PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

STUDY OF INSTITUTIONAL IMPROVEMENT ON REHABILITATIONFOR WATER SUPPLY SYSTEMS FOR 10 TEN (10) LOCAL TOWNS IN KENYA

Problems	Symptoms	Cause	Recommended Change
1. Organization Structure			
Office Set-up Lack of decent or sufficient office space, Lacking equipment, Lacking or delayed stationery, No calculators, No computers.	• Messy office environment. lost files, limited communication. • Low staff morale. • Reduced efficiency. • Delayed billing, wrong billing calculation. • Delayed consumer problem attendance. • No data base.	• Insufficient funding. • Delays in A.I.E. processing. • Centralised GOK printing. • Centralised decision-making.	• Decentralise decision-making process. • Change funding procedure. • Arrange for decent office space
Staffing Set-up Delayed promotion, No training opportunities No skill in commercial field / management, Lacking recruitment by qualification, Low remuneration, No O/T payments or compensation, Limited personnel management and control, "Technical" attendance to work.	• Reduced efficiency. • Low staff morale. • No commercial approach. • Lacking understanding of commercial operations.	• Inefficient / delayed personnel management at HQ. • Insufficient funding. • GOK recruit practice concerning commercial or managerial skill. • GOK salary scales. • Lacking organisation chart. • Lacking job description. • Favourism at HQ level. • Inefficient system of staff discipline. • Lacking personnel management and control.	• Decentralise decision-making. • Change funding procedure. • Set up organisation charts with detailed job description and skill requirements • Arrange for intensive management training for Engineers or recruit well-qualified managers. • Set up positive and negative staff sanctioning system. • Use negative sanctioning as retrenchment criteria. • Limit recruitment to the system requirement, based on skill and merit.
Transport No or limited transport	• Certain field operations not possible. • Delayed reaction time to field operations • Reduced control over field activities	• Insufficient funding • Lack of planning on Asset Maintenance i.e. grounded vehicles. • No planning on transport l requirement.	• Change funding procedure • Prepare criteria for transport requirements based on size of system coverage, pipe network, number of consumer e.t.c. • Decentralise decision making

PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

Problems	Symptoms	Cause	Recommended Change
2. Organization Activities and Procedures			
Consumer Management No application forms available, different forms used, No conditions of supply (back page not copied), Out dated format or no agreement form filled, just connected All consumer information held in consumer ledgers, No control system over new connections in the field, Different interpretation of gazette notice on new meters, No quality control on connection material and meter, semi-Illegal connections	• Insufficient consumer information • Connections not included in consumer ledger • High UfW • No legal agreement as basis for supply • Information not in compiled format • No comprehensive data base • New Flat Rate consumers. • Meters still provided through the water undertaker. • Issues kept pending due to lack of clear guidance • High rate of meter malfunction	• No control of new applications • Centralised GOK printing • Delays in AIE processing • Insufficient funding • No control over consumer applications and connections / Illegal staff consumer co-operation • No regular review of GOK formats • Insufficient operating and / or outdated implementation guidelines • No guidelines and control on quality standards	• Introduce administration fee for new connection application • Increase connection charges to commercial rates • Decentralise procurement of stationary • Change funding procedure • Redesign application format and other formats • Computerise consumer data base and obtain field information from all existing consumer using the re-designed application format • Design meaningful recording formats and reports. • Prepare implementation guidelines related to gazette notices and relating procedures. • Prepare guidelines on control of new connections • Stop installation of unmetered new connections • Use negative sanctioning as retrenchment criteria.

PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

Problems	Symptoms	Cause	Recommended Change
Meter Reading No routing for MR, On Minimum charge and still "read" monthly, Involvement of a single MR in several steps of the meter reading up to billing process, Lack of stationary, Lack of transport, unmotivated staff, Wrong meter reading	• Low reliability of information found • High % of all connections are estimated. • High number of connections on minimum • Wrong billing	• No meter reading procedure • No logic MR reading routing • No MR control in place • Unskilled staff • GOK salary scale • Insufficient funding • No motivation to boost efficiency	• Design a controlled meter reading and routing process • Design zoning where necessary • Design meaningful connection referencing. • Replace meters that serve Minimum charge consumers with Flow Restriction Meters (Devices to avoid waste) • Concentrate reading meters A/C's > 10 cbm consumption and control the Meter Reading in to a meaningful effort. • Prepare staff re-organisation plan • Use negative sanctioning as retrenchment criteria.
Billing Wrong billing, Delayed tariff implementation not retroactively implemented, Delayed stationary, Unskilled staff and no calculators, High number of estimated bills	• Low billing efficiency • Increased UfW. • Wrongly calculated bills • Reduced collection efficiency due to consumer disputes and complaints • Inconsistent calculations • Delayed billing	• No calculators • No clear instruction from HQ on gazette implementation like New deposit , Delayed tariff adjustments New meter handling • Monthly returns to HQ are never checked. • No sanctioning for inefficient and dishonest staff • Delays in AIE processing • High percentage of defective and not serviced meters	• Change funding procedure • Prepare implementation instructions for gazetted changes • Consider billing software for stations with consumers > 1,000 • Control reporting procedure • Use negative sanctioning as retrenchment criteria.
Dis-connection No disconnection material, No set disconnection criteria system, wrongly organised staff, no transport, Consumer / staff collaboration, No record maintenance, Low disconnection efforts, bills lack due date remark	• Low collection	• Delays in AIE processing • Insufficient funding • No control on disconnection / reconnection records • No follow up for years, (those consumers are simply forgotten) • No motivation to boost efficiency	• Design organised disconnection program. • Design implementation and control program. • Increase deposits to the latest requirement level. • Investigate into simplified disconnection method. • Computerise for systems > 1000 consumers

PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

Problems	Symptoms	Cause	Recommended Change
Illegal Connection / Illegal re-connection Suspected high rate of illegal connection and re-connection, no transport	• High UfW • Low rate of re-connection statistics.	• Illegal staff / consumer collaboration • No suitable technical approach to disconnect such that no illegal re-connection possible (low income estates) • No spot checks on disconnected accounts for years, disconnected consumers are forgotten • No legal action, where consumer caught with illegal connections • Legal action difficult as case difficult to substantiate and knowledge of staff inadequate. • Police / judiciary not supportive. • Weak Water Act, penalties low and legal system open for corruption. • No clear guidance on how to deal with illegal consumers	• Amend Water Act to impose stiff penalties • Amend water act to include debt recovery, including additional cost incurred. • Investigate into flow restriction meters to consumers with illegal re-connection tendencies. If account cannot be legalised, find technical approach to seal permanently. • Set clear guidelines on how to handle illegal activities • Introduce penalties for illegal consumers through the water undertaker • Use of District Bailiffs
Debt Arrears Very high debt arrears Unrellable Records, Lacking debt substantiation, GOK the biggest debtor	• Monthly increasing debt while no systematic disconnection • Unrealistically high monthly consumption of GOK institutions (hospital, police, prison)	• No efficient and timely disconnection system • No clear HQ guidelines • Weak Water Act with no provision for debt collection. • Civil proceedings expensive on the onset to file suite. • Preferential treatment of GOK bodies • Legal action difficult as records difficult to substantiate • No motivation to boost efficiency • Old and leaking system (taps, tanks, pipes) in GOK institutions	• Treat GOK bodies like any other consumer • Undertake analysis to substantiate and confirm old debts • Determine which old debtors should be written off (dead accounts, e.t.c.) • Amend GOK write off procedure (Old community accounts) • Introduce late payment penalties • Overhaul internal plumbing, piping and storage system of GOK institutions

PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

Problems	Symptoms	Cause	Recommended Change
Revenue Collection Wrong bills, bills lack due date remark, consumers have no payment moral	• Low collection efficiency • High consumer complaints	• Incorrect meter reading • No motivation to boost efficiency • Insufficient disconnection • No priority given to major consumers. • Weak or no debt collection systems • No efficient collection monitoring • Lacking information on cost of production and distribution of water	• Control organised disconnection program. • Set up positive and negative staff sanctioning system. • Create staff and stake holder awareness on cost of production and distribution of water • Use negative sanctioning as retrenchment criteria • Design a major consumer monitoring and control system • Computerise for systems > 1000 consumers • Design a suitable, safe and consumer friendly cash collection system
UfW Unreliable or no records on production and consumption and no information where water is lost (physical loss, wrong or no MR, illegal consumption), No transport, No materials, No tools, Poor reticulation design, Poor workmanship when laying pipe network, No quality control on material used for consumer lines, Poor installation of consumer meters , wrong and high estimated meter reading, Illegal connections	• High UfW. • Estimated unaccounted for water, as no production figures details available • Limited supply, as high percentage of water lost	• Master meters defunct or non-existent • Majority of consumer meters defunct • Poor maintenance of the reticulation system	• Arrange for servicing facilities for master meters (outsource) • Install flow restriction meters • Set up servicing facility and program for consumer meters • Rehabilitate the existing network • Consider leak detection exercise, depending on the extent of project rehabilitation of the existing network

PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

Problems	Symptoms	Cause	Recommended Change
Funding Delay in A.I.E. Shortage of funds available	• Chronic shortage of everything required for office and field operation	• AIE earned is not equal AIE received • Lengthy and delayed AIE processing procedure. With involvement of District Administration • Limited liquidity at the DC's office • Centralized procurement through HQ • GOK procurement procedures • Low billing and collection efficiency • Reporting to the HQ does not depict the actual status quo • Information received by the HQ is not used as a management tool for concerned planning and control • Receipt of extra AIE depends on political interests and efforts / stamina of DWO	• Decentralise AIE procedures to district level and transfer efficient and stringent control to the provincial level • Cash retainer out of revenue collections to remain at the water supply system • Simplify AIE procedures • Decentralise procurement to system level • Simplify GOK procurement procedures • Involve an external consultant/ market price analyst to give annual pricing guidelines and limitations • Setup positive and negative staff sanctioning system • Use mismanagement of funds as a retrenchment criteria

PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

Problems	Symptoms	Cause	Recommended Change
Costs No or limited information about cost at system level, No cost consciousness at system or HQ level, Lengthy district administration payment processing on vouchers issued by the DWO, Centralised tendering, High power bills depending on system design, inadequate tariff not cost related, but politically justifiable	• Costs > collected revenue • Inflated tenders • Inflated costs • Very high power bills	• Low billing and collection efficiency • No meaningful cost control • Vested interest in the District Tender Board and district administration • No planning, never preventive always reactive operation • Water tariff is fixed where as power tariff has a variable cost component incorporating external factors of the economy (oil price, Kshs. exchange rate) • At the time of investment operating cost were given a lesser priority than investment cost. • There is no basis for information to calculate a cost covering tariff • Water tariffs are politically sensitive, as water has no substitute •	• Decentralise planning and control of cost to create cost consciousness • Involve an external consultant/ market price analyst to give annual pricing guidelines and limitations • Decentralise procurement procedure to system level • Outsource certain activities to provincial level where economies of scale are of advantage to the system • Decentralise system control to the provincial level with independent external annual auditors • Decentralise chemical procurement to system level • Negotiate reduced power tariff used for production of water
Financial Control No HQ control over AIE is spending, No HQ control over billing,	• AIE spending not O&M demand driven. • Priorities left to DWO's decision with control or substantiation. • No compiled information everything OK as long as procurement procedure complied with	• GOK procurement procedure (district tender board) (counter productive control) • GOK reporting and control procedures not effective • Occasional internal audit checks by colleagues of the system and not effective • Disciplinary (GOK) system only transfers therefore inefficient • District Administration accounts for the AIE spent to Treasury • MENR only receives the expenditure information from treasury against the respective votes	• Design a transparent reporting and accounting system within the MENR for AIE expenditure • Decentralise control to provincial level and additional independent external auditor • DWO to prepare financial plans • Use mismanagement of funds as retrenchment criteria • Use price guideline of an external consultant/ market price analyst as a control instrument • Assess and set up benchmarks for adequate use of chemicals

PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

Problems	Symptoms	Cause	Recommended Change
Stock Procurement procedure, shortage level, no stock management, no summarised stock movement records	• Chronic shortage • High UFW • Questionable Water quality • Delayed attendance to source and network problems • Assistance of well-wishers (donor agencies and consumers) • Delay in all aspects of operation	• Insufficient funding • GOK procurement procedure • Centralized procurement • Neglect of divisional systems	• Set up stock management system and controls • Decentralise AIE procurement procedures • Decentralise procurement of chemicals to system level • Decentralise AIE funding
3. O&M Field Activities and Procedures			
Consumer Meter servicing Lacking materials, tools and skill, No meter servicing facilities, No transport, buried meters	• High UfW • Majority of meters estimated for billing • Low billing efficiency	• No servicing schedule • No field control • Wrong priorities and AIE spending not controlled • Low staff moral • No staff planning • No technical guidance available	• Improve on funding procedures • Design a routine meter servicing schedule • Arrange for staff training • Decentralise AIE funding • Decentralise procurement procedures without the District Administration • Undertake survey on servicing capacity within the province • Setup consumer meter repair workshop • Arrange for simple meter volumetric test facility. • Prepare standard consumer meter installation manual • Gradual consumer meter installation rehabilitation in line with proposed installation manual

PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

Problems	Symptoms	Cause	Recommended Change
Master Meter servicing Lacking materials, tools and skill, Insufficient information about the existing network	• Lack of reliable production details	• No system level skill • No parts at provincial level • No efforts made by staff • Insufficient funding	• Improve on funding procedure • Outsource servicing, pegged to supply / tenders of the master meters • Look into economies of scale under provincial officer
Pipe Network servicing No transport No tools No materials, skill, "Spaghetti" consumer lines, No location information and network plans	• Delayed attendance to burst and leaks • High UfW	• Mixed network piping material • No planned network design • No technical guidance available / manual • No preventive maintenance on network appurtenances • Insufficient funding • No stock management	• Prepare a planned pipeline network with standardised materials • Ensure rehabilitation on high and controlled standard • Introduce retainer security on contracted work • Clarify and document water wayleafs • Include consumer lines into the planned network • Amend the Water Act, Transfer responsibility of the consumer line connections up to the meter from the consumer to the water undertaker. • Prepare preventive maintenance schedule and manuals
Source & T-Works High power consumption, Power rationing, damage caused by uncontrolled power surges, system neglect	• Pumps not working • Laboratory not operational • Water quality questionable • Dosing system not functioning • Reduced production / pumping hours	• Lacking preventive maintenance • No financial planning on replacement of assets • Insufficient funding • Power tariff too high in comparison to the water tariff • No technical guidance / manual • No preventive maintenance • No funds to repair of defective pumps	• Negotiate a reduced power tariff used for water production and distribution • Investigate into the possibilities of water used to create power before it is treated and distributed • Exclude water production from power rationing • Prepare preventive maintenance schedule and manuals • Update WS operators handbook • Out-source pump maintenance • Improve funding procedure

PROBLEM – SYMPTOM – CAUSE – RECOMMENDATION MATRIX

Problems	Symptoms	Cause	Recommended Change
4. Reporting			
Data is copied from one month to the next and from one year to the next, No adequate filing system for returns	• No control nor planning tool • Information not readily available.	• Outdated report format (quantity not quality)	• Decentralise to provincial level • Set up a meaningful M.I.S reporting system. • Redesign current reporting system and format with filtered information for HQ

ACTION PLAN

SUMMARY TABLE: ST 8.4

STUDY OF INSTITUTIONAL IMPROVEMENT ON REHABILITATION OF WATER SUPPLY SYSTEMS FOR TEN (10) LOCAL TOWNS IN KENYA

No.	Action	Narok	Meru	Muranga	Kabarnet	Makindu	Wundanyi	Migori	Lamu	Webuye	Mumias	Utility Management Plan	Action to be taken by	Donor involvement recommended	Phase I	Phase II	Phase III
1.	Arrange for decent office space							x		x	x		MENR		→		
2.	Set up organisation charts with detailed job description and skill requirements.	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
3.	Arrange for intensive management training for Engineers or recruit well-qualified managers.	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
4.	Arrange for commercial and technical staff training	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
5.	Set up positive and negative staff sanctioning system.	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
6.	Use negative sanctioning as retrenchment criteria.	x	x	x	x	x	x	x	x	x	x		MENR		→	→	
7.	Decentralise personnel management to provincial / regional level												MENR		→	→	
8.	Limit recruitment to the system requirement, based on skill and merit.	x	x	x	x	x	x	x	x	x	x	x	Consultant & MENR		→		
9.	Prepare criteria for transport requirements based on size of system coverage, pipe network, number of consumer e.t.c.	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
10.	Redesign consumer recording and reporting formats	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
11.	Computerise consumer data base and consider billing software	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
12	Obtain field information from all existing consumer using the re-designed application format	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		

