

CHAPTER 9: INSTITUTIONAL AND LEGAL FRAMEWORK FOR WATER SUPPLY AND SANITATION SYSTEM IN TEN LOCAL TOWNS

9.1 LEGAL AND INSTITUTIONAL OPTIONS FOR THE TEN TOWNS

The legal framework for water sector management in Kenya includes The Water Act, Cap. 372; The National Water Policy set out in Sessional Paper No. 1 of 1999; and the National Water Master Plan. The institutional framework for the water sector involves: the Ministry of Environment and Natural Resources; the National Water Conservation and Pipeline Corporation; the five River Basin Development Authorities; private sector operators and non governmental organizations;

9.2 CONSTRAINTS IN WATER SUPPLY AND SANITATION MANAGEMENT IN URBAN AREAS

The constraints identified in the water supply and sanitation management in the urban areas include: uncertain legal and policy framework in the water sector; weak management structures and inadequate funding mechanisms; over centralized management systems; and overlapping roles of various actors in the sector;

9.3 INSTITUTIONAL MANAGEMENT FOR THE WATER SECTOR

Government commitment to the improvement in the management of the water sector is reflected in the Sessional Paper No. 1 of 1999 and the proposed amendments to the Water Act, Cap. 372. The proposed restructuring of the water sector will re-define the role of Government and other players. This will improve the management of the sector by allowing, in particular, a structured involvement of the private sector in the management of this sector.

9.4 INSTITUTIONAL OPTIONS AND LEGAL ASPECTS OF THE TEN LOCAL TOWNS

The main considerations for proposing various options include: Government policy on the water sector and the eligibility criteria for grant funding within the sector by Government of Japan. Other considerations include; sustainability of water supply and sanitation services; improved access to community, especially women; and community participation and involvement.

The institutional and legal options considered include: public limited company; private limited company; company limited by guarantee; The Societies Act (Act No. 12 of 1997); and the Trust Corporations under the Trustee (Perpetual succession) Act, Cap. 164.

On the basis of a detailed analysis, the Trust Corporation is recommended as a viable institutional and legal option for the operation and management of the water supply and sanitation system within the ten towns.

CHAPTER 10: FINANCIAL AND ECONOMIC EVALUATION

10.1 GENERAL

Financial data for the last three years on operation costs and revenues generated was collected. Based on this information and other relevant data on population, current and projected demand for water (to the year 2010), financial and economic evaluations were conducted.

In determining the viability, both financial and economic, for each of the towns, rehabilitation cost estimates for each of the ten towns was used to work out the financial cash flows and economic cash flows. Within the financial costs have been included Institutional Management and Utility Management costs for the rehabilitated schemes. The economic cost of rehabilitation in each town was mainly the incremental cost for households to connect to the mains.

10.2 FINANCIAL BENEFITS FROM REHABILITATION

The main benefit of the rehabilitation plan will be institutional strengthening of the town's water supply system. This will result in enhancement of management. The observable outcomes will be increased water supply, reduction of water losses and improvement in the revenue collection efficiency. The benefits will accrue under the following assumptions:

1. The management Consultant is in place at the beginning of Year 1 and involved for it period of 36 months.
2. The distribution network and metering would be rehabilitated/replaced during the first year of the management involvement.
3. Staff levels, remuneration and requirements are as proposed by the recommended organization chart.
4. The working capital to kick-start the process is available.
5. The appropriate infrastructure to support operations (transport, computers and software requirements and office space) is available.

The benefits will accrue as listed below:

- Revenue from extra water sold
- Reduction in Unaccounted for Water (UfW)
- Improvement in Collection Efficiency

10.3 ECONOMIC BENEFITS FROM REHABILITATION

In identifying the benefits, the way to be consistent and accurate is to look at all people conceivably affected by the program and ask how much better off they will be as a result of the expected water and sanitation rehabilitation exercise in the town. In order to give a precise estimation of the social benefits accruing to each individual category, a number of assumptions are made in each approach.

The major focus for this study is on three broad categories of social benefits that are assumed to accrue to the household within a situation of an improved water and sanitation system. These are:

- Social/economic benefits (hereby referred to as opportunity costs) of alternative uses of time previously used for fetching water by the household over along distance.
- Social benefits enjoyed by the household due to better health for water users and their families.
- Social benefits accruing from reduction in health costs.

10.4 ABILITY TO MEET O&M COSTS

The water supply schemes were analyzed for their ability to raise enough incremental revenue to cover operating and maintenance costs.

10.5 FINANCIAL EVALUATION

Financial analysis was subjected to sensitivity analysis. It is generally agreed that evaluation a water utility over a ten-year period may be too ambitious. Most water utility investments are expected to indicate positive returns from 25 to 30 years after investment. In this case the project was financially evaluated using the following scenarios.

Case 1: The project is has a life of 15 years.

Case 2: The project is has a life of 15 years but costs (Investment + O&M) increase by 15%.

Case 3: The project is has a life of 15 years and is financed by Grant.

In carrying out the above analysis it was assumed that the cash flow at the end of year 10 is maintained in the additional periods.

10.6 ECONOMIC EVALUATION

The results of the economic evaluations are summarized in Table 10.5, which shows that the rehabilitation costs for Migori town water supply are justifiable with a fairly acceptable economic rate of return. An average discount rate of

about 4%, which reflects the current cost of soft loans to Kenya, is used for the evaluation.

The project is evaluated using:

- (a) a rate of EIRR (Economic Rate of Return)
- (b) a value of NPV (Net Present Value)
- (c) a ratio of CBR (Cost Benefit Ratio)

An economic sensitivity analysis was performed to determine whether changed circumstances would affect the viability of the projects. The following assumptions were made for the sensitivity analysis.

Case 1: Investment costs increase by 15%

Case 2: O&M costs increase by 15%

Case 3: Both investment costs and O&M increase by 15%

The projects are economically viable under all the given conditions except Makindu and Wundanyi that are sensitive to changes in investment costs.

A summary of the financial and economic status of each of the ten towns is given in Table 10 below. The projects were found to be financially viable (with sensitivity analysis) except Wundanyi town.

