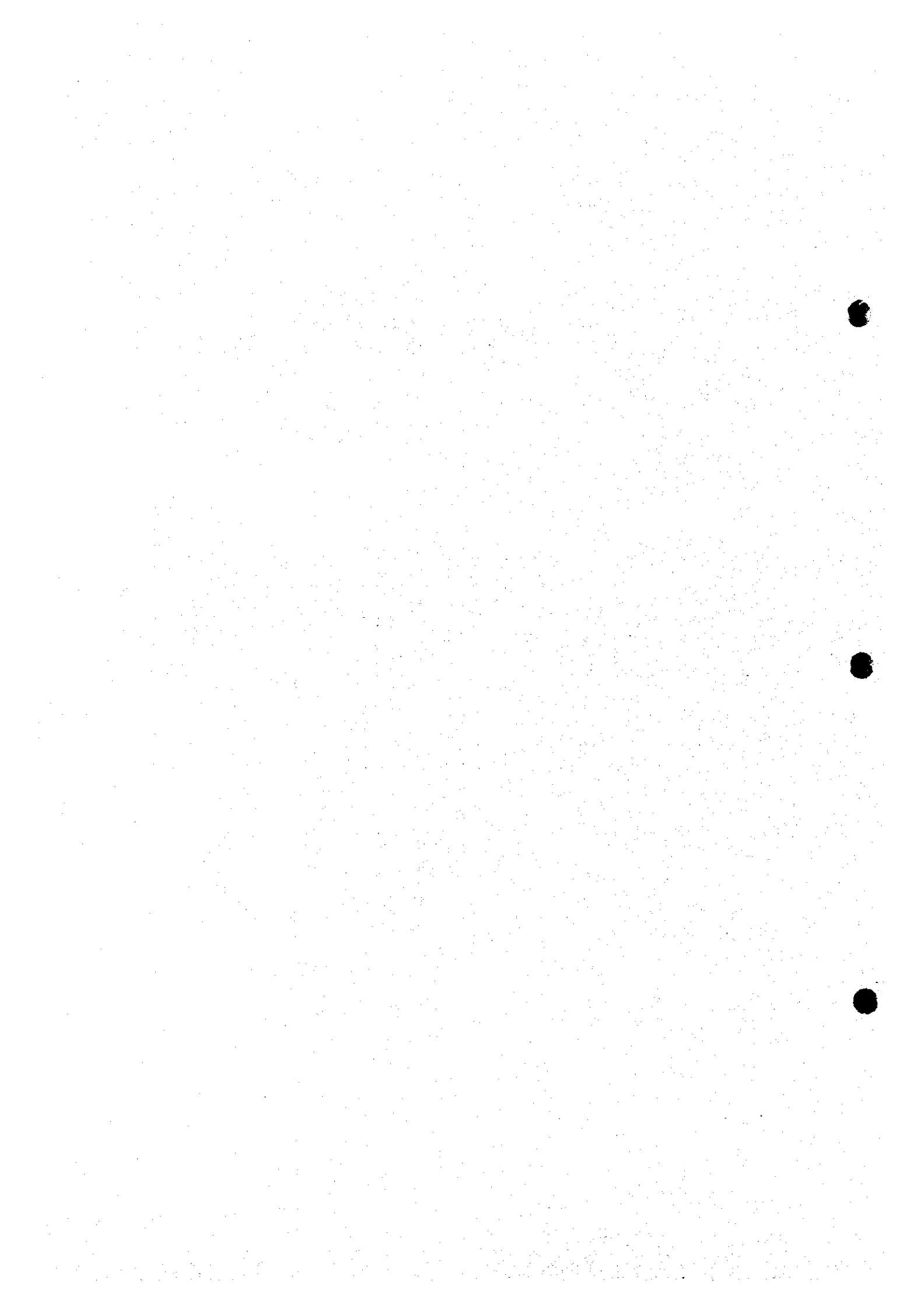


PART VI

PROJECT EVALUATION



**THE AFTERCARE STUDY
ON THE NATIONAL WATER MASTER PLAN**

SUPPORTING REPORT

PART VI : PROJECT EVALUATION

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CHAPTER 1 EVALUATION METHOD

Only the following selected priority projects were evaluated: (i) urban water supply, (ii) rural water supply, and (iii) sewerage. The livestock water supply was not evaluated because of the lack of necessary information.

Only economic viability of the projects was evaluated. This decision was made mainly because the evaluation unit for the projects was determined to be not by scheme, but by either urban centre or district as a whole where different undertaker operates several schemes in different scale and tariff. The financial viability of the projects was not, therefore, evaluated.

Furthermore, the economic evaluation of the rural water supply projects was made not by quantitative method, but by qualitative method because the evaluation unit covered a wide range of rural areas in the district which did not have sufficient socioeconomic data. Calculation of EIRR (Economic Internal Rate of Return) or other evaluation measures such as NPV (Net Present Value) and CBR (Cost Benefit Ratio) was not, therefore, done, but some socioeconomic impacts of the projects were assessed.

CHAPTER 2 EVALUATION OF PRIORITY URBAN WATER SUPPLY PROJECTS

2.1 General

The economic viability of the priority urban water supply projects was evaluated for the following urban centres: Msambweni (U-46), Tala and Kangundo (U-77), Wajir (U-116), Kisumu (U-120), Homa Bay (U-129), Narok (U-163), Luanda (U-213) and Mbale (U-214). Calculation of EIRR, on the basis of the estimated investment costs, O&M costs and the quantifiable economic benefits, was conducted for evaluating the viability of the projects.

2.2 Identification of Economic Benefits

Based on the data and information collected in the field survey conducted, the economic benefits of the priority urban water supply projects are:

- 1) The increased quantity of available water for consumption will alleviate shortage of water and water rationing, particularly during the dry season,
- 2) Cost saving for water vendor will be realised for the people who are currently dependent on fairly expensive vending water compared to the water tariffs of the public water supply systems, and
- 3) The improved quality water will contribute to preventing the people from catching waterborne diseases through taking unsanitary water.

Among the economic benefits identified, the benefits of (i) increased water and (ii) cost saving were selected as quantifiable benefits.

2.3 Estimate of Quantifiable Benefit

2.3.1 Increased Water

The first major benefit is the net increase of water gained through improvement of rehabilitation and expansion of the priority projects. The net increase of water was, therefore, valued at the marginal production cost of water by calculating an average incremental cost of the water production value per cubic meter. This is termed the Average Incremental Costs (AIC).

2.3.2 Cost Saving

Cost saving through not purchasing vending water of a jerry can is another major benefit of the priority projects. Cost saving benefit is then valued by estimating the difference between the economic value of a jerry can and the marginal production cost of water. Both were valued per cubic meter. One jerry can (20 litres) was assumed to cost at 1 Kshs.

2.4 Economic Cash Flow Analysis

2.4.1 Assumptions

The following assumptions were made for the economic analysis:

- 1) The investment costs, O&M costs, and economic benefits of the projects are estimated at the price level of early 1998.
- 2) Local portion of the financial investment costs were converted to economic investment costs by applying a conversion factor of 0.9, and the economic investment costs of the projects as presented in **Table - 2.4.1**,
- 3) The economic benefits were estimated on the basis of "with and without project principle," as stated in the previous section of the estimate of quantifiable benefit, as presented in **Table - 2.4.2**,
- 4) The quantifiable benefits of increased water and cost saving were included in the calculation.
- 5) The opportunity cost of capital was assumed to be 10%, discounting the costs of the projects and benefits. (for estimating NPV and CBR)

2.4.2 Results of the Evaluation

The economic cash flow table for each priority project was prepared on an annual basis. In addition to EIRR, NPV and CBR were also estimated to further verify the economic viability of the projects.

The results of the analysis are summarised in the table below. The cash flows for each priority project are presented in **Table - 2.4.3**.