ACTION PLAN

SUMMARY TABLE: ST 8.4

No.	Action	Narok	Meru	Muranga	Kabarnet	Makindu	Wundanyi	Migori	Lamu	Webuye	Mumias	Utility Management Plan	Action to be taken by	Donor involvement recommended	Phase I	Phase II	Phase III
13.	Prepare implementation guidelines related to gazette notices and relating procedures	x	x	x	x	x	x	x	x	x	x	x	Consultant & MENR		→		
14.	Prepare consumer and connection management guidelines	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
15.	Investigate replacement of Minimum charge consumer meters with Flow Restriction Meters (Devices to avoid waste)	x	x	x	x	x	x	x	x	x	x		MENR		→		
16.	Design consumer / connection – management guidelines	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
17.	Design meter reading / servicing / disconnection schedules and guidelines.	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
18.	Amend the Water Act to impose stiff penalties, debt recovery including additional costs incurred												MENR	x	→	→	→
19.	Introduce penalties for illegal consumers through the water under taker												MENR		→	→	→
20.	Treat GOK bodies like any other consumer.	x	x	x	x	x	x	x	x	x	x		MENR		→		
21.	Undertake analysis to substantiate and confirm old debts	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
22.	Propose write off procedure for old debtors	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR		→	→	→
23.	Recommend commercial charges and penalties	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR		→		
24.	Create staff, consumer and stake holder awareness on cost of production and distribution of water	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		

ACTION PLAN

SUMMARY TABLE: ST 8.4

No.	Action	Narok	Meru	Muranga	Kabarnet	Makindu	Wundanyi	Migori	Lamu	Webuye	Mumias	Utility Management Plan	Action to be taken by	Donor involvement recommended	Phase I	Phase II	Phase III
25.	Outsource the servicing for master meters and condition future supply / tenders to procurement with service backup	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR		→		
26.	Decentralise AIE funding and procurement procedures to system level and transfer efficient and stringent control to the provincial / regional office level	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR			→	
27.	Decentralise decision making process to station level	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR			→	
28.	Decentralise planning and control of cost	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR			→	
29.	Design efficient and stringent control system for the provincial / regional office level (Price analyst, independent external auditors, adequate use of chemicals)	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR		→	→	
30.	Negotiate reduced power tariff used for production of water												MENR	x	→		
31.	Investigate into the possibilities of water used to create power before it is treated and distributed.												MENR	x	→		
32.	Design MIS reporting system for Povincial to HQ reporting (investment planning, policy making)	x	x	x	x	x	x	x	x	x	x	x	Consultant		→	→	
33.	Set up stock management system and controls	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
34.	Set up consumer meter workshop (with volumetric test facilities)	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		

ACTION PLAN

SUMMARY TABLE: ST 8.4

No.	Action	Narok	Meru	Muranga	Kabarnet	Makindu	Wundanyi	Migori	Lamu	Webuye	Mumias	Utility Management Plan	Action to be taken by	Donor involvement recommended	Phase I	Phase II	Phase III
35.	Prepare / update O&M guidelines / manuals	x	x	x	x	x	x	x	x	x	x	x	Consultant		→		
36.	Propose outsourcing criterias for pump maintenance depending on the pump capacity.											x	Consultant		→		
37.	Include consumer lines into the planned network	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR	x	→		
38.	Clarify and document water wayleafs	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR		→	→	→
39.	Introduce retainer security on contracted civil works and quality control	x	x	x	x	x	x	x	x	x	x	x	Consultant and MENR	x	→	→	→

APPENDIX E4
MAKINDU TOWN

Table E4-1: Water Demand Projection **Makindu Town Water Supply** TableC4-1 Demand

Year	Population	Income brackets		Population	Domestic demand rate (lcd)	Domestic water demand (m^3/day)	Institutional demand (m^3/day)	Total demand (m^3/day)	Production capacity (m^3/day)	Transmission capacity (m^3/day)	Storage capacity (m^3)
		Status	%								
1999	6,226	High	14	872	250	218					
		Middle	45	2,802	150	420	150	**980**	480	400	60
		Low	41	2,553	75	191					
2000	6,400	High	14	896	250	224					
		Middle	45	2,880	150	432	150	**1,003**	480	400	60
		Low	41	2,624	75	197					
2001	6,600	High	14	924	250	231					
		Middle	45	2,970	150	446	150	**1,029**	480	400	60
		Low	41	2,706	75	203					
2002	6,800	High	14	952	250	238					
		Middle	45	3,060	150	459	150	**1,056**	480	400	60
		Low	41	2,788	75	209					
2003	7,000	High	14	980	250	245					
		Middle	45	3,150	150	473	150	**1,083**	480	400	60
		Low	41	2,870	75	215					
2004	7,100	High	14	994	250	249					
		Middle	45	3,195	150	479	150	**1,096**	480	400	60
		Low	41	2,911	75	218					
2005	7,300	High	14	1,022	250	256					
		Middle	45	3,285	150	493	150	**1,123**	480	400	60
		Low	41	2,993	75	224					
2006	7,600	High	14	1,064	250	266					
		Middle	45	3,420	150	513	150	**1,163**	480	400	60
		Low	41	3,116	75	234					
2007	7,800	High	14	1,092	250	273					
		Middle	45	3,510	150	527	150	**1,189**	480	400	60
		Low	41	3,198	75	240					
2008	8,000	High	14	1,120	250	280					
		Middle	45	3,600	150	540	150	**1,216**	480	400	60
		Low	41	3,280	75	246					
2009	8,200	High	14	1,148	250	287					
		Middle	45	3,690	150	554	150	**1,243**	480	400	60
		Low	41	3,362	75	252					
2010	8,400	High	14	1,176	250	294					
		Middle	45	3,780	150	567	150	**1,269**	480	400	60
		Low	41	3,444	75	258					

