

5. EXISTING WASTE WATER DISPOSAL & SANITATION CONDITIONS

5.1 SANITATION SYSTEM

5.1.1 The municipal sewerage system

(a) Sewerage inventory

About 3.2 km² of Murang'a municipality is currently served by a sewerage system while the water supply network covers an area of about 10 km². This sewer network serves the central business district (CBD) and the high density residential areas through approximately 1,000 connections.

According to the *Aftercare Study for the National Water Masterplan* it was estimated that there were 500 sewer connections in 1998. This suggests that there has been an increase of 500 since 1998. The current active number of water connections are about 2,850. The existing sewer network is shown on Figure 5.1.

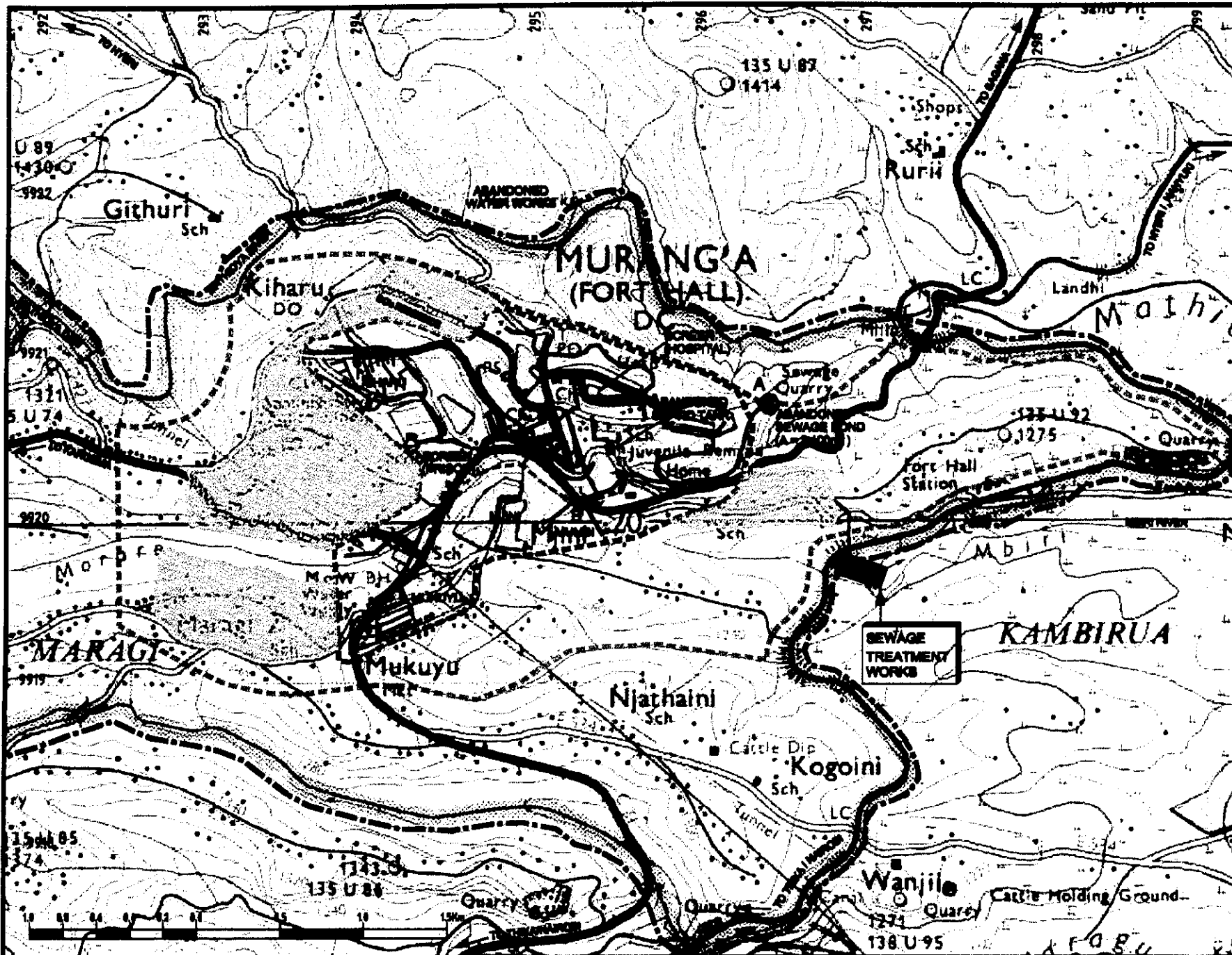
This sewerage system was constructed in phases as follows:

- Initial construction in 1959 and extended in 1969 to a total of 2.0 km sewerlines. These sewers are all 150mm diameter in size.
- 1998 extension works under Murang'a Sewerage Project added 15.0 km of sewers giving a current total sewer network of 17.0 km. These sewers vary in size from 150mm to 525mm diameter. The 150mm diameter sewers were implemented only where they are draining into the 1969 150mm diameter sewers.