Summary of Economic Evaluation for Priority Water Supply Projects

Urban Centre	EIRR	NPV (US\$10 ³)	CBR
Msambweni	16.6%	1,833	1.63
Tala+Kangundo	16.7%	2,423	1.61
Wajir	12.4%	1,426	1.21
Kisumu	9.8%	▲852	0.98
Homa Bay	17.4%	4,595	1.72
Narok	1.2%	▲10,748	0.45
Luanda	18.6%	9,915	1.86
Mbale	24.7%	2,792	1.95

The results of the analysis show that Msambweni, Tala and Kangundo, Wajir, Homa Bay, Luanda and Mbale were found to be economically viable with the fairly acceptable EIRR ratios, being more than the opportunity cost of capital of 10% assumed in the analysis. The alternative evaluation measures of these six projects also indicated that these projects attained economically viable values. Furthermore, Kisumu was marginally viable with EIRR rate of 9.8%, being still justifiable. Narok was, however, hardly acceptable with an EIRR rate of only 1.2%, being not

economically justifiable. Narok could not become economically viable mainly because the quite high investment costs of dam construction.

2.5 Sensitivity Analysis

2.5.1 General

Having done cash flow analysis in the previous section, a sensitivity analysis was conducted in order to verify if the projects would remain economically viable under changes to investment or O&M costs in the future. The cash flows made for this analysis were presented in **Table - 2.5.1**.

2.5.2 Assumptions

The following three cases were made for the sensitivity analysis.

- 1) Case I : Investment costs increased by 20%
- 2) Case II : O&M costs increased by 20%
- 3) Case III : Both investment and O & M costs increased by 20%

2.5.3 Results

The results of the analysis are illustrated in table below:

Sensitivity Analysis by for Priority Urban Water Supply Projects

Urban Centre	Index	Base Case	Case I	Case II	Case III
Msambweni	EIRR	16.6%	14.4%	16.3%	14.1%
	NPV	1,833	1,345	1,735	1,247
	CBR	1.63	1.39	1.57	1.36
Tala+Kangundo	EIRR	16.5%	14.2%	16.1%	13.9%
	NPV	2,423	1,755	2,291	1,623
	CBR	1.61	1.38	1.55	1.34
Wajir	EIRR	12.4%	10.4%	12.1%	10.1%
	NPV	1,426	235	1,243	52
	CBR	1.21	1.03	1.18	1.01
Kisumu	EIRR	9.8%	7.9%	9.5%	7.7%
	NPV	▲852	▲10,827	▲2,121	▲12,096
	CBR	0.98	0.84	0.96	0.82
Homa Bay	EIRR	17.4%	15.1%	17.1%	14.8%
	NPV	4,595	3,528	4,390	3,322
	CBR	1.72	1.47	1.67	1.44
Narok	EIRR	1.2%	-	0.9%	-
	NPV	▲10,748	▲14,284	▲11,104	▲14,640
	CBR	0.45	0.38	0.44	0.37
Luanda	EIRR	18.6%	16.2%	18.3%	15.9%
	NPV	9,915	7,981	9,536	7,602
	CBR	1.86	1.59	1.80	1.55
Mbale	EIRR	24.7%	22.6%	22.9%	20.9%
	NPV	2,792	2,613	2,385	2,206
	CBR	1.95	1.84	1.71	1.63

The above table shows that the economic viability of the projects is slightly sensitive to both increase of the investment costs (Case I) while not sensitive to the increase of investment and O&M costs (Case III). However, as shown in Case III all the six projects are economically viable, being more than the opportunity cost of capital of 10%, except for Kisumu and Narok.

2.6 Overall Evaluation

The six priority urban water supply projects of Msambweni, Tala+Kangundo, Wajir, Homa Bay, Luanda and Mbale were identified to be economically feasible with fairly acceptable economic returns, even with the increase in investment and O&M costs in the future. Kisumu was also found to be justifiable with marginal EIRR attained, but not justifiable with the increase of the costs under Case I and Case III. Narok can not become economically viable with any conditions.

CHAPTER 3 EVALUATION OF PRIORITY RURAL WATER SUPPLY PROJECTS

3.1 General

The economic viability of the priority rural water supply projects was evaluated by qualitative method for the selected districts: Kwale (320), Mandera (520), Migori (650), Kipsigis (720), Narok (750) and Transmara (790). The socioeconomic impacts of the projects were mainly evaluated.

3.2 Identification of Socio-Economic Impacts

Based on the data and information collected in the field survey conducted, the following were the socioeconomic impacts of the priority rural water supply projects are:

- 1) The increase of available water will contribute enhancing the public health conditions of the local residents, thereby decreasing the infection of water-borne diseases,
- 2) Improved access to water will prevent women from heavy burden of water-carrying for a long distance, resulting in improvement of public welfare such as health conditions and spare time for other social and economic activities, and
- 3) These benefits will contribute particularly to the local residents living in the ASAL area where access to water is quite limited, therefore being suffered from obtaining daily living water.

3.3 Socioeconomic Impacts of the Projects

The socioeconomic impacts of the projects identified in the previous section were evaluated. The impacts discussed were public health, access to safe water and water-carrying burden. The socioeconomic impacts expected through implementation of the projects are summarised in the table below. The information used was obtained from the household survey conducted in the Welfare Monitoring Survey II (CBS, World Bank and UNICEF, 1994).

The indicators used for the evaluation are based on the percentages measured by the national average index (national average = 100), to show the comparative status or situation of the priority projects in the country.

Socio-Economic Impacts Expected through Implementation of Priority Rural Water Supply Projects

Socio-Economic Conditions	Kwale		Mandera		Migori		Kipsigis		Narok		Transmara	
	Rate	Impact Expected	Rate	Impact Expected	Rate	Impact Expected	Rate	Impact Expected	Rate	Impact Expected	Rate	Impact Expected
A. Public Health												
Vomit/Diarrhoea Case Population (%) (National Average Index = 100)	24.3 (259)	●	2.3 (25)	-	17.8 (189)	●	9.5 (101)	●	4.6 (49)	-	4.6 (49)	-
Fever/Malaria Case Population (%) (National Average Index = 100)	56.1 (109)	●	46.4 (90)	-	40.5 (79)	-	45.7 (89)	-	75 (146)	●	75 (146)	●
B. Access to Safe Water												
Access Ratio (%) (National Average Index = 100)	22.5 (50)	●	8.2 (18)	●	5.5 (12)	●	32 (71)	●	24.9 (55)	●	24.9 (55)	●
C. Water Carrying Burden												
More than 2 Hours during Dry Season (%) (National Average Index = 100)	20.5 (373)	●	44.0 (800)	●	9.8 (178)	●	4.9 (89)	-	6.4 (116)	●	6.4 (116)	●
D. Overall Evaluation	-	⊙	-	○	-	○	-	△	-	○	-	○

Symbols:

- = Expected socio-economic impacts of the project found to be high
- ⊙ = Overall impacts of the project expected to be significant
- = Overall impacts of the project expected to be high
- △ = Overall impacts of the projects expected to be not so high

3.3.1 Public Health

Impacts on public health were basically assessed by the percentage of the case population who are suffering from the water-related diseases such as vomit/diarrhoea and fever/malaria. Of the six project areas, Kwale, Migori, Narok, and Transmara were found to have the high impacts on public health through implementation of the projects. Particularly, the impacts of Kwale were identified to be significant compared to the others, since Kwale are currently suffering from both vomit/diarrhoea (24.3% in case population or 259 in national average index) and fever/malaria (56.1% or 109). The others are affected either by vomit/diarrhoea or fever/malaria. The incidence of vomit/diarrhoea in Kipsigis was found to be not so significant compared to the others, staying at almost the same as the national average. Furthermore, Mandera was identified not to have significant impacts for public health.

3.3.2 Access to Safe Water

Regarding the access to safe water, the impacts were evaluated by the percentage of households who have access to safe water. All the project areas were found to have high impacts on the access to safe water. Of the six project areas, Mandera and Migori would have the significant impacts because only 8.2% and 5.5% of the households, respectively, have access to safe water at present. These figures were considerably far below the national average, accounting for only 18% and 12% of the national average, respectively. The other four project areas were also identified to be suffering from obtaining safe water as well with the access ratio being approximately half of the national average.

3.3.3 Water Carrying Burden

Women in Kenya basically conduct water carrying, which is a heavy burden on them in terms of health and time. For this evaluation, the impacts were assessed by the percentages of the households who spend more than 2 hours for water fetching during the dry season. All the

project areas were found to have high impacts, except Kipsigis where the situation was better than the others being lower than the national average. Of the six project areas, the impact of water carrying would be considerably high in Mandera where 44% of the households spend more than 2 hours for water fetching. The national average index of Mandera was then found to be 800 or eight times the national average.