Table 10 Financial and Economic Viability of the Ten Towns

TOWNS	Financial Evaluation	Economic Evaluation
Narok	Viable (under case 3)	Viable
Meru	Viable (under case 1&3)	Viable
Murang'a	Viable (under case 3)	Viable
Kabarnet	Viable	Viable
Makindu	Viable (under case 3)	Viable
Wundanyi	Non-viable	Viable
Migori	Viable (under case 3)	Viable
Lamu	Viable (under case 3)	Viable
Webuye	Viable (under case 1&3)	Viable
Mumias	Viable (under case 3)	Viable

10.7 SOCIAL EVALUATION

There is no doubt that society values water due to its effect on social welfare. In this study the two main issues considered were full time availability of clean water and the impact of water on public sanitation and health. Residents in the urban area were requested, through a rapid assessment survey, to specify the relative importance they attach to each of these two aspects.

In all the cases, full time availability of clean water was considered to be of very great importance, with a weighting of 98% by residents surveyed. The residents were willing to pay a higher tariff to have availability of water guaranteed. This means that it might be probable for tariff increases to be justified, which would further enhance the financial viability of the project.

The residents were quite clear in their minds that clean water impacts positively on public sanitation and health. On health issues, the response indicated that 95% of disease incidences suffered at the local level should be eliminated by the supply of clean water. Again, residents were willing to pay a premium to mitigate against the health effects of non-availability of clean water.

Towns whose water supplies estimated rehabilitation costs were found to be both economically and financially not viable included Makindu, Wundanyi and Webuye. Kabarnet town, whose water supply was covered by this study, was excluded from the table below since no recommendations for rehabilitation works were made and therefore the issues of cost estimates did not arise

CHAPTER 11: IMPLEMENTATION PROGRAMME FOR PROPOSED PLANS

11.1 Water Supply, Wastewater and Sanitation Rehabilitation

The general proposed implementation schedule for rehabilitation of the ten towns water systems are as given in Fig. 11-1.

11.2 Environmental Impact

The programme for implementation of environmental impact mitigation will form part of the total physical implementation of the rehabilitation.

11.3 Utility Management Plan

The recommended utility management plan is as summarized in Fig.11.1.

11.4 INSTITUTIONAL AND LEGAL FRAMEWORK

Operationalizing the Trust Corporation will entail:

- Sensitization of the stakeholders to this option;
- Appointment of the Board of Trustees;
- Preparation and registration of the Trust Instrument;
- Valuation of all assets to be taken over by the Trust Corporation.

It will also be necessary to develop the tactical plans of the new institution and prepare operations manual to guide the nascent organization.

Fig. 11.2 summarizes the foregoing points using Meru Water Supply as a test case.

Figure 11.1

STUDY OF INSTITUTIONAL IMPROVEMENTS AND REHABILITATION OF WATER SUPPLY AND SEWERAGE SYSTEMS FOR 10 LOCAL TOWNS IN KENYA
IMPLEMENTATION SCHEDULES OF PROPOSED PLANS
WATER SUPPLY AND SEWERAGE REHABILITATION WORKS AND Q&M

[illegible]

Figure 11.2: Meru Water Supply and Sewerage Services – Transitional Arrangements and Time Frame

No.	Activity	Year	2000							2001						
		Month	12	1	2	3	4	5	6	7	8	9	10	11	12	
1.	Hold consensus building workshop		● --- ➔	★												
2.	Appoint Board of Trustees		● --- ➔	★												
3.	Develop and present for registration the Trust Instrument		● --- ➔		★											
4.	Identify and make an inventory of water and sanitation infrastructure assets and estimate their value. Identify and estimate the value of other assets.		● --- ➔		★											
5.	Develop structures and staffing plans			● --- ➔	★											
6.	Prepare financial plan for the Trust			● --- ➔	★											
7.	Agree on:															
	(i) Lease, transfer or sale of assets					● --- ➔						★				
	(ii) Transfer or recruitment of staff					● --- ➔						★				
	(iii) Financial support					● --- ➔						★				
8.	Develop operations manuals					● --- ➔	★									
9.	Assets, staff and financial resources in place												★			
10.	Meru Water Supply and Sewerage Services operational													★		

Key:

Event ● --- ➔

Event deadline ★

CHAPTER 12 CONCLUSIONS AND RECOMMENDATIONS

12.1 WATER SUPPLY, WASTEWATER AND SANITATION REHABILITATION

The proposed Water Supply, Wastewater and Sanitation Rehabilitation items for each town together with their attendant costs are provided in the summary tables appended to this chapter (Tables 12A – 12J).

12.2 ENVIRONMENTAL IMPACT

The mitigation plans for environmental concerns shall be drawn up after detailed design of rehabilitation.

12.3 UTILITY MANAGEMENT

The utility indices and figures compiled in Annex K3 – ST6.2 allow drawing up of conclusions and good comparisons between towns. With the appropriate logistical support in terms of management consultant input for the first three years, computer backup and adequate manpower to be trained by the consultant all the schemes should become viable investments

12.4 INSTITUTIONAL AND LEGAL FRAMEWORK

The Trust Company form of Institution has been recommended. The inter-ministerial core team should work with stakeholders to make the institutions are reality.

12.5 FINANCIAL AND ECONOMIC VIABILITY

All the water supply schemes were found to be financially and economically viable except Wundanyi town water supply, which was not viable financially. It may be necessary, however, to point out that financial return alone should not become the only criterion of making decisions as to the projects that should be funded through the government. Certain types of projects may not score highly on the basis of their financial evaluation, yet these may be considered to be socio-economically viable and to be priority projects by the government for the sake of the welfare of the public.