The inventory of the existing sewers is given in Table 5.1 below.

Table 5.1
Details of the existing sewers

Time of construction	Sewer size (mm)	Length (m)	Sewers materials	Type of covers
1959 and 1969	150	2,000	concrete	Triangular cast iron concrete filled.
1999	150	500	uPVC	Triangular cast iron concrete filled for sewers under roads and circular concrete on all other areas
	200	10,775	uPVC	
	250	1,110	uPVC	
	300	978	uPVC	
	450	330	concrete	
	525	1,415	concrete	
Total		17,108		



NORTH

NOTE
 Shaded DA, NEW SECTION BETWEEN POINTS A & B HAVE BEEN ABANDONED.

LEGEND

- 1800 DA, OLD SEWERLINE
- 1800 DA, NEW SEWERLINE
- 1800 DA, NEW SEWERLINE
- 1800 DA, NEW SEWERLINE
- 1800 DA, NEW SEWERLINE
- 1800 DA, NEW SEWERLINE

CBD CENTRAL BUSINESS DISTRICT

EXISTING SEWERAGE COVERAGE

PROPOSED SEWERAGE EXTENSION

WATER SUPPLY COVERAGE

MUNICIPAL BOUNDARY

Client
 JAPAN INTERNATIONAL CO-OPERATION AGENCY

Consultant
 GIBB Eastern Africa

Project Title
 TEN TOWNS WATER SUPPLY & SANITATION STUDY

Drawing Title
 MURANG'A MUNICIPALITY
 EXISTING AND PROPOSED SEWERAGE COVERAGE

Date
 DEC 2004

Scale
 1:5,000

One screening facility has been constructed at the district hospital and another one at prisons as shown on Figure 5.1. The council maintains the screening facility at the district hospital while the prisoners maintain the one at prisons.

A new sewer flushing facility has been constructed along the 250mm diameter section of the trunk sewer from Mukuyu Market near Mumbi Estate. This is used to flush the sewer using portable water from the water supply network when there is high siltation in the sewer.

The existing 525mm diameter trunk sewer laid at a slope of 1 in 200 in the critical area has a capacity of 329l/s (28,400m³/d) while the existing treatment plant has a capacity of 1,564m³/d average dry weather flow (ADWF).

(b) Conditions of the existing sewerage system

The sewers constructed in 1959 and 1969 are in good structural condition. However, the sewers are prone to frequent blockages due to the following reasons:

- Small size to accommodate the actual flows.
- Abuse of the system by the users.

Though there are no records of sewer blockages kept by the municipality. It was reported that on average 2 blockages are reported per day. This is mainly on the old 150mm diameter sewers.

It must be noted that these sewers are serving the steep section of the town and siltation due to low sewage flows is not likely.

The newly constructed sewers are all in good condition.

(c) Effect from stormwater runoff

A separate sewerage system without allowance for stormwater has been designed in Murang'a, This is as is generally the case in other towns in Kenya.

All the manholes along the new sewers have covers above the ground level and intrusion of surface water into the sewer network is unlikely. Manhole covers along these newly constructed sewers have not been vandalised.

The old 1959/1969 sewers have cast iron concrete filled manhole covers, which are generally flush with the ground surface. The covers provide adequate sealing and in view of the steepness of the area, the intrusion of stormwater runoff is estimated to be minimal.

The council staff reported no incidences of sewage surcharge from the sewers during the rainy periods which confirms the above statements.

5.1.2 Sewage treatment plant

(d) Inventory of the existing treatment plant

The sewerage system discharges to a recently constructed central sewage treatment plant comprising of two streams of anaerobic, facultative and maturation ponds. This plant was constructed under the Murang'a Sewerage Project and was completed in 1999.

Though this system has been in operation since 1998, it has not been officially commissioned. The layout plan of the existing sewage treatment plant is shown on Figure 5.2. Design details of this new sewage treatment plant with a treatment capacity of 1,564m³/d ADWF are:

- 1 no. coarse screen with a downstream fine screen.
- 2 no. parallel constant flow grit removal channels with a flume channel
- 2 no. anaerobic ponds with a retention period of 4.5 days.
- 2 no. primary facultative ponds with a retention period of 17.5 days.
- 2 no. secondary facultative ponds with a retention period 5.3 days.
- 2 no. maturation ponds with a retention period of 3.5 days.