3.4 Overall Evaluation

Overall, Kwale was found to have significant socioeconomic impacts through the implementation of the projects because all the selected socioeconomic impacts would be expected in Kwale. For Mandera, Migori, Narok and Transmara, the impacts would be also expected to be high, as indicated in the table above. Though Kipsigis was found to have not so high overall impacts, the priority projects were justified in general, economically, in terms of socioeconomic impacts.

CHAPTER 4 EVALUATION OF PRIORITY SEWERAGE PROJECTS

4.1 General

With the quantifiable benefits identified in the subsequent section, the economic viability of the priority sewerage projects was evaluated for the selected urban centres: Malindi (U-40), Mombasa (U-52), Machakos (U-71), Kisumu (U-120) and Narok (U-163). Based on the estimated investment costs, O&M costs, and the quantifiable economic benefits identified, the calculation of EIRR was undertaken for evaluating the viability of the projects.

4.2 Identification of Economic Benefits

According to the field survey conducted, the economic benefits of the priority sewerage projects are:

4.2.1 Major Economic Benefits

The major economic benefits of sewerage projects are:

- 1) Resource costs saving associated with not having to depend on alternative sanitation facilities such as pit latrines and septic tanks,
- 2) Willingness to pay for an improvement in sewerage service will be realised in terms of the increased service for the urban communities who are currently not connecting to sewerage systems and therefore relying on only alternative sanitation facilities, and
- 3) The introduction of the proposed sewerage systems will contribute to improving the hygiene, health and environment conditions of the urban communities.

4.2.2 Quantifiable Economic Benefits

Of the economic benefits identified, the benefits from (i) resource costs savings and (ii) willingness to pay for increased service were selected as quantifiable benefits.

4.3 Estimate of Quantifiable Benefits

4.3.1 Resource Costs Savings

The first major benefit is the resource costs savings of not having to depend on the on-site sanitation facilities such as pit latrines and septic tanks. Information on the investment and O&M costs for pit latrine and septic tank was obtained from another feasibility study done recently in Kenya and used as the assumptions for the analysis.

4.3.2 Increased Service (Willingness-To-Pay)

In addition to the resource costs savings, the willingness-to-pay of the urban communities was considered as another major economic benefit of the project and then defined as increased service. For the purpose of the analysis, the increased service of sewerage service was valued at the marginal treatment cost of wastewater by calculating an average incremental cost of the wastewater treatment value per cubic meter. This is defined as the AIC.

4.4 Economic Cash Flow Analysis

4.4.1 Assumptions

The following assumptions were made for the economic cash flow analysis:

- 1) The investment costs, O&M costs and economic benefits of the projects are estimated at the price level of early 1998,
- 2) Local portion of the financial investment costs are converted to economic investment costs by applying a conversion factor of 0.9, and the economic investment costs are presented in **Table - 4.4.1**,
- 3) The economic benefits were estimated on the basis of "with and without project principle," estimated as stated in the previous section of the estimate of quantifiable benefit, as presented in **Table - 4.4.2**,
- 4) The quantifiable benefits of resource costs savings and increased service (willingness-to-pay) were included in the calculation, and
- 5) The opportunity cost of capital was assumed to be 10%, discounting the costs of the projects and benefits.

4.4.3 Results

The economic cash flow was prepared on an annual basis for each priority project. In addition to EIRR, alternative evaluation measures of NPV and CBR were also applied to further verify the economic viability of the projects.

The results of the analysis are summarised in the table below. The cash flows for each priority project are presented in **Table - 4.4.2**.

Summary of Economic Evaluation for Priority Sewerage Projects

Index	Malindi UC	Mombasa UC	Machakos UC	Kisumu UC	Narok UC
EIRR	14.5%	11.8%	22.1%	11.6%	13.1%
NPV	2,289	4,281	4,440	4,264	1,396
CBR	1.23	1.08	1.82	1.09	1.21

According to the results of the analysis, all the projects have acceptable economic return with fairly acceptable rates of EIRR, showing the higher rates than the opportunity costs of capital of

10% used in the analysis. Other evaluation measures of NPV and CBR also indicated the economic viability of the projects with the positive values.

4.5 Sensitivity Analysis

4.5.1 General

Having done cash flow analysis, the projects was further evaluated to verify if the projects would be economically viable under the uncertain conditions such as the change of the costs of investment and O&M in the future. The sensitivity analysis was, therefore, conducted. The cash flows made for this analysis were presented in **Table - 4.5.1**.

4.5.2 Assumptions

The following three cases were made for the sensitivity analysis.

- 1) Case I : Investment costs increased by 20%
- 2) Case II : O&M costs increased by 20%
- 3) Case III : Both investment and O & M costs increased by 20%

4.5.3 Results

The results of the analysis are summarised in the table below.

The economic viability of the projects was found to be sensitive to the increase of both investment and O&M costs (Case III). Mombasa and Kisumu under Case I and Case III were, however, found to be not economically viable, being less than the opportunity cost of capital of 10%. Even under the Case II, Kisumu was also fund to be not viable.

Sensitivity Analysis for Priority Sewerage Projects

Urban Centre	Index	Base Case	Case I	Case II	Case III
Malindi	EIRR	14.5%	12.3%	12.6%	10.5%
	NPV	2,289	1,304	1,281	296
	CBR	1.23	1.12	1.12	1.02
Mombasa	EIRR	11.8%	9.3%	10.0%	7.7%
	NPV	4,281	▲1,824	101	▲6,004
	CBR	1.08	0.97	1.00	0.90
Machakos	EIRR	22.1%	19.4%	21.0%	18.4%
	NPV	4,440	3,855	3,937	3,351
	CBR	1.82	1.64	1.66	1.51
Kisumu	EIRR	11.6%	9.6%	9.9%	8.0%
	NPV	4,264	▲1,331	▲149	▲5,743
	CBR	1.09	0.98	1.00	0.90
Narok	EIRR	13.1%	10.8%	12.3%	10.1%
	NPV	1,396	411	1,024	39
	CBR	1.21	1.05	1.14	1.00

4.6 Overall Evaluation

All the priority projects selected for sewerage were basically found to be economically feasible with fairly acceptable EIRR return. However, the sensitivity analysis indicated that the two projects in Mombasa and Kisumu would not be economically feasible if the costs of the investment and O&M were increased by more than 20% in the future.