COST TABLES

12 A- 12J

NAROK

Table 12A-1 : Cost estimates of rehabilitation works for Narok water supply

Ref	Description	Unit	Quantity	Rate (Kshs)	Amount (Kshs)
1.	Raw water intake				
1.1	Trash rack, coarse and fine screens	sum		400,000	400,000
2.	Pumphouse & raw water pumps				
2.1	Rehabilitate structure (doors, windows, etc)	sum		1,000,000	1,000,000
2.2	Low lift pumps (motors, seals, impellers, etc.)	sum		1,000,000	1,000,000
3.	Treatment works				
3.1	17m³/hr horizontal flow sedimentation tank				
3.1.1	Gravity chemical dosers	no.	2	600,000	1,200,000
3.1.2	De-sludging valves	no.	4	25,000	100,000
	Filters				
3.1.3	Filter media	m ³	30	5,000	150,000
3.1.4	Underdrain system	sum		500,000	500,000
3.2	23m³/hr upward flow sedimentation tank				
3.2.1	Gravity chemical dosers	no.	2	600,000	1,200,000
3.2.2	De-sludging valves	no.	4	25,000	100,000
	Filters				
3.2.3	Filter media	m ³	30	5,000	150,000
3.2.4	Underdrain system	sum		500,000	500,000
3.3	32m³/hr horizontal flow sedimentation tank				
3.3.1	Gravity chemical dosers	no.	4	600,000	2,400,000
3.3.2	De-sludging valves	no.	8	25,000	200,000
	Filters				
3.3.3	Filter media	m ³	50	5,000	250,000
3.3.4	Underdrain system	sum		1,000,000	1,000,000
4.	Clear water tanks (100m³ & 8m³)				
4.1	Gravity chemical dosers	no.	4	600,000	2,400,000
5.	High lift pumps				
5.1	Low lift pumps (motors, seals, impellers, etc.)	sum		1,000,000	1,000,000
6.	Buildings				
6.1	Rehabilitate offices, chemical store and laboratory	sum		3,000,000	3,000,000
6.2	Laboratory equipment	sum		3,000,000	3,000,000
6.3	Reagents	sum		1,000,000	1,000,000
7.	Water meters				
7.1	Bulk meters (various diameters)	no.	8	250,000	2,000,000
7.2	Domestic meters	no.	2,000	6,000	12,000,000
8.	Storage				
8.1	50m ³ steel tank on existing supports	sum		7,000,000	7,000,000
9.	Pipes				
9.1	Pumping mains uPVC DN200	m	3,000	6,000	18,000,000
9.2	Distribution uPVC DN 50 - 100	km	5	2,000	10,000,000
10.	Logistical facilities and equipment				
10.1	Rehabilitate existing office buildings	sum		5,000,000	5,000,000
10.2	4WD twin-cab pick-ups	no.	2	2,500,000	5,000,000
10.3	Saloon cars	no.	1	1,500,000	1,500,000
10.4	Motorcycles	no.	5	250,000	1,250,000
10.5	Computers	no.	3	200,000	600,000
10.6	Printers	no.	2	100,000	200,000
10.7	Computer software	sum		500,000	500,000
10.8	Office equipment & furniture	sum		1,000,000	1,000,000
		Total of works			84,600,000
Add	20% preliminaries and general items				16,920,000
		Sub-total			101,520,000
	15% contingencies				15,228,000
		Sub-total			116,748,000
	20% consultancy fee				23,349,600
		GRAND TOTAL			140,097,600
		say			140 million

NAROK

Table 12A-2 : Cost estimates of expansion works for Narok water supply

Ref	Description	Unit	Quantity	Rate (Kshs)	Amount (Kshs)
1.	Raw water intake and raw water main	sum			15,000,000
2.	8000m ³ /day water treatment works	sum			65,000,000
3.	DN500 transmission main	km	10	20,000	200,000,000
4.	3,600m ³ storage	sum			15,000,000
5.	Break pressure tanks	nr	10	500,000	5,000,000
6.	Distribution pipework	km	75	3,000	225,000,000
7.	Bulk meters	nr	10	250,000	2,500,000
8.	Domestic meters	nr	8,000	5,000	40,000,000
	Total for works				567,500,000
	20% preliminary and general items				113,500,000
	15% contingencies				102,150,000
	20% consultancy fee				156,630,000
	GRAND TOTAL				939,780,000
				say	940 million

MERU

Table 12B-1 : Cost estimates of rehabilitation works for Meru water supply

Ref	Description	Unit	Quantity	Rate (Kshs)	Amount (Kshs)
1.	Water meters				
1.1	Bulk meters (various diameters)	no.	12	250,000	3,000,000
1.2	Domestic meters	no.	3,000	6,000	18,000,000
2.	Storage				
2.2	1,000 m ³ ground level tank	no.	4	5,000,000	20,000,000
3.	Pipes				
3.1	Distribution uPVC DN 50 - 100	km	50	2,000	100,000,000
4.	Logistical facilities and equipment				
4.1	Rehabilitate existing office buildings	sum		2,000,000	3,000,000
4.2	4WD twin-cab pick-ups	no.	2	2,500,000	5,000,000
4.3	Saloon car	no.	1	1,500,000	1,500,000
4.4	Motorcycles	no.	6	250,000	1,500,000
4.5	Computers	no.	8	200,000	1,600,000
4.6	Printers	no.	3	100,000	300,000
4.7	Computer software	sum		500,000	500,000
4.8	Office equipment & furniture	sum		1,000,000	1,000,000
Add		Total of works			155,400,000
	20% preliminaries and general items				31,080,000
		Sub-total			186,480,000
	15% contingencies				27,972,000
		Sub-total			214,452,000
	20% consultancy fee				42,890,400
GRAND TOTAL				257,342,400	
				say	260 million

MERU

Table 12B-2: Cost estimate for the rehabilitation works for Meru Sewerage

Item No.	Item description	Unit	Quantity	Rate Kshs	Cost Kshs
1	Desludging of the existing ponds	Item			2,400,000
2	New inlet works	Item			1,500,000
3	Rehabilitate effluent percolation system.	Item			1,600,000
4	Replace manhole covers	Item			800,000
5	Unblock and clean sewer lines	Item			1,500,000
6	Maintenance equipment	Item			250,000
	Subtotal				8,050,000
	Add 20% P&G				1,610,000
	Subtotal				9,660,000
	Add 15% contingencies				1,449,000
	Total				9,499,000
	Add 20% consultancy				1,899,800
	Grand total				11,398,800