The two sewage treatment plants which were constructed in 1959 were de-commissioned in 1998 when construction of the new plant was completed. The locations of these abandoned facilities are shown in Figure 5.1. The details of these treatment plants are:

- A pond with a plan area of 3,400m² and a capacity of 178m³/d on the north-eastern part of the town.
- A septic tank located near the Juvenile Remand Home at the central part of the town.

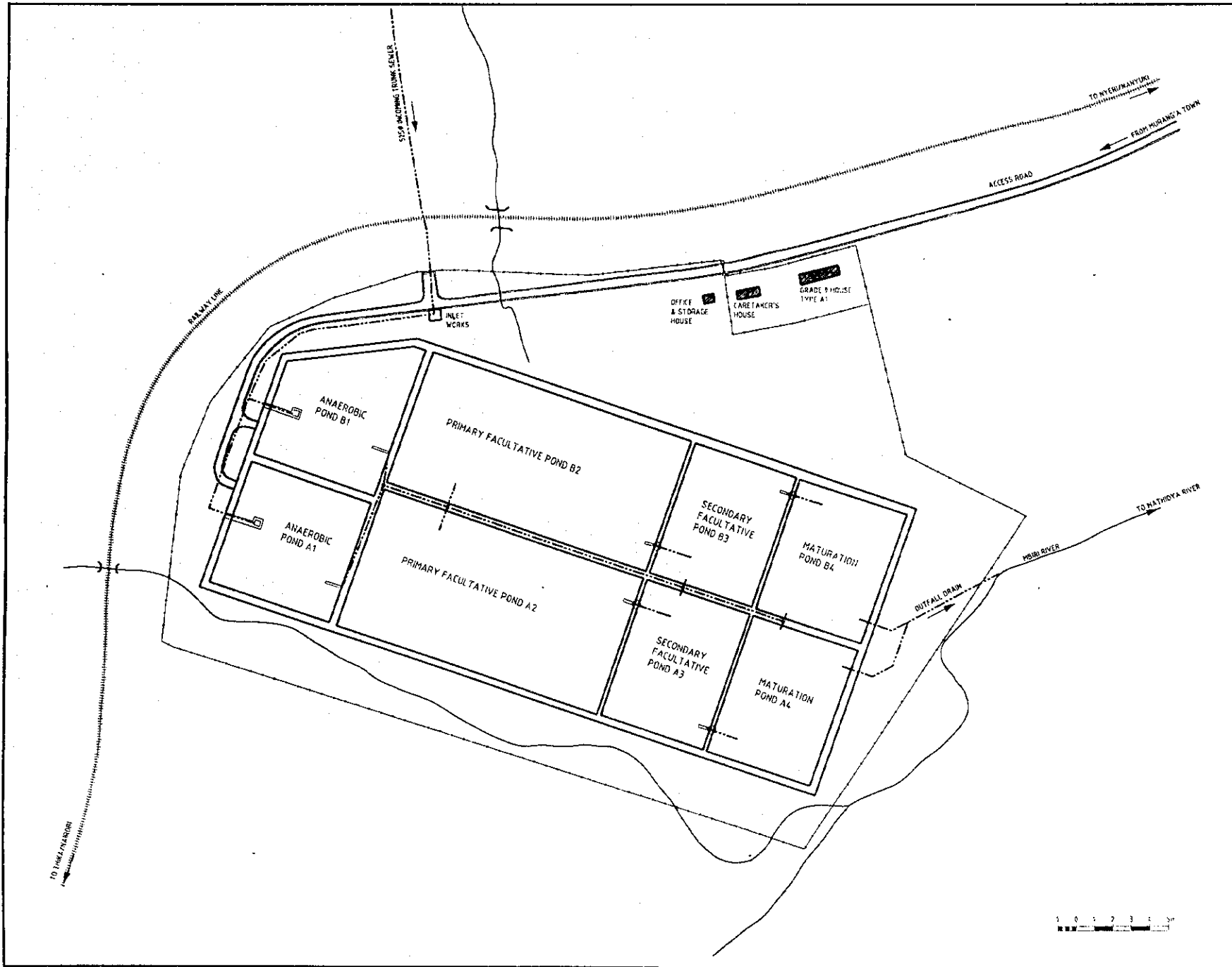
(e) Current flows

There are two calibrated linear gauges located as follows:

- At the inlet works.
- Along the outfall drain of the sewage treatment works.

The flow measurements are taken in accordance with tables provided under the Murang'a Sewerage Project which allows for only two flow readings per day at 8 am and 10 pm. This data is not recorded on a regular basis and there is insufficient information to estimate the current flows to the sewage treatment works.