- PART VI : PROJECT EVALUATION -

TABLES

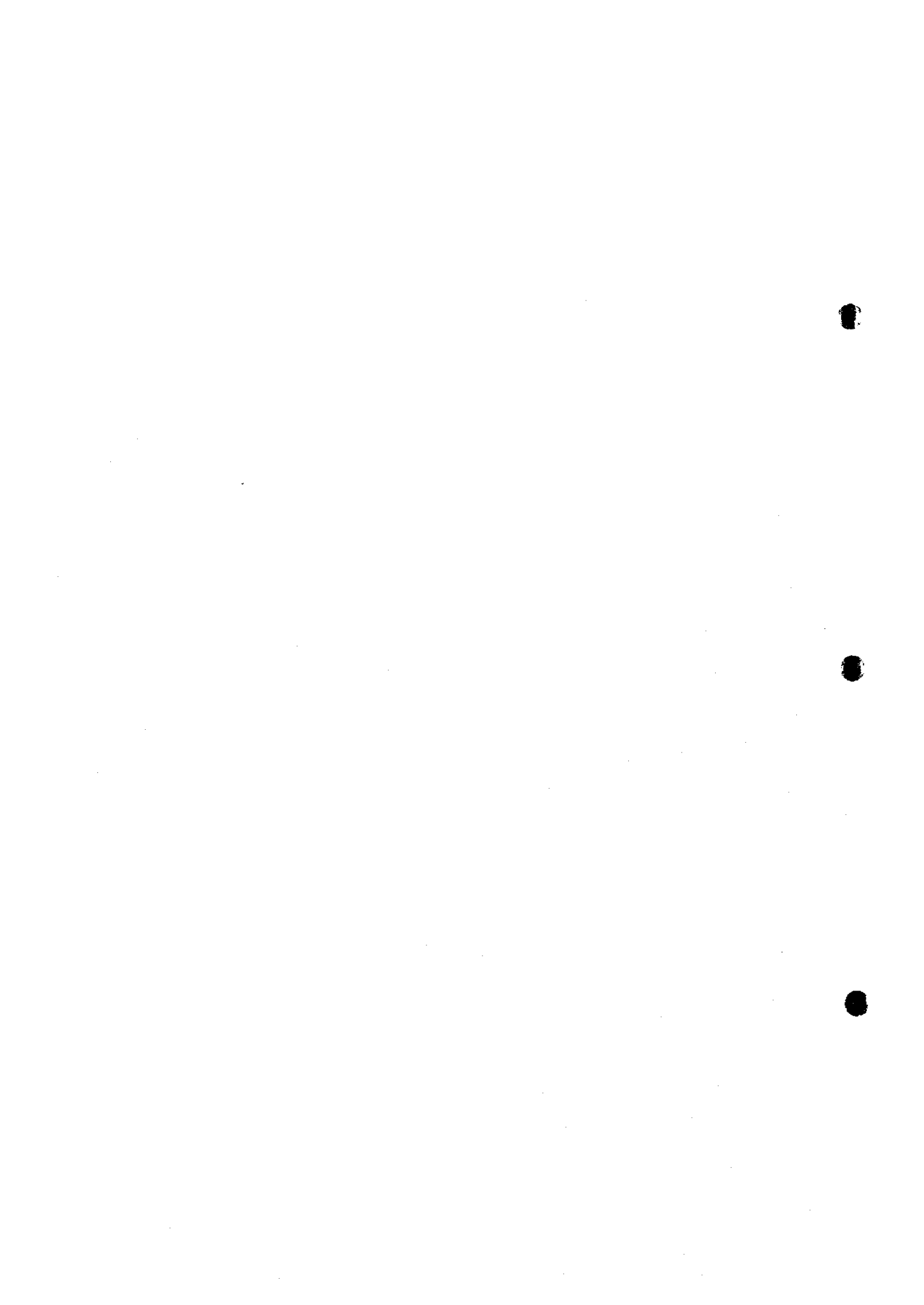


Table - 2.4.1 Project Costs for Priority Urban Water Supply Projects

Financial Investment Costs	(Unit: US\$ 1,000)																				Total			
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		2019	2020	2021
Msamwari UC	134	134	159	1,171	1,171	1,171																		3,940
Tala+Kangundo UC	182	182	198	1,614	1,614	1,614																		5,404
Wajir UC	322	322	328	2,890	2,890	2,890																		9,642
Kisumu UC	3,373	3,373	11,335	20,116	20,116	20,116																		78,428
Homa Bay UC	293	293	357	2,559	2,559	2,559																		8,620
Narok UC	1,287	1,287	5,181	6,578	6,578	6,578																		27,489
Luanda UC	526	526	581	4,669	4,669	4,669																		15,640
Mbale UC	202	202	222	222	222	222																		1,491.63
Total	6,117	6,117	18,139	39,597	39,597	39,597																		149,163

Economic Investment Costs	(Unit: US\$ 1,000)																				Total			
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		2019	2020	2021
Msamwari UC	129	129	153	1,124	1,124	1,124																		3,782
Tala+Kangundo UC	175	175	190	1,549	1,549	1,549																		5,188
Wajir UC	309	309	315	2,774	2,774	2,774																		9,256
Kisumu UC	3,238	3,238	10,882	19,311	19,311	19,311																		75,291
Homa Bay UC	281	281	343	2,457	2,457	2,457																		8,275
Narok UC	1,236	1,236	4,974	6,315	6,315	6,315																		26,389
Luanda UC	505	505	558	4,482	4,482	4,482																		15,014
Mbale UC	194	194	213	213	213	213																		1,431.96
Total	5,872	5,872	17,413	38,013	38,013	38,013																		143,196

Incremental O&M Costs	(Unit: US\$ 1,000)																				Total			
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		2019	2020	2021
Msamwari UC							108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	1,836
Tala+Kangundo UC							146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	2,482
Wajir UC							202	202	202	202	202	202	202	202	202	202	202	202	202	202	202	202	202	3,434
Kisumu UC							1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	1,401	23,817
Homa Bay UC							227	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227	3,859
Narok UC							393	393	393	393	393	393	393	393	393	393	393	393	393	393	393	393	393	6,681
Luanda UC							419	419	419	419	419	419	419	419	419	419	419	419	419	419	419	419	419	7,123
Mbale UC							450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	7,650
Total							2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	49,232

Table - 2.4.2 Estimated Economic Benefits for Priority Urban Water Supply Projects

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Totals
Mission Vieja UC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Supplies (m ³ /day)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Supplies (1,000m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Increased Benefits (US\$/m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Increased Benefits (US\$/m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vendor Water Savings Benefits (1,000m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Benefits (US\$ 1,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mission Vieja UC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Supplies (m ³ /day)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Supplies (1,000m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Increased Benefits (US\$/m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Increased Benefits (US\$/m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vendor Water Savings Benefits (1,000m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Benefits (US\$ 1,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mission Vieja UC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Supplies (m ³ /day)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Supplies (1,000m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Increased Benefits (US\$/m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Increased Benefits (US\$/m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vendor Water Savings Benefits (1,000m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Benefits (US\$ 1,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mission Vieja UC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Supplies (m ³ /day)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Supplies (1,000m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Increased Benefits (US\$/m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Increased Benefits (US\$/m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vendor Water Savings Benefits (1,000m ³ /year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Benefits (US\$ 1,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Water Supplies (m ³ /day)	1.00	Kaha
Water Supplies (1,000m ³ /year)	50.00	Kaha
Conversion factor	0.90	
Water Savings (1,000 Liters = m ³)	45.00	Kaha
Conversion factor	0.74	US\$
Vendor Water Savings Benefits		
Mission Vieja UC		
Water Supplies (m ³ /day)	0.28	US\$/m ³
Water Supplies (1,000m ³ /year)	0.13	US\$/m ³
Conversion factor	0.01	US\$/m ³
Service Increased Benefits (US\$/m ³)	0.31	US\$/m ³
Service Increased Benefits (US\$/m ³ /year)	0.31	US\$/m ³
Vendor Water Savings Benefits (1,000m ³ /year)	0.34	US\$/m ³
Estimated Benefits (US\$ 1,000)	0.34	US\$/m ³

Table - 2.5.1 (3/3) Sensitivity Analysis for Priority Urban Water Supply Projects
- Case III: Investment and O&M Costs Increased by 20% -

(Unit: 1,000US\$)

Member	Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Mamlati LC	Annual Investment Costs	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154
	Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Annual Costs	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154
	Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Net Annual Benefits	-154	-154	-154	-154	-154	-154	-154	-154	-154	-154	-154	-154	-154	-154	-154	-154	-154
NPV (10%)	14.7%																	
ERR	14.7%																	
CRF (10%)	1.6%																	
CRF (ERR)	1.6%																	
Mamlati LC	Annual Investment Costs	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271
	Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Annual Costs	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271
	Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Net Annual Benefits	-271	-271	-271	-271	-271	-271	-271	-271	-271	-271	-271	-271	-271	-271	-271	-271	-271
NPV (10%)	16.2%																	
ERR	16.2%																	
CRF (10%)	1.3%																	
CRF (ERR)	1.3%																	
Mamlati LC	Annual Investment Costs	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371
	Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Annual Costs	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371
	Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Net Annual Benefits	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371
NPV (10%)	16.1%																	
ERR	16.1%																	
CRF (10%)	1.2%																	
CRF (ERR)	1.2%																	
Mamlati LC	Annual Investment Costs	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
	Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Annual Costs	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
	Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Net Annual Benefits	-365	-365	-365	-365	-365	-365	-365	-365	-365	-365	-365	-365	-365	-365	-365	-365	-365
NPV (10%)	16.2%																	
ERR	16.2%																	
CRF (10%)	1.2%																	
CRF (ERR)	1.2%																	
Mamlati LC	Annual Investment Costs	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333
	Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Annual Costs	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333
	Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Net Annual Benefits	-333	-333	-333	-333	-333	-333	-333	-333	-333	-333	-333	-333	-333	-333	-333	-333	-333
NPV (10%)	20.9%																	
ERR	20.9%																	
CRF (10%)	1.6%																	
CRF (ERR)	1.6%																	