MERU

Table 12B - 3: Cost estimate for future extensions of the sewerage system

Item No.	Item description	Unit	Quantity	Rate Kshs	Cost Kshs
1	Construction of sewers in the town centre	M	38,000	8,000	304,000,000
2	Construction of a new sewage treatment plant	Item			280,000,000
	Subtotal				584,000,000
	Add 20% P&G				116,800,000
	Subtotal				700,800,000
	Add 15% contingencies				105,120,000
	Total				805,920,000
	Add 20% consultancy				161,184,000
	Grand total				967,104,000

MERU

Table 12B-4: Cost estimates for O&M activities for Meru water supply

Ref	Description	Unit	Amount (Kshs)
1.	Capital costs		
1.1	Management consultancy (2 years)	sum	36,000,000
1.2	Vehicles, office equipment, etc.	sum	13,400,000
	Sub-total		49,400,000
2.	Recurrent costs (monthly)		
2.1	Salaries and allowances	sum	1,500,000
2.2	Electricity charges	sum	500,000
2.3	Chemical charges	sum	250,000
2.4	Vehicle running costs & maintenance	sum	150,000
2.5	Office running costs	sum	100,000
2.6	Housing maintenance	sum	100,000
	Sub-total		2,600,000
3.	Spare parts (for 1 year)		
3.1	Pipes	sum	1,000,000
3.2	Fittings	sum	200,000
3.3	Valves	sum	250,000
3.4	Meters		
3.4.1	bulk	sum	500,000
3.4.2	domestic	sum	2,000,000
3.5	Pumps		
3.5.1	impellers	sum	1,000,000
3.5.2	seals	sum	100,000
3.5.3	packing	sum	100,000
3.6	Electric motors, re-winding	sum	250,000
3.7	Pump controls, relays, MCBs, etc.	sum	250,000
3.8	Dosing equipment, spares	sum	200,000
	Sub-total		5,850,000

MERU

Table 12B-5: Estimated operation and maintenance cost of Sewerage Works

Item description	Number of staff	Annual cost per person, (Kshs)	Total annual cost (Kshs)
Labourers for sewer maintenance	5	144,000	720,000
Labourers for sewage treatment plant	6	144,000	864,000
Foremen for both sewerage and sewage treatment plant	2	180,000	360,000
Superintendent	1	204,000	204,000
Total staff cost			2,148,000
Add 10% for protective garments and maintenance equipment			214,800
Grand total			2,363,000

MURANG'A

Table 12C-1: Cost estimate of rehabilitation works for Murang'a water supply

Description	Unit	Quantity	Rate	Current Study Amount (KShs)	ENEP Rehab Amount (KShs)
Intake works, raw water pumping and mains					
Kiharu pumpstation: supply and install a new electric raw water pump set (75cu.m/hr at 175m head) with associated fittings	nr	1	1,200,000	1,200,000	
Allow for addition and modification to the existing control panel	Sum			400,000	
Allow for extensions to the existing pump house	Sum			500,000	
subtotal				2,100,000	
ENEP Construction of intake works and raw water main					5,308,250
Water treatment works, treated water pumping and mains					
Rehabilitate boreholes C2868 and C3034 at District water office	Sum			3,000,000	
Kayahwe: flood control and earth works outside pump house	Sum			1,000,000	
Replacement and realignment of rising main with 250 mm nominal diameter steel pipe	m	4,800	15,000	72,000,000	
Kayahwe: generator set replacement and refurbish existing set	Sum			3,000,000	
Bulk water meters, 200mm diameter	nr	3	500,000	1,500,000	
Kayahwe and Kiharu: laboratory equipment and materials	Sum			4,500,000	
Kayahwe: buildings rehabilitation	Sum			1,000,000	
Kayahwe: staff houses, water & sanitation facilities rehabilitation	Sum			500,000	
Kiharu: treatment works rehabilitation	Sum			4,000,000	
Kiharu: rehabilitation of elevated backwash tank	Sum			1,000,000	
subtotal				91,500,000	
ENEP Rehabilitation of tanks, M&E for pump sets, civil works and part rising main					10,435,000
Distribution system					
New 1,500 m3 reservoir at Maragi, including ancillaries	Sum			8,000,000	
Rehabilitate Mukuyu market elevated tank	Sum			2,000,000	
150 mm nominal diameter uPVC pipes	m	3,000	3,000	9,000,000	
100 mm nominal diameter uPVC pipes	m	11,500	2,000	23,000,000	
New zonal bulk meters (100/150mm diameter)	nr	12	250,000	3,000,000	
New consumer meters (replacement and stock)	nr	1,500	6,000	9,000,000	
Meter test bench	nr	1	3,500,000	3,500,000	
O & M tool kits and equipment	nr	3	250,000	750,000	
subtotal				58,250,000	
ENEP Rising and distribution mains					35,421,000
Logistical facilities and equipment					
New office and laboratory facilities at MENR District water office and treatment works sites	m ²	400	25,000	10,000,000	
4WD twin-cab pickups	nr	2	2,500,000	5,000,000	
4WD standard vehicles	nr	2	1,500,000	3,000,000	
Motorcycles for line patrols, disconnections, meter readings, etc.	nr	6	250,000	1,500,000	
Multi-gear mountain bikes	nr	2	25,000	50,000	
Desk top computer setups	nr	6	200,000	1,200,000	
Printers	nr	2	100,000	200,000	
Licensed standard computer software	Sum			1,000,000	
Standard office equipment, furniture and fittings	Sum			1,500,000	
subtotal				23,450,000	
Overall Total				175,300,000	51,164,250
Add 20% P&G				35,060,000	
Sub-total				210,360,000	
Add 15% Contingencies				31,554,000	
Sub-total				241,914,000	
Add 20% consultancy design fees				48,382,800	
GRAND TOTAL				290,296,800	

MURANG'A

Table 12C-2: Cost estimate for expansion works for Murang'a water supply (2010 planning horizon)

Description	Unit	Quantity	Rate (Kshs)	Amount (Kshs)
Treatment works (Kiharu and Kayahwe)				
Expansion of raw water pumping, filtration, high lift pumping and ancillaries	sum			75,000,000
Storage				
Reinforced concrete ground level tanks, capacity 1,500m ³	nr	3	8,000,000	24,000,000
Distribution pipework				
uPVC, steel pipes DN 300 - 50	km	75	3,000	225,000,000
Fittings	sum			25,000,000
Domestic meters	nr	8,000	5,000	40,000,000
Sub-total				389,000,000
Add				
20% preliminary and general items				77,800,000
15% contingencies				70,020,000
20% consultancy fees				107,364,000
TOTAL				644,184,000
			say	650,000,000