Table E4-2: BUSINESS PLANS Makindu Town Water Supply

CASH FLOWS

Year	1	2	3	4	5	6	7	8	9	10
REVENUE GENERATED										
Revenue from Extra Water Sold	626,038	730,377	1,043,396	1,043,396	1,043,396	1,043,396	1,043,396	1,043,396	1,043,396	1,043,396
Revenue from Unaccounted for Water	915,933	915,933	1,202,162	1,202,162	1,202,162	1,202,162	1,202,162	1,488,391	1,488,391	1,488,391
Savings from Collection Efficiency	-	2,093,263	2,359,581	2,359,581	2,359,581	2,359,581	2,359,581	2,359,581	2,359,581	2,359,581
Revenue from Sewerage Charges	-	-	-	-	-	-	-	-	-	-
Total	1,541,971	3,739,573	4,605,139	4,605,139	4,605,139	4,605,139	4,605,139	4,891,368	4,891,368	4,891,368
Expenditures (Kenya Shilling)										
Transport & Staff Related Expenses	277,555	673,123	828,925	828,925	828,925	828,925	828,925	880,446	880,446	880,446
O&M	308,394	747,915	921,028	921,028	921,028	921,028	921,028	978,274	978,274	978,274
Postage	5,859	14,210	17,500	17,500	17,500	17,500	17,500	18,587	18,587	18,587
Telephone	14,032	34,030	41,907	41,907	41,907	41,907	41,907	44,511	44,511	44,511
Purchase of meters	25,288	61,329	75,524	75,524	75,524	75,524	75,524	80,218	80,218	80,218
Stationery	16,807	40,761	50,196	50,196	50,196	50,196	50,196	53,316	53,316	53,316
Fuel & Gas	77,870	188,848	232,560	232,560	232,560	232,560	232,560	247,014	247,014	247,014
Current O&M Costs	(1,264,846)	(1,264,846)	(1,264,846)	(1,264,846)	(1,264,846)	(1,264,846)	(1,264,846)	(1,264,846)	(1,264,846)	(1,264,846)
Incremental O&M Costs	**(539,040)**	**495,371**	**902,793**	**902,793**	**902,793**	**902,793**	**902,793**	**1,037,521**	**1,037,521**	**1,037,521**
Sulplus(Deficit)	**2,081,011**	**3,244,202**	**3,702,346**	**3,702,346**	**3,702,346**	**3,702,346**	**3,702,346**	**3,853,847**	**3,853,847**	**3,853,847**
Average Tariff (Kshs/m3)	38.63	38.63	38.63	38.63	38.63	38.63	38.63	38.63	38.63	38.63
Investment Costs										
Net Cash Flow	**2,081,011**	**3,244,202**	**3,702,346**	**3,702,346**	**3,702,346**	**3,702,346**	**3,702,346**	**3,853,847**	**3,853,847**	**3,853,847**
Cumulative Cash Flow	**2,081,011**	**5,325,213**	**9,027,559**	**12,729,905**	**16,432,251**	**20,134,597**	**23,836,943**	**27,690,791**	**31,544,638**	**35,398,485**

Table E4-3: Financial Cash Flow **Makindu Town Water Supply**

Year	Investment Cost	O&M Cost	Total Cost	Water Revenue	Net Revenue
1	55,492,000	(539,040)	54,952,960	1,541,971	(53,410,989.00)
2	89,040,000	495,371	89,535,371	3,739,573	(85,795,798)
3	44,328,000	902,793	45,230,793	4,605,139	(40,625,654)
4	14,520,000	902,793	15,422,793	4,605,139	(10,817,654)
5		902,793	902,793	4,605,139	3,702,346
6	-	902,793	902,793	4,605,139	3,702,346
7	-	902,793	902,793	4,605,139	3,702,346
8	-	1,037,521	1,037,521	4,891,368	3,853,847
9	-	1,037,521	1,037,521	4,891,368	3,853,847
10	-	1,037,521	1,037,521	4,891,368	3,853,847
Total	203,380,000	7,582,858	210,962,858	42,981,343	(167,981,515)