Table - 4.4.1 Project Costs for Priority Sewerage Projects

(Unit: US\$ 1,000)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Financial Investment Costs																								
Malindi UC	191	191	191	2,675	4,732																			7,980
Mombasa UC	2,122	2,122	980	980	980	980	980	1,448	48,693	5,968	5,968													71,221
Machakos UC	84	84	1,663	364	2,073	171	171																	4,610
Kisumu UC	712	712	4,561	7,943	7,943	5,022	12,152	12,152																51,197
Narok UC	191	191	191	2,675	4,732																			7,980
Total	3,300	3,300	7,586	14,637	20,460	6,173	13,303	13,600	48,693	5,968	5,968													142,988

(Unit: US\$ 1,000)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Economic Investment Costs																								
Malindi UC	76	76	76	1,070	1,893																			3,192
Mombasa UC	849	849	392	392	392	392	392	579	19,477	2,387	2,387													28,488
Machakos UC	34	34	665	146	829	68	68																	1,844
Kisumu UC	285	285	1,824	3,177	3,177	2,009	4,861	4,861																20,479
Narok UC	76	76	76	1,070	1,893																			3,192
Total	1,320	1,320	3,034	5,855	8,184	2,469	5,321	5,440	19,477	2,387	2,387													57,195

(Unit: US\$ 1,000)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	
Incremental O&M Costs																									
Malindi UC						990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	17,820	
Mombasa UC												8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	105,012
Machakos UC								627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	10,032	
Kisumu UC									6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	93,270	
Narok UC						365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	6,570	
Total						1,355	1,355	1,952	8,200	8,200	8,200	16,951	16,951	16,951	16,951	16,951	16,951	16,951	16,951	16,951	16,951	16,951	16,951	232,704	

Table - 4-4.2 (1/5) Estimated Economic Benefits and Economic Cash Flow for Priority Sewerage Project - Malindi UC

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
Annual Investment Costs	180	180	180	2,215	4,448	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,500	
Annual O&M Costs	0	0	0	0	0	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	17,620
Total Annual Costs	180	180	180	2,215	4,448	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	25,321
Estimated Annual Benefits	0	0	0	0	0	961	1,368	1,792	2,032	2,431	2,931	3,221	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	48,427
Net Annual Benefits	▲ 180	▲ 180	▲ 180	▲ 2,215	▲ 4,448	▲ 291	378	802	1,042	1,441	1,941	2,241	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	23,106
EBK *	14.5%																									
NPV *	2,269																									
CBR *	1.23																									
Resources Cost Savings Benefits	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
Total Urban Population	0	77,339	0	0	0	108,346	114,547	121,042	124,310	127,617	130,845	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	
Population Connected to Sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Population without Sewer	0	0	0	0	0	108,346	114,547	121,042	124,310	127,617	130,845	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	134,152	
Population with Pit Latrine	0	0	0	0	0	70,425	74,456	78,703	80,827	82,951	85,075	87,199	87,199	87,199	87,199	87,199	87,199	87,199	87,199	87,199	87,199	87,199	87,199	87,199	87,199	
Population with Septic Tank	0	0	0	0	0	37,921	40,091	42,339	43,532	44,666	45,810	46,953	46,953	46,953	46,953	46,953	46,953	46,953	46,953	46,953	46,953	46,953	46,953	46,953	46,953	
Number of Pit Latrine	0	0	0	0	0	3,012	6,136	4,372	4,490	4,608	4,726	4,844	4,844	4,844	4,844	4,844	4,844	4,844	4,844	4,844	4,844	4,844	4,844	4,844	4,844	
Number of Septic Tank	0	0	0	0	0	6,220	6,952	7,063	7,254	7,444	7,635	7,826	7,826	7,826	7,826	7,826	7,826	7,826	7,826	7,826	7,826	7,826	7,826	7,826	7,826	
New Facilities - Pit Latrine	0	0	0	0	0	224	224	236	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	
New Facilities - Septic Tank	0	0	0	0	0	302	302	381	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	
Replacement - Pit Latrine	0	0	0	0	0	274	290	306	314	323	331	339	339	339	339	339	339	339	339	339	339	339	339	339	339	
Replacement - Septic Tank	0	0	0	0	0	253	267	283	290	298	305	313	313	313	313	313	313	313	313	313	313	313	313	313	313	
Investment Costs - Pit Latrine (US\$)	0	0	0	0	0	214,096	220,790	233,003	183,408	189,450	193,001	196,553	145,816	145,816	145,816	145,816	145,816	145,816	145,816	145,816	145,816	145,816	145,816	145,816	145,816	
Investment Costs - Septic Tank (US\$)	0	0	0	0	0	360,353	349,148	410,624	297,422	302,138	306,855	311,572	193,653	193,653	193,653	193,653	193,653	193,653	193,653	193,653	193,653	193,653	193,653	193,653	193,653	
O&M Costs - Pit Latrine (US\$)	0	0	0	0	0	32,113	33,120	34,063	27,685	28,417	28,990	29,483	21,872	21,872	21,872	21,872	21,872	21,872	21,872	21,872	21,872	21,872	21,872	21,872	21,872	
O&M Costs - Septic Tank (US\$)	0	0	0	0	0	5,703	6,037	6,159	4,481	4,532	4,603	4,674	2,905	2,905	2,905	2,905	2,905	2,905	2,905	2,905	2,905	2,905	2,905	2,905	2,905	
Total Financial Costs (US\$)	0	0	0	0	0	272,212	289,067	313,225	215,516	222,020	226,694	234,201	170,264	170,264	170,264	170,264	170,264	170,264	170,264	170,264	170,264	170,264	170,264	170,264	170,264	
Conversion Factor	0.29	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9		
Total Economic Costs (US\$)	0	0	0	0	0	568,033	594,914	616,346	404,099	472,004	484,053	327,821	327,821	327,821	327,821	327,821	327,821	327,821	327,821	327,821	327,821	327,821	327,821	327,821	327,821	
Total Benefits (US\$ 109K)	0	0	0	0	0	569	564	616	464	472	460	465	328	328	328	328	328	328	328	328	328	328	328	328	328	
Increased Service Benefits	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
Wastewater Flow (L/Person/Day)	0	0	0	0	0	1,365	651	677	1,303	1,624	1,954	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279		
Average Incremental Costs (US\$/m ³)	0.00	0.00	0.00	0.00	0.00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20		
Total Benefits (US\$/1000)	0	0	0	0	0	302	784	1,176	1,568	1,959	2,351	2,743	2,743	2,743	2,743	2,743	2,743	2,743	2,743	2,743	2,743	2,743	2,743	2,743		
Exchange Rate (KSh/US\$)	0.1																									
Pit Latrine Coverage Ratio	65.0%																									
Septic Tank Coverage Ratio	35.0%																									
Person/Facility (Pit Latrine)	18																									
Person/Facility (Septic Tank)	6																									
Replacement Ratio (Pit Latrine)	7.0%																									
Replacement Ratio (Septic Tank)	4.0%																									
Investment Costs (Pit Latrine)	20,700	339																								
Investment Costs (Septic Tank)	37,800	619																								
O&M Costs (Pit Latrine)	15.0%																									
O&M Costs (Septic Tank)	1.5%																									

AIC - Average Incremental Costs 1.20 US\$/m³
ALC - Average Incremental Costs 74 KSh/m³

Exchange Rate (KSh/US\$)	0.1
Pit Latrine Coverage Ratio	65.0%
Septic Tank Coverage Ratio	35.0%
Person/Facility (Pit Latrine)	18
Person/Facility (Septic Tank)	6
Replacement Ratio (Pit Latrine)	7.0%
Replacement Ratio (Septic Tank)	4.0%
Investment Costs (Pit Latrine)	20,700
Investment Costs (Septic Tank)	37,800
O&M Costs (Pit Latrine)	15.0%
O&M Costs (Septic Tank)	1.5%