MURANG'A

Table 12C-3: Cost estimate for the rehabilitation works for Murang'a Sewerage

Item No.	Item description	Unit	Quantity	Rate Kshs	Cost of item Kshs
1	Rehabilitation of 150mm diameter sewers with 225mm diameter. Depth not exceeding 1.5m	m	1,400	8,000	11,200,000
2	Rehabilitation of 150mm diameter sewers with 225mm diameter. Depth 1.5-2.0m	m	400	10,000	4,000,000
3	Rehabilitation of 150mm diameter sewers with 225mm diameter. Depth 2.0-2.5m	m	400	12,000	4,800,000
4	Allow for connection to the new system.	nr	100	12,000	1,200,000
5	Relocation of inlets to the primary facultative ponds	nr	2	500,000	1,000,000
6	Construction of new sludge drying beds for anaerobic ponds	m ²	500	5,000	2,500,000
7	Septic tank exhauster	nr	1	6,000,000	6,000,000
	Subtotal				30,700,000
	Add 20% P&G				6,140,000
	Add 15% contingencies				5,526,000
	Total				42,370,000
	Add 20% consultancy				8,473,200
	Grand total				50,840,000

MURANG'A

Table12C-4: Cost estimate for future extensions of the sewerage system

Item No.	Item description	Unit	Quantity	Rate Kshs	Cost Kshs
1	Construction of new sewers in the town centre - 225mm diameter.	M	2,000	8,000	16,000,000
2	Construction of sewer extension in new areas - 225mm diameter.	M	28,000	7,000	196,000,000
3	Construction of sewer extension in new areas - 300mm diameter	M	2,000	12,000	24,000,000
4	Construction of a new sewage treatment plant extension with a capacity of 5,100m ³ /d ADWF.	Item			350,000,000
	Subtotal				586,000,000
	Add 20% P&G				117,200,000
	Add 15% contingencies				105,480,000
	Total				808,680,000
	Add 20% consultancy				161,736,000
	Grand total				970,420,000

MURANG'A

Table 12C-5: O&M Costs after Rehabilitation of Water Supply Scheme

CAPITAL COSTS		
Management consultancy, 2 years		25,000,000
Purchase of vehicles, office equipment		10,000,000
Sub-Total		35,000,000
RECURRENT COSTS (MONTHLY)		
Monthly salaries		1,500,000
Electricity charges		500,000
Chemicals costs		250,000
Vehicle running costs and maintenance		150,000
Office running costs		80,000
Housing maintenance		80,000
Sub-Total		2,560,000
SPARE PARTS (FOR 1 YEAR)		
Pipes		1,000,000
Fittings		200,000
Valves		250,000
Meters	bulk	250,000
	domestic	2,000,000
Pumps	impellers	200,000
	seals	100,000
	packing	50,000
Motors	re-winding	150,000
Controls	relays	150,000
	MCBs , etc	incl.
Dosers	parts	100,000
Sub-Total		4,450,000

KABARNET

Table 12D-1
Rehabilitation costs for Kabarnet Water Supply

Description	Unit	Quantity	Rate	Amount (KShs)
Distribution system				
200 mm pipework	m	2,000	6,500	13,000,000
Pipework 150 mm and smaller	m	10,000	1,800	18,000,000
E.O. excavation in rock	m ³	9,200	6,800	62,560,000
25 m ³ break pressure tanks	nr	2	400,000	800,000
New consumer meters (replacement and stock)	nr	400	3,000	1,200,000
Subtotal				95,560,000
Logistical facilities and equipment				
4WD twin-cab pickups	nr	1	2,500,000	2,500,000
Motorcycles for line patrols, meter readings, etc.	nr	3	250,000	750,000
Desk top computer setups	nr	3	200,000	600,000
Printers	nr	1	100,000	100,000
Licensed standard computer software	Sum			200,000
subtotal				4,150,000
Overall Total				99,710,000
Add 20% P&G				19,942,000
Sub-total				119,652,000
Add 15% Contingencies				17,947,800
Sub-total				137,599,800
Add 20% consultancy design fees				27,519,960
GRAND TOTAL				165,119,760

MAKINDU

Table 12E-1: Cost estimate for rehabilitation works for Makindu water supply

Description	Unit	Quantity	Rate (KShs)	Amount (KShs)
Intake works site facilities and raw/treated water pumps				
New intake chamber, raised pump station structure&	Sum			2,000,000
Allow for extension to power mains	Sum			1,750,000
New 30 HP electrical pump set	nr	1	1,500,000	1,500,000
New standby 30 HP diesel engine and pump set	nr	1	2,000,000	2,000,000
Allow for addition and modification to existing contro	Sum			400,000
Refurbish staff houses and new septic tank	Sum			1,200,000
subtotal				8,850,000
Water treatment and rising main				
Replace in-line chlorination facility	Sum			1,200,000
Replacement and realignment of rising main with 100 mm diameter GI pipe	m	3,820	10,000	38,200,000
Aerial crossing along rising main	m	180	15,000	2,700,000
subtotal				42,100,000
Access road to intake				
Rehabilitate at mudholes and grade with earth drain	Sum			4,500,000
Construct drift with 450 mm diameter culverts at river	Sum			1,750,000
subtotal				6,250,000
Distribution system				
New 500m ³ elevated storage tank on 12m high tower plus site works	Sum			7,500,000
Rehabilitation and augmentation of ND 50 to 150mm uPVC distribution pipework	m	3,000	2,500	7,500,000
New bulk water meters, AVs, NRVs, SVs, etc	Sum			4,500,000
Laboratory equipment and materials	Sum			1,750,000
Tool kits	nr	2	250,000	500,000
subtotal				21,750,000
Logistical facilities and equipment				
New office and laboratory building facilities	m ²	150	25,000	3,750,000
4WD twin-cab pickups	nr	2	2,500,000	5,000,000
Motorcycles	nr	3	250,000	750,000
Multi-gearred mountain bikes	nr	2	25,000	50,000
Desk top computer setups	nr	2	200,000	400,000
Printers	nr	2	100,000	200,000
Licensed standard computer software	Sum			300,000
Standard office equipment, furniture and fittings	Sum			600,000
subtotal				11,050,000
Overall Total				90,000,000
Add 20% P&G				18,000,000
sub-total				108,000,000
Add 15% Contingencies				16,200,000
sub-total				124,200,000
Add 20% consultancy design fees				24,840,000
GRAND TOTAL				149,040,000