Average Tariff Rate (Ksh/m3)	38.63

FIRR		**#NUM!**
NPV		**(159,133,086)**
RER		**0.204**

Table E4-4: Economic Cash Flow **Makindu Town Water Supply**

Year	Economic InvestmentCost	O&M Cost	Total Cost	Economic Benefit	Net Revenue
1	56,917,000	(539,040)	56,377,960	21,373,899	(35,004,061)
2	89,040,000	495,371	89,535,371	22,132,436	(67,402,935)
3	44,328,000	902,793	45,230,793	22,890,974	(22,339,819)
4	14,520,000	902,793	15,422,793	23,270,242	7,847,449
5		902,793	902,793	24,028,780	23,125,987
6		902,793	902,793	25,166,586	24,263,793
7		902,793	902,793	25,925,123	25,022,330
8		1,037,521	1,037,521	26,683,661	25,646,140
9		1,037,521	1,037,521	27,442,198	26,404,677
10		1,037,521	1,037,521	28,200,736	27,163,215
Total	**204,805,000**	**7,582,858**	**212,387,858**	**247,114,635**	**34,726,777**

Current Tariff Rate (Ksh/m3)	38.63

EIRR		**5%**
NPV		**3,712,734**
CBR		**0.859**

Makindu Town Water Supply

Table E4-5: Estimated Benefit of time saved through water carrying.

Year	Population served	Number of Household	Current Households Served	Projected Households Served	Additional Households Served	Water Carriage Benefit	Health Benefit	Health Costs Saved	Total Benefits
2001	6,600	1,065	140	958	818	14,033,897	6,135,484	1,204,518	21,373,899
2002	6,800	1,097	140	987	847	14,531,945	6,353,226	1,247,265	22,132,436
2003	7,000	1,129	140	1016	876	15,029,994	6,570,968	1,290,012	22,890,974
2004	7,100	1,145	140	1031	891	15,279,018	6,679,839	1,311,386	23,270,242
2005	7,300	1,177	140	1060	920	15,777,066	6,897,581	1,354,133	24,028,780
2006	7,600	1,226	140	1103	963	16,524,139	7,224,194	1,418,254	25,166,586
2007	7,800	1,258	140	1132	992	17,022,187	7,441,935	1,461,001	25,925,123
2008	8,000	1,290	140	1161	1021	17,520,235	7,659,677	1,503,748	26,683,661
2009	8,200	1,323	140	1190	1050	18,018,284	7,877,419	1,546,495	27,442,198
2010	8,400	1,355	140	1219	1079	18,516,332	8,095,161	1,589,242	28,200,736
Total	**74,800**					**162,253,097**	**70,935,484**	**13,926,054**	**247,114,635**

Current Tariff Rate	**Kshs.**	38.63				38.63

Note:

The benefits increase with increase in population

Table E4-6: ESTIMATED WATER REVENUE **Makindu Town Water Supply**

YEAR	0	1	2	3	4	5	6	7	8	9	10	11
Design production capacity (m^3/day)	480	480	480	480	480	480	480	480	480	480	480	480
ditto (million m^3/year)	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
Current daily production (m3/day)	406	406	406	406	406	406	406	406	406	406	406	406
Current daily water sales (m3/day)		239	239	239	239	239	239	239	239	239	239	239
Projected population	6,226	6,400	6,600	6,800	7,000	7,100	7,300	7,600	7,800	8,000	8,200	8,400
Projected daily demand (m^3/day)	980	1,003	1,029	1,056	1,083	1,096	1,123	1,163	1,189	1,216	1,243	1,269

Average Tariff		Kshs	38.63	38.63	38.63	38.63	38.63	38.63	38.63	38.63	38.63	38.63
Revenue from Extra Water Sold		Kshs	626,038	730,377	1,043,396	1,043,396	1,043,396	1,043,396	1,043,396	1,043,396	1,043,396	1,043,396
Revenue from Unaccounted for Water		Kshs	915,933	915,933	1,202,162	1,202,162	1,202,162	1,202,162	1,202,162	1,488,391	1,488,391	1,488,391
Savings from Collection Efficiency		Kshs	-	2,093,263	2,359,581	2,359,581	2,359,581	2,359,581	2,359,581	2,359,581	2,359,581	2,359,581
Revenue from Sewerage Charges		Kshs	-	-	-	-	-	-	-	-	-	-
Total Financial Benefits		Kshs	**1,541,971**	**3,739,573**	**4,605,139**	**4,605,139**	**4,605,139**	**4,605,139**	**4,605,139**	**4,891,368**	**4,891,368**	**4,891,368**

Table E4-7: Mean Household Size and Income by Region and Poverty

District	Town	Mean Household Size			Total Household Income (Kshs)
		Non-Poor	Poor	Mean	
Narok	Narok	5.3	6.6	5.6	18,164.20
Meru	Meru	5.6	7.1	6	9,320.70
Murang'a	Murang'a	5.3	7.2	5.9	11,512.90
Baringo	Kabarnet	4.5	6.5	5.1	9,532.90
Makueni	Makindu	4.7	7	6.2	8,520.10
Taita-Taveta	Wundanyi	3.5	5.3	4.2	3,526.10
Migori	Migori	4.9	6.4	5.3	6,641.20
Lamu	Lamu	4.3	6.3	4.7	10,321.30
Bungoma	Webuye	6.2	7.1	6.6	7,981.70
Butere-Mumias	Mumias	4.8	6.3	5.5	7,270.20