Table - 4.4.2 (2/5) Estimated Economic Benefits and Economic Cash Flow for Priority Sewerage Project - Mombasa UC

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
Annual Investment Costs	1,995	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	66,948	
Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Annual Costs	1,995	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	66,948
Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net Annual Benefits	1,995	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	66,948
NPV =	11,406	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241
CFR =	10%																									

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	
Revenue Cost Savings Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Population	0	637,100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Population Connected to Sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Population without Sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Population with P/L Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Population with Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of P/L Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Facilities - P/L Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Facilities - Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement - P/L Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacement - Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Investment Costs - P/L Latrine (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Investment Costs - Septic Tank (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O&M Costs - P/L Latrine (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O&M Costs - Septic Tank (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Financial Costs (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conversion Factor	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Total Economic Costs (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Benefits (US\$ (1,000))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ALC - Average Incremental Costs 0.62 US\$/m³
 ALC - Average Incremental Costs 34 Ksh/m³

	81.1
P/L Latrine Coverage Ratio	81.0%
Septic Tank Coverage Ratio	20.0%
Person/Privately (P/L Latrine)	18
Person/Privately (Septic Tank)	6
Replacement Ratio (P/L Latrine)	7.0%
Replacement Ratio (Septic Tank)	4.0%
Investment Costs (P/L Latrine)	20,700
Investment Costs (Septic Tank)	37,600
O&M Costs (P/L Latrine)	15.0%
O&M Costs (Septic Tank)	1.5%

Table - 4-4.2 (3/5) Estimated Economic Benefits and Economic Cash Flow for Priority Sewerage Project - Machakos UC

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	
Annual Investment Costs	79	79	1,563	342	1,949	161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,333	
Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Annual Costs	79	79	1,563	342	1,949	161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,333	
Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net Annual Benefits	79	79	1,563	342	1,949	161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,333	
NPV =	22.1%																								
IRR =	4.46%																								
CRF =	1.42																								

Revenue Cost Saving Benefits	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Total Kenyan Population	0	349,791	0	0	0	351,071	362,422	373,771	385,122	396,472	407,822	419,172	430,522	441,872	453,222	464,572	475,922	487,272	498,622	510,000	521,350	532,700	544,050	555,400
Population Connected to Sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Population without Sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Population with Pit Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Population with Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Pit Latrines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Septic Tanks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Facilities - Pit Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Facilities - Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacements - Pit Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Replacements - Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Investment Costs - Pit Latrine (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Investment Costs - Septic Tank (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O&M Costs - Pit Latrine (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O&M Costs - Septic Tank (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Financial Costs (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conversion Factor	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Total Financial Costs (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Benefits (US\$ (1,000))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Service Increased Benefits	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Wastewater Flow (100Kms)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average Incremental Costs (US\$/m ³)	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Total Benefits (US\$ (1,000))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Exchange Rate (KSh=US\$1)	61.1
Pit Latrine Coverage Ratio	05.0%
Septic Tank Coverage Ratio	15.0%
Person/Facility (Pit Latrine)	16
Person/Facility (Septic Tank)	6
Replacement Ratio (Pit Latrine)	7.0%
Replacement Ratio (Septic Tank)	4.0%
Investment Costs (Pit Latrine)	20,700
Investment Costs (Septic Tank)	37,800
O&M Costs (Pit Latrine)	15.0%
O&M Costs (Septic Tank)	1.5%

ALC - Average Incremental Costs	0.23	US\$/m ³
AIC - Average Incremental Costs	1.4	Ksh/m ³

Table - 4.4.2 (4/5) Estimated Economic Benefits and Economic Cash Flow for Priority Sewerage Project - Kisumu UC

(Unit: 1,000 US\$)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
Annual Investment Costs	600	600	4,287	7,466	7,466	4,721	11,423	11,423	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48,125	
Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93,370
Total Annual Costs	600	600	4,287	7,466	7,466	4,721	11,423	11,423	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	141,995
Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245,657
Net Annual Benefit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103,662
NPV	11,696																									
ICR	4,264																									
ICR	1.09																									
Monetary Cost Savings Benefits	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
Total Urban Population	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	130,000	
Population Connected to Sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	130,000	
Population without Sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Population with PH Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Population with Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Number of PH Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Number of Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
New Facilities - PH Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
New Facilities - Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Replacement - PH Latrine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Replacement - Septic Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Investment Costs - PH Latrine (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Investment Costs - Septic Tank (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O&M Costs - PH Latrine (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O&M Costs - Septic Tank (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Investment Costs (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Capitalization Factor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Economic Costs (US\$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Benefits (US\$ (1,000))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service Increased Benefits	1000	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
Wastewater Flow (L/Day/Person)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Average Incremental Costs (US\$/m ³)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Total Benefits (US\$/m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Exchange Rate (Ksh/US\$)	41.1																									
PH Latrine Coverage Ratio	65.0%																									
Septic Tank Coverage Ratio	35.0%																									
Person/Facility (PH Latrine)	18																									
Person/Facility (Septic Tank)	6																									
Replacement Ratio (PH Latrine)	7.0%																									
Replacement Ratio (Septic Tank)	1.0%																									
Investment Costs (PH Latrine)	20,700	339																								
Investment Costs (Septic Tank)	37,800	619																								
O&M Costs (PH Latrine)	15.0%																									
O&M Costs (Septic Tank)	1.5%																									

A/LC - Average Incremental Costs 1:76 US\$/m³
 A/C - Average Incremental Costs 1:107 Ksh/m³

PH Latrine Coverage Ratio	65.0%
Septic Tank Coverage Ratio	35.0%
Person/Facility (PH Latrine)	18
Person/Facility (Septic Tank)	6
Replacement Ratio (PH Latrine)	7.0%
Replacement Ratio (Septic Tank)	1.0%
Investment Costs (PH Latrine)	20,700
Investment Costs (Septic Tank)	37,800
O&M Costs (PH Latrine)	15.0%
O&M Costs (Septic Tank)	1.5%

Table - 4.4.2 (S/S) Estimated Economic Benefits and Economic Cash Flow for Priority Sewerage Project - Narok UC