WUNDANYI

Table 12F-1: Initial planning cost estimates for expansion works for Wundanyi water supply

Ref	Description	Unit	Quantity	Rate (Kshs)	Amount (Kshs)
Source works					
1	Dam storage	sum	1	*	*
2	Pumphouse, raw water pumps and transmission main	sum	1	*	*
Storage					
3	Additional storage of 100 m3	nr	1	2,500,000	2,500,000
Distribution pipework					
4	uPVC and steel pipes of 80-100 mm diameter (inclusive of valves, chambers etc.)	m	19,000	4,000	76,000,000
Add	20% preliminaries and general items 15% contingencies 20% consultancy fee	Total of works			78,500,000
					15,700,000
		Sub-total			94,200,000
		Sub-total			14,130,000
					108,330,000
				21,666,000	
GRAND TOTAL				129,996,000	

say	130 million
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* The estimate for source works and transmission can only be prepared after a source has been identified

MIGORI

Table 12G-1: Costs for rehabilitating Migori gazetted water supply system

Description	Unit	Quantity	Rate (Kshs)	Amount (KShs)
Boreholes and collector pipework				
Equip ENEP borehole 3 to deliver to chlorine contact tank, including pump, riser and headworks pipework and electrical installation	Sum			3,000,000
Equip ENEP borehole 4	Sum			3,000,000
Re-equip existing borehole 5	Sum			3,000,000
80 mm steel collector pipework from borehole 5 to borehole 4	m	200	5,600	1,120,000
100 mm steel collector pipework from borehole 4 to old waterworks site	Sum	1,700	6,000	10,200,000
Cap disused boreholes 3 and 8	nr	2	5,000	10,000
Subtotal				20,330,000
Groundwater disinfection and surface mounted pumps				
80 m ³ chlorine contact tank	Sum			1,200,000
Pump house for surface mounted pumps	Sum			1,000,000
One duty plus one standby surface-mounted pumps	Sum			4,000,000
41m ³ /hr against 112 m, 22 Kw				
150 mm steel rising main from old waterworks site to hilltop storage	m	700	6,900	4,830,000
Subtotal				11,030,000
Distribution system				
110 mm uPVC pipe from break pressure tank to Migori Teacher's Training College	m	1,700	1,000	1,700,000
Install float operated shutoff valves at elevated tanks	nr	2	80,000	160,000
New consumer meters (replacement and stock)	nr	700	3,000	2,100,000
Subtotal				3,960,000
Logistical facilities and equipment				
New office and laboratory facilities	m ²	400	25,000	10,000,000
4WD twin-cab pickups	nr	1	2,500,000	2,500,000
4WD standard vehicles	nr	1	1,500,000	1,500,000
Motorcycles for line patrols, meter readings, etc.	nr	3	250,000	750,000
Multi-gear bikes	nr	2	25,000	50,000
Desk top computer setups	nr	3	200,000	600,000
Printers	nr	2	100,000	200,000
Licensed standard computer software	Sum			1,000,000
Standard office equipment, furniture and fittings	Sum			1,500,000
Subtotal				18,100,000
Overall Total				53,420,000
Add 20% P&G				10,684,000
Sub-total				64,104,000
Add 15% Contingencies				9,615,600
Sub-total				73,719,600
Add 20% consultancy design fees				14,743,920
GRAND TOTAL				88,463,820

MIGORI

Table 12G-2: Cost of expanding water supplies in Migori Town

Description	Unit	Quantity	Rate	Amount (KShs)
Intake and raw water main				
Intake on Migori River	Sum			25,000,000
700 mm steel raw water main	m	6,900	28,000	193,200,000
Subtotal				218,200,000
Treatment and transmission				
21,000 m ³ /d treatment plant	Sum			260,000,000
Clear water pumps	nr	6	7,000,000	42,000,000
350 mm steel rising main to Oruba	m	4,300	13,000	55,900,000
350 mm steel rising main to Marindi	m	4,800	13,000	62,400,000
350 mm steel rising main to main storage site	m	1,800	13,000	23,400,000
subtotal				443,700,000
Storage				
10,000 m ³ storage at Oruba	Sum			50,000,000
Elevated tank and pumps, allow	Sum			6,000,000
10,000 m ³ storage at Marindi	Sum			50,000,000
Elevated tank and pumps, allow	Sum			6,000,000
10,000 m ³ storage at Kadika	Sum			50,000,000
subtotal				162,000,000
Distribution system				
Distribution pipework	m	520,000	1,600	832,000,000
Break pressure tanks, allow	Sum			10,000,000
Consumer meters, allow	nr	30,000	3,000	90,000,000
subtotal				881,000,000
Overall Total				1,730,400,000
Add 20% P&G				346,080,000
Sub-total				2,076,480,000
Add 15% Contingencies				311,472,000
Sub-total				2,387,952,000
Add 20% consultancy design fees				477,590,400
GRAND TOTAL				2,865,542,400

MIGORI

Table 12G-3: Cost of future sewerage system in Migori Town

Description	Unit	Quantity	Rate	Amount (KShs)
Collector sewers	m	4,500	4,000	18,000,000
Outfall sewer	m	2,500	5,400	13,500,000
Waste stabilisation ponds	Sum			95,000,000
Overall Total				126,500,000
Add 20% P&G				25,300,000
Sub-total				151,800,000
Add 15% Contingencies				22,770,000
Sub-total				174,570,000
Add 20% consultancy design fees				34,914,000
GRAND TOTAL				209,484,000