Source: Welfare Monitoring Survey II, 1994

Table C4-8: Institutional Development Costs Makindu Town Water Supply

No.	Activity	Bases of cost estimate	Estimated cost (Ksh.)
1	Hold consensus building workshop	(a) Travel refreshments and honorarium for 50 participants at SH. 5,000 /= per participant	250,000
		(b) Consultants facilitation costs and travel	700,000
		(c) Transport and related expenses for ministry staff	200,000
2	Develop and register the trust instrument	Legal and follow up effort	50,000
3	Management Contract	Appoint local expert to support the institutional rehabilitation process for the 3 year period	39,600,000
4	(a) Identify water supply and sewerage infrastructure and estimate cost	Standard infrastructural valuation procedures	5,000,000
	(b) Identify and value other assets.		
5	Develop staffing and financial plans for the new organisation	25 working days at Sh. 40,000 per w/day	1,000,000
6	Develop operations manual	20 working days at Sh. 30,000 per day	600,000
7	Operational Support	Vehicles, motor cycles, computers and software, office equipment	
8	Provide initial working capital to the new organisation	Average annual billings for the last 3 years	2,000,000
Sub -total			**49,400,000**
Contingency (10%)			**4,940,000**
Total			**54,340,000**

Table C4-9 Financial Costs

Table E4-9: Financing Plan **Makindu Town Water Supply**

	1	2	3	4	Total
	Kshs	Kshs	Kshs	Kshs	Kshs
Institutional Development Costs	10,780,000	14,520,000	14,520,000	14,520,000	54,340,000
Consultancy Fees for Works (20% of works)	7,452,000	12,420,000	4,968,000	-	24,840,000
Water Supply Rehabilitation	37,260,000	62,100,000	24,840,000		124,200,000
Sanitation Rehabilitation	-	-	-	-	-
Total Overall Project Cost	**55,492,000**	**89,040,000**	**44,328,000**	**14,520,000**	**203,380,000**

Table C4-10: Economic Investment Costs **Makindu Town Water Supply**

	1	2	3	4	Total
	Kshs	Kshs	Kshs	Kshs	Kshs
Institutional Development Costs	10,780,000	14,520,000	14,520,000	14,520,000	54,340,000
Household costs	1,425,000				1,425,000
Consultancy Fees for Works (20% of works)	7,452,000	12,420,000	4,968,000	-	24,840,000
Water Supply Rehabilitation	37,260,000	62,100,000	24,840,000	-	124,200,000
Sanitation Rehabilitation	-	-	-	-	-
Total Overall Project Cost	**56,917,000**	**89,040,000**	**44,328,000**	**14,520,000**	**204,805,000**

Table E4-11: Financial Sensitivity Analysis - Increase Project Life to 15 years

Financial Cash Flow **Makindu Town Water Supply**

Year	Investment Cost	O&M Cost	Total Cost	Water Revenue	Net Revenue
1	55,492,000	(539,040)	54,952,960	1,541,971	(53,410,989)
2	89,040,000	495,371	89,535,371	3,739,573	(85,795,798)
3	44,328,000	902,793	45,230,793	4,605,139	(40,625,654)
4	14,520,000	902,793	15,422,793	4,605,139	(10,817,654)
5		902,793	902,793	4,605,139	3,702,346
6	-	902,793	902,793	4,605,139	3,702,346
7	-	902,793	902,793	4,605,139	3,702,346
8	-	1,037,521	1,037,521	4,891,368	3,853,847
9	-	1,037,521	1,037,521	4,891,368	3,853,847
10	-	1,037,521	1,037,521	4,891,368	3,853,847
11	-	1,037,521	1,037,521	4,891,368	3,853,847
12	-	1,037,521	1,037,521	4,891,368	3,853,847
13	-	1,037,521	1,037,521	4,891,368	3,853,847
14	-	1,037,521	1,037,521	4,891,368	3,853,847
15	-	1,037,521	1,037,521	4,891,368	3,853,847
Total	203,380,000	12,770,463	216,150,463	67,438,183	(148,712,280)

Average Tariff Rate (Ksh/m3)	38.63

FIRR		**#DIV/0!**
NPV		**(147,542,673)**
RER		**0.312**

Table E4-12: Financial Sensitivity Analysis - Increase Project Life to 15 years + Investment Cost & O&M by 15%

Financial Cash Flow **Makindu Town Water Supply**

Year	Investment Cost	O&M Cost	Total Cost	Water Revenue	Net Revenue
1	63,815,800	(619,897)	63,195,903	1,541,971	(61,653,933)
2	102,396,000	569,677	102,965,677	3,739,573	(99,226,104)
3	50,977,200	1,038,212	52,015,412	4,605,139	(47,410,273)
4	16,698,000	1,038,212	17,736,212	4,605,139	(13,131,073)
5		1,038,212	1,038,212	4,605,139	3,566,927
6	-	1,038,212	1,038,212	4,605,139	3,566,927
7	-	1,038,212	1,038,212	4,605,139	3,566,927
8	-	1,193,149	1,193,149	4,891,368	3,698,219
9	-	1,193,149	1,193,149	4,891,368	3,698,219
10	-	1,193,149	1,193,149	4,891,368	3,698,219
11	-	1,193,149	1,193,149	4,891,368	3,698,219
12	-	1,193,149	1,193,149	4,891,368	3,698,219
13	-	1,193,149	1,193,149	4,891,368	3,698,219
14	-	1,193,149	1,193,149	4,891,368	3,698,219
15	-	1,193,149	1,193,149	4,891,368	3,698,219
Total	233,887,000	14,686,032	248,573,032	67,438,183	(181,134,849)