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total			
Annual Investment Costs	180	180	180	2,515	4,448	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,560		
Annual O&M Costs	0	0	0	0	0	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	6,570	
Total Annual Costs	180	180	180	2,515	4,448	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	14,071	
Estimated Annual Benefits	0	0	0	0	0	637	922	1,099	1,372	1,646	1,920	2,193	2,467	2,741	3,014	3,287	3,560	3,834	4,107	4,380	4,653	4,927	5,200	5,473	2,047	32,324	
Net Annual Benefits	▲180	▲180	▲180	▲2,515	▲4,448	272	557	734	1,007	1,281	1,555	1,828	2,101	2,375	2,649	2,922	3,195	3,468	3,741	4,014	4,287	4,560	4,833	5,106	1,682	16,253	
NPV #	13.0%																										
CBR #	1.396																										
	1.21																										
Resource Cost Saving Benefits	0	0	0	0	0	209	209	209	207	208	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	2,508	
Total Urban Population	0	37,253	0	0	0	68,318	71,289	74,259	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230
Acquisition Cost Savings to Sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Population without Sewer	0	0	0	0	0	68,318	71,289	74,259	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230	77,230
Population with PI Latrine	0	0	0	0	0	34,471	37,426	39,390	40,941	42,773	44,556	46,338	48,120	49,902	51,684	53,466	55,248	57,030	58,812	60,594	62,376	64,158	65,940	67,722	69,504	69,504	
Population with Septic Tank	0	0	0	0	0	22,081	24,863	26,739	27,529	28,516	29,764	30,892	32,020	33,148	34,276	35,404	36,532	37,660	38,788	39,916	41,044	42,172	43,300	44,428	45,556	45,556	
Number of PI Latrines	0	0	0	0	0	1,915	2,079	2,176	2,377	2,578	2,675	2,876	3,077	3,278	3,479	3,680	3,881	4,082	4,283	4,484	4,685	4,886	5,087	5,288	5,288		
Number of Septic Tanks	0	0	0	0	0	3,650	4,137	4,357	4,555	4,753	4,951	5,149	5,347	5,545	5,743	5,941	6,139	6,337	6,535	6,733	6,931	7,129	7,327	7,525	7,525		
New Facilities - PI Latrine	0	0	0	0	0	331	164	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	
New Facilities - Septic Tank	0	0	0	0	0	246	328	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	
Replacements - PI Latrine	0	0	0	0	0	124	146	152	159	165	172	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	
Replacements - Septic Tank	0	0	0	0	0	153	166	176	182	190	198	206	206	206	206	206	206	206	206	206	206	206	206	206	206	206	
Investment Costs - PI Latrine (US\$)	0	0	0	0	0	157,556	104,925	65,205	67,553	69,901	69,901	69,901	69,901	69,901	69,901	69,901	69,901	69,901	69,901	69,901	69,901	69,901	69,901	69,901	69,901		
Investment Costs - Septic Tank (US\$)	0	0	0	0	0	244,229	306,025	230,327	226,227	240,126	245,029	249,930	254,831	259,732	264,633	269,534	274,435	279,336	284,237	289,138	294,039	298,940	303,841	308,742	313,643		
O&M Costs - PI Latrine (US\$)	0	0	0	0	0	23,633	15,739	12,781	13,133	13,485	13,837	14,190	14,542	14,894	15,246	15,598	15,950	16,302	16,654	17,006	17,358	17,710	18,062	18,414	18,766		
O&M Costs - Septic Tank (US\$)	0	0	0	0	0	5,725	4,590	3,455	3,720	3,602	3,675	3,749	3,822	3,895	3,968	4,041	4,114	4,187	4,260	4,333	4,406	4,479	4,552	4,625	4,698		
Total Investment Costs (US\$)	0	0	0	0	0	433,121	431,279	331,767	339,442	347,116	354,791	362,466	370,141	377,816	385,491	393,166	400,841	408,516	416,191	423,866	431,541	439,216	446,891	454,566	462,241		
Conversion Factor	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9			
Total Economic Costs (US\$)	0	0	0	0	0	386,409	366,151	296,350	305,497	312,465	319,312	326,219	333,126	340,033	346,940	353,847	360,754	367,661	374,568	381,475	388,382	395,289	402,196	409,103	416,010		
Total Benefits (US\$ (1,000))	0	0	0	0	0	390	396	200	365	312	319	326	333	340	347	354	361	368	375	382	389	396	403	410	417		
Service Investment Benefits	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		Total		
Wastewater Flow (Liters/Day)	0	0	0	0	0	168	375	563	750	938	1,126	1,313	1,501	1,689	1,877	2,065	2,253	2,441	2,629	2,817	3,005	3,193	3,381	3,569	19,699		
Average Incremental Costs (US\$/m ³)	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42		
Total Benefits (US\$ (1,000))	0	0	0	0	0	267	533	800	1,067	1,334	1,600	1,867	2,134	2,401	2,668	2,935	3,202	3,469	3,736	4,003	4,270	4,537	4,804	5,071	24,006		

ALC - Average Incremental Costs 1.42 US\$/m³
 ALC - Average Incremental Costs 1.42 US\$/m³
 Kibum? Kibum?

Percentage Spent/Kibum(US\$) 61.1%
 PI Latrine Coverage Ratio 60.0%
 Septic Tank Coverage Ratio 40.0%

Person/Facility (PI Latrine)	18	(Double PI Latrine)
Person/Facility (Septic Tank)	6	(Septic Tank and Soakaway)
Replacement Ratio (PI Latrine)	7.0%	
Replacement Ratio (Septic Tank)	4.0%	
Investment Costs (PI Latrine)	20,700	339
Investment Costs (Septic Tank)	37,600	619
O&M Costs (PI Latrine)	15.0%	(% of Investment Costs)
O&M Costs (Septic Tank)	1.5%	(% of Investment Costs)

Table - 4.5.1 (1/3) Sensitivity Analysis for Priority Sewerage Project
 - Case I: Investment Costs Increased by 20% -

		(Unit: 1,000US\$)																									
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
Mandali UC	Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
	Annual Investment Costs	215	215	215	3,017	5,338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,001		
	Annual O&M Costs	0	0	0	0	0	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	17,820		
	Total Annual Costs	215	215	215	3,017	5,338	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	990	24,821		
	Estimated Annual Benefits	0	0	0	0	0	963	1,368	1,792	2,032	2,431	2,831	3,231	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	48,527		
	Net Annual Benefits	▲ 215	▲ 215	▲ 215	▲ 3,017	▲ 5,338	▲ 29	▲ 376	▲ 802	▲ 1,042	▲ 1,441	▲ 1,841	▲ 2,241	▲ 2,081	▲ 2,081	▲ 2,081	▲ 2,081	▲ 2,081	▲ 2,081	▲ 2,081	▲ 2,081	▲ 2,081	▲ 2,081	▲ 2,081	21,706		
	EBRR =																								12.3%		
	NPV (10%) =																								1,804		
	CBR (10%) =																								1.12		
Moonbasa UC	Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
	Annual Investment Costs	2,994	2,994	1,105	1,105	1,105	1,105	1,105	1,633	54,926	6,732	6,732	0	0	0	0	0	0	0	0	0	0	0	0	80,837		
	Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	105,012		
	Total Annual Costs	2,994	2,994	1,105	1,105	1,105	1,105	1,105	1,633	54,926	6,732	6,732	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	8,751	185,849		
	Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	26,884	22,761	22,761	22,761	22,761	22,761	22,761	22,761	22,761	22,761	22,761	22,761	22,761	277,356		
	Net Annual Benefits	▲ 2,994	▲ 2,994	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,633	▲ 54,926	▲ 6,732	▲ 6,732	▲ 18,233	▲ 14,010	▲ 14,010	▲ 14,010	▲ 14,010	▲ 14,010	▲ 14,010	▲ 14,010	▲ 14,010	▲ 14,010	▲ 14,010	▲ 14,010	92,509		
	EBRR =																								9.3%		
	NPV (10%) =																								1,824		
	CBR (10%) =																								0.97		
Machakos UC	Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
	Annual Investment Costs	95	95	1,876	411	2,338	193	193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,200		
	Annual O&M Costs	0	0	0	0	0	0	0	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	10,032		
	Total Annual Costs	95	95	1,876	411	2,338	193	193	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	15,232		
	Estimated Annual Benefits	0	0	0	0	0	0	208	1,835	2,128	2,920	2,713	3,006	2,488	2,488	2,488	2,488	2,488	2,488	2,488	2,488	2,488	2,488	2,488	30,755		
	Net Annual Benefits	▲ 95	▲ 95	▲ 1,876	▲ 411	▲ 2,338	▲ 193	▲ 75	▲ 1,208	▲ 1,501	▲ 1,793	▲ 2,086	▲ 2,379	▲ 1,861	▲ 1,861	▲ 1,861	▲ 1,861	▲ 1,861	▲ 1,861	▲ 1,861	▲ 1,861	▲ 1,861	▲ 1,861	▲ 1,861	24,553		
	EBRR =																								19.4%		
	NPV (10%) =																								3,855		
	CBR (10%) =																								1.64		
Kisumu UC	Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
	Annual Investment Costs	803	803	5,145	8,960	8,960	5,665	13,707	13,707	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57,750		
	Annual O&M Costs	0	0	0	0	0	0	0	0	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	93,270		
	Total Annual Costs	803	803	5,145	8,960	8,960	5,665	13,707	13,707	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	6,218	151,020		
	Estimated Annual Benefits	0	0	0	0	0	0	0	0	9,881	14,083	18,285	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	245,652		
	Net Annual Benefits	▲ 803	▲ 803	▲ 5,145	▲ 8,960	▲ 8,960	▲ 5,665	▲ 13,707	▲ 11,920	▲ 3,663	▲ 7,865	▲ 12,067	▲ 11,413	▲ 11,413	▲ 11,413	▲ 11,413	▲ 11,413	▲ 11,413	▲ 11,413	▲ 11,413	▲ 11,413	▲ 11,413	▲ 11,413	▲ 11,413	92,631		
	EBRR =																								9.6%		
	NPV (10%) =																								1,331		
	CBR (10%) =																								0.98		
Narok UC	Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total		
	Annual Investment Costs	215	215	215	3,017	5,338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,001		
	Annual O&M Costs	0	0	0	0	0	965	965	965	965	965	965	965	965	965	965	965	965	965	965	965	965	965	965	6,570		
	Total Annual Costs	215	215	215	3,017	5,338	965	965	965	965	965	965	965	965	965	965	965	965	965	965	965	965	965	965	15,571		
	Estimated Annual Benefits	0	0	0	0	0	657	922	1,099	1,372	1,646	1,920	2,193	2,047	2,047	2,047	2,047	2,047	2,047	2,047	2,047	2,047	2,047	2,047	32,324		
	Net Annual Benefits	▲ 215	▲ 215	▲ 215	▲ 3,017	▲ 5,338	▲ 292	▲ 557	▲ 734	▲ 1,007	▲ 1,281	▲ 1,555	▲ 1,828	▲ 1,682	▲ 1,682	▲ 1,682	▲ 1,682	▲ 1,682	▲ 1,682	▲ 1,682	▲ 1,682	▲ 1,682	▲ 1,682	▲ 1,682	16,752		
	EBRR =																								10.6%		
	NPV (10%) =																								411		
	CBR (10%) =																								1.05		