LAMU

Table 12H-1 : Cost estimates of rehabilitation works for Lamu water supply

Ref	Description	Unit	Quantity	Rate (Kshs)	Amount (Kshs)
1.	Water meters				
1.1	Bulk meters (various diameters)	no.	4	250,000	1,000,000
1.2	Domestic meters	no.	1,000	6,000	6,000,000
2.	Storage				
2.1	Rehabilitate existing 450m ³ ground level tank	sum		1,000,000	1,000,000
2.2	500m ³ ground level tank	sum		6,000,000	6,000,000
3.	Pipes				
3.1	Distribution uPVC DN 50 - 100	km	25	2,000	50,000,000
4.	Transformer				
4.1	100 KVA transformer	no.	1	4,000,000	4,000,000
5.	Logistical facilities and equipment				
5.1	Rehabilitate existing office buildings	sum		3,000,000	3,000,000
5.2	4WD twin-cab pick-ups	no.	1	2,500,000	2,500,000
5.3	Motor boat	no.	1	1,500,000	1,500,000
5.4	Motorcycles	no.	3	250,000	750,000
5.5	Computers	no.	1	200,000	200,000
5.6	Printers	no.	1	100,000	100,000
5.7	Computer software	sum		200,000	200,000
5.8	Office equipment & furniture	sum		1,000,000	1,000,000
Add	Total of works				77,250,000
	20% preliminaries and general items				15,450,000
	15% contingencies				92,700,000
					13,905,000
	20% consultancy fee				106,605,000
GRAND TOTAL					127,926,000
				say	130 million

LAMU

Table 12H-2 : Cost estimates of expansion works for Lamu water supply

Ref	Description	Unit	Quantity	Rate (Kshs)	Amount (Kshs)
1.	Water meters				
1.1	Bulk meters (various diameters)	no.	4	250,000	1,000,000
1.2	Domestic meters	no.	1,000	6,000	6,000,000
2.	Pipes				
2.1	Distribution uPVC DN 50 - 200	km	25	2,000	50,000,000
Add	20% preliminaries and general items 15% contingencies 20% consultancy fee	Total of works			57,000,000
					11,400,000
		Sub-total			68,400,000
					10,260,000
		Sub-total			78,660,000
				15,732,000	
GRAND TOTAL				94,392,000	
				say	95 million

WEBUYE

Table 12I-1: Rehabilitation costs for Webuye Water Supply

Description	Unit	Quantity	Rate (Kshs)	Amount (KShs)
Intake and raw water main				
Construct splitter box to apportion flow between plants	Sum			240,000
Subtotal				240,000
Treatment plant				
Install dosers for soda ash	nr	6	100,000	600,000
Provide laboratory equipment and consumables	Sum			4,500,000
New clear water pumps	nr	2	4,800,000	9,600,000
250 mm steel rising main	m	1,500	9,375	14,062,500
Subtotal				28,762,500
Storage				
Construct 2,000 m ³ reservoir	Sum			6,250,000
Subtotal				6,250,000
Distribution system				
315 mm uPVC reservoir outlet	m	1,270	5,900	7,493,000
Distribution pipework	m	30,000	1,600	48,000,000
New consumer meters (replacement and stock)	nr	2,000	3,000	6,000,000
Subtotal				61,493,000
Logistical facilities and equipment				
New office and laboratory facilities	m ²	400	25,000	10,000,000
4WD twin-cab pickups	nr	1	2,500,000	2,500,000
4WD standard vehicles	nr	1	1,500,000	1,500,000
Motorcycles for line patrols, meter readings, etc.	nr	4	250,000	1,000,000
Multi-geared bikes	nr	2	25,000	50,000
Desk top computer setups	nr	5	200,000	1,000,000
Printers	nr	2	100,000	200,000
Licensed standard computer software	Sum			1,000,000
Standard office equipment, furniture and fittings	Sum			1,500,000
Subtotal				18,750,000
Overall Total				115,495,500
Add 20% P&G				23,099,100
Sub-total				138,594,600
Add 15% Contingencies				20,789,190
Sub-total				159,383,790
Add 20% consultancy design fees				31,876,758
GRAND TOTAL				191,260,548

WEBUYE

Table 12I-2: Estimated cost of expanding water supplies for Webuye Town

Description	Unit	Quantity	Rate	Amount (KShs)
Intake, treatment and transmission				
500 mm raw water main	m	300	20,000	6,000,000
11,000 m ³ /d treatment plant	Sum			130,000,000
Clear water pumps	nr	2	7,000,000	14,000,000
400 mm clear water main	m	1,500	15,000	22,500,000
Subtotal				172,500,000
Storage				
11,000 m ³ reservoir	Sum			55,000,000
Subtotal				55,000,000
Distribution				
uPVC distribution pipework n.e. 150 mm	m	1,250,000	1,600	200,000,000
Consumer meters	nr	14,000	3,000	42,000,000
Subtotal				242,000,000
Overall Total				469,500,000
Add 20% P&G				93,900,000
Sub-total				563,400,000
Add 15% Contingencies				84,510,000
Sub-total				647,910,000
Add 20% consultancy design fees				129,582,000
GRAND TOTAL				777,492,000

WEBUYE

Table 12I-3: Cost estimate for the rehabilitation of Sewerage works for Webuye Town

Description	Unit	Quantity	Rate	Amount (Kshs)
Desludging of the existing ponds	m ³	17,290	1,000	17,290,000
Sludge holding lagoons	m ³	750	3,000	2,250,000
Reinstatement of scum board at outlets of both ponds	nr	2	15,000	30,000
Concrete works for the inlet works	Sum			180,000
Screens at inlet works and screens collection troughs	Sum			60,000
Stainless steel flow measuring gauge	nr	1	10,000	10,000
Demolition of existing inlet channel/feed pipe	Sum			50,000
Construction of two maturation ponds	Sum			10,735,500
Interpond connections and outlet from last new pond	nr	3	100,000	300,000
Fencing of the pond area	Sum			1,500,000
Gravelling of access road	m	1,000	3,000	3,000,000
Small operators' building at site housing a laboratory. Include supply of lab. equipment	Sum			1,500,000
Maintenance equipment	Sum			150,000
Overall Total				37,055,500
Add 20% P&G				7,411,100
Sub-total				44,466,600
Add 15% Contingencies				6,669,990
Sub-total				51,136,590
Add 20% consultancy design fees				10,227,310
GRAND TOTAL				61,363,900