Average Tariff Rate (Ksh/m3)	38.63

FIRR		**#DIV/0!**
NPV		**(177,012,156)**
RER		**0.271**

Table E4-13: Financial Sensitivity Analysis - Finance by Grant

Financial Cash Flow **Makindu Town Water Supply**

Year	Investment Cost	O&M Cost	Total Cost	Water Revenue	Net Revenue
1	55,492,000	(539,040)	54,952,960	1,541,971	(53,410,989)
2	89,040,000	495,371	89,535,371	3,739,573	(85,795,798)
3	44,328,000	902,793	45,230,793	4,605,139	(40,625,654)
4	14,520,000	902,793	15,422,793	4,605,139	(10,817,654)
5		902,793	902,793	4,605,139	3,702,346
6	-	902,793	902,793	4,605,139	3,702,346
7	-	902,793	902,793	4,605,139	3,702,346
8	-	1,037,521	1,037,521	4,891,368	3,853,847
9	-	1,037,521	1,037,521	4,891,368	3,853,847
10	-	1,037,521	1,037,521	4,891,368	3,853,847
11	-	1,037,521	1,037,521	4,891,368	3,853,847
12	-	1,037,521	1,037,521	4,891,368	3,853,847
13	-	1,037,521	1,037,521	4,891,368	3,853,847
14	-	1,037,521	1,037,521	4,891,368	3,853,847
15	-	1,037,521	1,037,521	4,891,368	3,853,847
Total	203,380,000	12,770,463	216,150,463	67,438,183	(148,712,280)

Average Tariff Rate (Ksh/m3)	38.63

FIRR		**#DIV/0!**
NPV		**(148,712,280)**
RER		**0.312**

Table E4-14: Economic Sensitivity Analysis - Increase Economic Investment Costs by 15%

Economic Cash Flow **Makindu Town Water Supply**

Year	Economic InvestmentCost	O&M Cost	Total Cost	Economic Benefit	Net Revenue
1	65,454,550	(539,040)	64,915,510	21,373,899	(43,541,611)
2	102,396,000	495,371	102,891,371	22,132,436	(80,758,935)
3	50,977,200	902,793	51,879,993	22,890,974	(28,989,019)
4	16,698,000	902,793	17,600,793	23,270,242	5,669,449
5		902,793	902,793	24,028,780	23,125,987
6		902,793	902,793	25,166,586	24,263,793
7		902,793	902,793	25,925,123	25,022,330
8		1,037,521	1,037,521	26,683,661	25,646,140
9		1,037,521	1,037,521	27,442,198	26,404,677
10		1,037,521	1,037,521	28,200,736	27,163,215
Total	**235,525,750**	**7,582,858**	**243,108,608**	**247,114,635**	**4,006,027**

Current Tariff Rate (Ksh/m3)	38.63

EIRR		**0%**
NPV		**(24,617,700)**
CBR		**0.984**

Table E4-15: Economic Sensitivity Analysis - Increase O&M Costs by 15%

Economic Cash Flow **Makindu Town Water Supply**

Year	Economic InvestmentCost	O&M Cost	Total Cost	Economic Benefit	Net Revenue
1	56,917,000	(619,897)	56,297,103	21,373,899	(34,923,205)
2	89,040,000	569,677	89,609,677	22,132,436	(67,477,240)
3	44,328,000	1,038,212	45,366,212	22,890,974	(22,475,238)
4	14,520,000	1,038,212	15,558,212	23,270,242	7,712,030
5		1,038,212	1,038,212	24,028,780	22,990,568
6		1,038,212	1,038,212	25,166,586	24,128,374
7		1,038,212	1,038,212	25,925,123	24,886,911
8		1,193,149	1,193,149	26,683,661	25,490,512
9		1,193,149	1,193,149	27,442,198	26,249,049
10		1,193,149	1,193,149	28,200,736	27,007,587
Total	**204,805,000**	**8,720,287**	**213,525,287**	**247,114,635**	**33,589,348**

Current Tariff Rate (Ksh/m3)	38.63

EIRR		**4%**
NPV		**2,836,206**
CBR		**0.864**

Table E4-16: Economic Sensitivity Analysis - Increase Economic Investment Costs and O& M by 15%

Economic Cash Flow **Makindu Town Water Supply**

Year	Economic InvestmentCost	O&M Cost	Total Cost	Economic Benefit	Net Revenue
2001	65,454,550	(619,897)	64,834,653	21,373,899	(43,460,755)
2002	102,396,000	569,677	102,965,677	22,132,436	(80,833,240)
2003	50,977,200	1,038,212	52,015,412	22,890,974	(29,124,438)
2004	16,698,000	1,038,212	17,736,212	23,270,242	5,534,030
2005		1,038,212	1,038,212	24,028,780	22,990,568
2006		1,038,212	1,038,212	25,166,586	24,128,374
2007		1,038,212	1,038,212	25,925,123	24,886,911
2008		1,193,149	1,193,149	26,683,661	25,490,512
2009		1,193,149	1,193,149	27,442,198	26,249,049
2010		1,193,149	1,193,149	28,200,736	27,007,587
Total	**235,525,750**	**8,720,287**	**244,246,037**	**247,114,635**	**2,868,598**

Current Tariff Rate (Ksh/m3)	38.63

EIRR		**0%**
NPV		**(25,494,227)**
CBR		**0.988**

Table E4.17 : Cost estimates of rehabilitation works		Makindu Town Water Supply		
Description	**Unit**	**Quantity**	**Rate (KShs)**	**Amount (KShs)**
Intake works site facilities and raw/treated water pumps				
New intake chamber, raised pump station str	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	nr	1	2,000,000	2,000,000
Allow for addition and modification to existing	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	Sum			4,500,000
Construct drift with 450 mm diameter culverts	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, et	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-geared 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 fittin	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**