Table - 4.5.1 (2/3) Sensitivity Analysis for Priority Sewerage Project
- Case II: O&M Costs Increased by 20% -

(Unit: 1,000US\$)

Municipal UC	Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total			
Mjiniuli UC	Annual Investment Costs	180	180	2,515	4,448	0	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	21,844		
	Annual O&M Costs	0	0	0	0	0	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	28,565		
	Total Annual Costs	180	180	2,515	4,448	0	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	2,376	48,409		
	Estimated Annual Benefits	0	0	0	0	0	961	1,368	1,792	2,032	2,431	2,831	3,231	3,631	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	48,427	
	Net Annual Benefits	▲180	▲180	▲2,515	▲4,448	▲22	▲1,415	▲1,180	▲516	▲656	▲1,000	▲1,455	▲1,855	▲1,255	▲1,255	▲1,255	▲1,255	▲1,255	▲1,255	▲1,255	▲1,255	▲1,255	▲1,255	▲1,255	▲1,255	19,552	
	EIRR =	12.6%																									
	NPV (10%) =	1.28																									
	CBR (10%) =	1.12																									
	Mombasa UC	Annual Investment Costs	1,995	1,995	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	66,948	
		Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Annual Costs		1,995	1,995	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	921	66,948	
Estimated Annual Benefits		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Net Annual Benefits		▲1,995	▲1,995	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	▲921	
EIRR =		10.0%																									
NPV (10%) =		1.01																									
CBR (10%) =		1.00																									
Mwachaka UC		Annual Investment Costs	79	79	1,363	342	1,949	161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,333
		Annual O&M Costs	0	0	0	0	0	0	352	752	752	752	752	752	752	752	752	752	752	752	752	752	752	752	752	752	12,038
	Total Annual Costs	79	79	1,363	342	1,949	161	352	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	16,372	
	Estimated Annual Benefits	0	0	0	0	0	0	268	1,835	2,124	2,420	2,713	3,006	2,488	2,488	2,488	2,488	2,488	2,488	2,488	2,488	2,488	2,488	2,488	2,488	39,795	
	Net Annual Benefits	▲79	▲79	▲1,363	▲342	▲1,949	▲161	▲268	▲1,333	▲1,624	▲1,916	▲2,213	▲2,506	▲1,988	▲1,988	▲1,988	▲1,988	▲1,988	▲1,988	▲1,988	▲1,988	▲1,988	▲1,988	▲1,988	▲1,988	▲23,423	
	EIRR =	21.0%																									
	NPV (10%) =	3.937																									
	CBR (10%) =	1.66																									
	Kisumu UC	Annual Investment Costs	669	669	4,287	7,466	4,721	11,423	11,423	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48,125
		Annual O&M Costs	0	0	0	0	0	0	0	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	111,924
Total Annual Costs		669	669	4,287	7,466	4,721	11,423	11,423	7,462	14,925	14,925	14,925	14,925	14,925	14,925	14,925	14,925	14,925	14,925	14,925	14,925	14,925	14,925	14,925	14,925	160,049	
Estimated Annual Benefits		0	0	0	0	0	0	1,787	5,040	9,881	14,083	18,285	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	17,631	293,652	
Net Annual Benefits		▲669	▲669	▲4,287	▲7,466	▲4,721	▲11,423	▲9,658	▲1,787	▲2,420	▲4,202	▲10,823	▲10,169	▲10,169	▲10,169	▲10,169	▲10,169	▲10,169	▲10,169	▲10,169	▲10,169	▲10,169	▲10,169	▲10,169	▲10,169	▲133,602	
EIRR =		9.9%																									
NPV (10%) =		▲149																									
CBR (10%) =		1.09																									
Narok UC		Annual Investment Costs	180	180	2,515	4,448	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,501	
		Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Total Annual Costs	180	180	2,515	4,448	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Net Annual Benefits	▲180	▲180	▲2,515	▲4,448	▲219	▲484	▲661	▲934	▲1,206	▲1,482	▲1,755	▲1,609	▲1,609	▲1,609	▲1,609	▲1,609	▲1,609	▲1,609	▲1,609	▲1,609	▲1,609	▲1,609	▲1,609	▲1,609	16,939	
	EIRR =	12.3%																									
	NPV (10%) =	1.024																									
	CBR (10%) =	1.14																									

Table - 4.5.1 (3/3) Sensitivity Analysis for Priority Sewerage Project
- Case III: Investment and O&M Costs Increased by 20% -

(Unit: 1,000US\$)

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	
Minardi UC	215	215	215	3,017	5,338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,001	
Annual Investment Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Costs	215	215	215	3,017	5,338	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	21,304
Estimated Annual Benefits	0	0	0	0	0	963	1,368	1,792	2,032	2,431	2,831	3,231	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	3,071	48,427
Net Annual Benefits	▲ 215	▲ 215	▲ 215	▲ 3,017	▲ 5,338	▲ 227	180	604	844	1,243	1,643	2,043	1,883	1,883	1,883	1,883	1,883	1,883	1,883	1,883	1,883	1,883	1,883	1,883	18,042
EIRR =	10.5%																								
NPV (10%) =	296																								
CFR (10%) =	1.02																								

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	
Mombash UC	2,394	2,394	2,394	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	26,014
Annual Investment Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Costs	2,394	2,394	2,394	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	26,014
Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Annual Benefits	▲ 2,394	▲ 2,394	▲ 2,394	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	▲ 1,105	26,014
EIRR =	7.7%																								
NPV (10%) =	6,004																								
CFR (10%) =	0.90																								

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	
Muechko UC	95	95	95	411	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	5,200
Annual Investment Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Costs	95	95	95	411	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	5,200
Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Annual Benefits	▲ 95	▲ 95	▲ 95	▲ 411	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	▲ 193	5,200
EIRR =	18.4%																								
NPV (10%) =	3,351																								
CFR (10%) =	1.51																								

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	
Kilumu UC	803	803	803	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	57,350
Annual Investment Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Costs	803	803	803	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	57,350
Estimated Annual Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Annual Benefits	▲ 803	▲ 803	▲ 803	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	▲ 8,960	57,350
EIRR =	8.0%																								
NPV (10%) =	5,743																								
CFR (10%) =	0.90																								

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	
Narok UC	215	215	215	3,017	5,338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,001	
Annual Investment Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual O&M Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Costs	215	215	215	3,017	5,338	438	438	438	438	438	438	438	438	438	438	438	438	438	438	438	438	438	438	438	7,894
Estimated Annual Benefits	0	0	0	0	0	657	922	1,099	1,372	1,646	1,920	2,193	2,047	2,047	2,047	2,047	2,047	2,047	2,047	2,047	2,047	2,047	2,047	2,047	32,322
Net Annual Benefits	▲ 215	▲ 215	▲ 215	▲ 3,017	▲ 5,338	▲ 219	484	661	934	1,208	1,482	1,755	1,609	1,609	1,609	1,609	1,609	1,609	1,609	1,609	1,609	1,609	1,609	1,609	15,428
EIRR =	10.1%																								
NPV (10%) =	39																								
CFR (10%) =	1.00																								







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