WEBUYE

Table 12I-4: Cost of expanding the sewerage system

Description	Unit	Quantity	Rate	Amount (Kshs)
Anaerobic ponds	Sum			5,000,000
225 mm new sewers, depth n.e. 1.5 m	m	70,000	8,000	560,000,000
Replacement of existing sewers	m	20,000	8,000	160,000,000
Overall Total				725,000,000
Add 20% P&G				145,000,000
Sub-total				870,000,000
Add 15% Contingencies				130,500,000
Sub-total				1,000,500,000
Add 20% consultancy design fees				200,100,000
GRAND TOTAL				1,200,600,000

WEBUYE

Table 121-5: Estimated operation and maintenance cost for Sewerage Works

Item description	Number of staff		Annual cost per person, (Kshs)	Total annual cost (Kshs)
	Current	Proposed addition		
Labourers for sewer and sewage treatment plant maintenance	4	10	144,000	2,016,000
Laboratory technician for sewage treatment plant	-	1	192,000	192,000
Foremen for both sewerage and sewage treatment plant	-	2	180,000	360,000
Superintendents	-	2	204,000	408,000
Total staff cost				2,976,000
Add 15% for protective garments, laboratory consumables and maintenance equipment				446,400
Grand total				3,422,400

MUMIAS

Table 12J-1: Rehabilitation costs for Mumias Water Supply

Description	Unit	Quantity	Rate	Amount (KShs)
Intake weir and raw water main				
Allow for works at weir and raw water main	Sum			2,500,000
Access to intake site	m	1,000	3,000	3,000,000
Subtotal				5,500,000
Treatment plant				
Refurbish sludge bleed pipes and valves at clarifiers	Sum			500,000
Replace air scour blowers	Sum			1,600,000
Install duty and standby dosing pumps for aluminium sulphate	nr	2	125,000	250,000
Install duty and standby dosing pumps for soda ash	nr	2	125,000	250,000
Install duty and standby gravity dosers for hypochlorite	nr	2	100,000	200,000
Provide laboratory equipment and consumables	Sum			4,500,000
Subtotal				7,300,000
Transmission				
New clear water pumps	nr	2	3,750,000	7,500,000
Replace air valves on rising main	Sum			350,000
Replace flow meter on rising main	Sum			100,000
Subtotal				7,950,000
Storage				
1,100 m ³ additional storage	Sum			5,250,000
Repair leaking valves	Sum			50,000
Refurbish elevated tank	Sum			5,000,000
Construct new pump house	Sum			5,000,000
New transfer pumps	nr	2	1,500,000	3,000,000
Subtotal				13,050,000
Distribution system				
New consumer meters (replacement and stock)	nr	1,560	3,000	4,680,000
Subtotal				4,680,000
Logistical facilities and equipment				
New office and laboratory facilities	m2	400	25,000	10,000,000
4WD twin-cab pickups	nr	1	2,500,000	2,500,000
Motorcycles for line patrols, meter readings, etc.	nr	3	250,000	750,000
Multi-gear mountain bikes	nr	2	25,000	50,000
Desk top computer setups	nr	3	200,000	600,000
Printers	nr	2	100,000	200,000
Licensed standard computer software	Sum			1,000,000
Standard office equipment, furniture and fittings	Sum			1,500,000
Subtotal				16,600,000
Overall Total				57,705,000
Add 20% P&G				11,541,000
Sub-total				69,246,000
Add 15% Contingencies				10,386,900
Sub-total				79,632,900
Add 20% consultancy design fees				15,926,580
GRAND TOTAL				95,559,480

MUMIAS

Table 12J-2: Estimated cost of expanding water supplies for Mumias Town

Description	Unit	Quantity	Rate	Amount (KShs)
Intake, treatment and transmission				
500 mm raw water main	m	1,000	20,000	20,000,000
22,000 m ³ /d treatment plant	Sum			260,000,000
Clear water pumps	nr	3	7,000,000	21,000,000
500 mm clear water main	m	2,650	20,000	53,000,000
Subtotal				354,000,000
Storage				
11,000 m ³ reservoir	Sum			55,000,000
New transfer pumps	nr	3	4,000,000	12,000,000
New elevated storage	Sum			10,000,000
Subtotal				77,000,000
Distribution				
700 mm spine main	m	4,300	40,000	172,000,000
uPVC distribution pipework n.e. 150 mm	m	1,000,000	1,600	1,600,000,000
Consumer meters	nr	42,000	3,000	126,000,000
Subtotal				1,898,000,000
Overall Total				2,329,000,000
Add 20% P&G				465,800,000
Sub-total				2,794,800,000
Add 15% Contingencies				419,220,000
Sub-total				3,214,020,000
Add 20% consultancy design fees				642,804,000
GRAND TOTAL				3,856,824,000

MUMIAS

Table 12J-3: Cost estimate for future extensions of the sewerage system

Item No.	Item description	Unit	Quantity	Rate KShs	Cost KShs
1	Construction of sewers in the town centre	m	13,000	8,000	161,606,900
2	Construction of sewer extension in Mill Hill Mission Hospital, Ereko Market, Mumias Sugar Factory, Mayoni Market	m	10,352	12,431	128,688,800
4	Construction of a new sewage treatment plant	Item			75,000,000
	Subtotal				365,295,718
	Add 20% P&G				73,059,144
	Subtotal				438,354,862
	Add 15% contingencies				65,753,229
	Total				504,108,090
	Add 20% consultancy				100,821,618
	Grand total				539,176,648

MUMIAS

Table 12J-4: Estimated operation and maintenance cost for Mumias Sewerage

Item description	Proposed staffing	Annual cost per person (KShs)	Total annual cost (KShs)
Labourers for sewer maintenance	3	144,000	432,000
Labourers for sewage treatment plant	3	144,000	432,000
Foremen for both sewerage and sewage treatment plant	1	180,000	180,000
Total staff cost			1,044,000
Add 15% for protective garments and maintenance equipment			156,600
Grand total			1,200,600