According to the council flow data records for the years 1998 - 2000, there was no effluent flow from the sewage treatment plant during the dry seasons. This was in spite of sewage inflows, for instance in January and February 2000, sewage inflow was estimated to vary from 9 to 12l/s at 8 am and 8 to



LEGEND

	EXISTING PIPELINES
	FENCE
	RAILWAY LINE
	BRIDGE

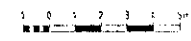
Client
JAPAN INTERNATIONAL CO-OPERATION AGENCY

GIBB Eastern Africa
 LAOWOBB Group Member

Project Title
TEN TOWNS WATER SUPPLY & SANITATION STUDY

Drawing Title
MURANGA TOWN EXISTING SEWAGE TREATMENT PLANT

Date: **OCT 2009** Fig. No: **5.2**



11l/s at 10 pm. In 1998 river water was diverted into the ponds to augment the inadequate inflow.

Thus, the current sewage flow to the treatment plant is well below the treatment works capacity. The following observations confirm this:

- The scum layer in the anaerobic pond is concentrated just near the inlet while the rest of the pond is clear. The pond is therefore acting as a facultative pond.
- There is substantial algal accumulation in the maturation ponds which is an indication of prolonged storage.

The low inflow to the sewage treatment plant is due to the low number of sewer connections in the developed area. Currently on average there are about 2 new connections per day.

The plot owners appear to be reluctant to connect to the new sewers due to the cost of connection preferring to maintain usage of the existing on plot sanitation facilities. In addition to the cost for the connection itself, the council charges a connection administrative fee of Kshs 1,000 once for every new connection.

(f) Inflow effluent quality

There is no regular effluent sampling to monitor the system performance. But, on the basis of the low effluent flows to the sewage treatment plant, the effluent is anticipated to be of good quality.

The Ministry of Environment and Natural Resources has taken samples from the sewage treatment plant twice to check the systems performance. The findings are summarised below.

August 1999 sampling:

- The system BOD₅ removal was about 83% with a final value of 30mg/l.
- Though there was marked decrease in total suspended solids in the anaerobic ponds, the final effluent had high value of about 118mg/l due to algae.
- The Ecoli of the final effluent was 110FC/100ml.

May 2000 sampling:

- The system BOD₅ removal was 79% with a final value of 50mg/l.
- The system total suspended solids removal was 61% with a final value of 938mg/l.

Based on the above ministry sample results, the system does not meet the required effluent quality due to the high algae content in the final effluent. Though algae is not harmful to the downstream water users it is not aesthetically acceptable and measures should be implemented to reduce the high concentration.

(g) Condition of existing sewage treatment plant

The treatment plant is relatively new and the only minor defects observed during the survey were:

- The pre-cast concrete waterline protection have been dislodged.
- The concrete channels at the sewage treatment plants have cracks and are leaking.
- There is no power supply to the staff houses.

5.2 SEWERAGE SYSTEM (O&M)

5.2.1 Current staffing and equipment

Murang'a Municipal Council is responsible for the operation and maintenance of the municipal sewerage system. Details of the staff maintaining the treatment plant is given in Section 5.3. The current council staff comprising of three labourers and one supervisor cannot adequately maintain the sewer line and the screen at the hospital. Since one person has to be located at the screen throughout the day this implies that only two labourers will be responsible for maintenance of the sewer lines.

The maintenance staff have two sets of sewer rods and a power rodder for unblocking the sewers. The power rodder uses the rods. The municipal council does not have specialised mechanical equipment eg jetting machine for maintenance of the sewer network. The workers are provided with basic protective facilities like gumboots, uniforms, gloves and antiseptic soaps.

5.2.2 Revenue collection

The Municipal Council of Murang'a is not the water undertaker. Revenue from the use of the sewerage system is collected by the municipality independently from the water revenue collected by the Ministry of Environment and Natural Resources. The current sewer rate is as follows:

- For the first 9m³ of water consumed, the minimum charge rate is Kshs72.
- Any additional consumption above 9m³, the rate is Kshs 8 per m³.

Payment of sewerage revenue is made in the municipal council offices. The amount of revenue collected is very disappointing. The average monthly collection for the year 1999 was Kshs 70,000 while the estimated billed amount was Kshs 120,000. This equates to 58% collection efficiency over that year.

Due to the absence of a system for enforcing payment for the sewer charges, the amount collected is not predictable. In 1998 and 1999, the amount of revenue collected was as follows:

- 1998 - Kshs 1,510,000.
- 1999 - Kshs 840,000.

5.3 SEWAGE TREATMENT WORKS (O&M)

5.3.1 Current staffing and O&M equipment

The council has 14 labourers and 1 supervisor for operation and maintenance of the sewage treatment plant.

In addition to the regular supply of protective garments to the workers, the municipal council has basic equipment for maintenance of the sewage treatment plant. This comprise the following:

- 5 wheel barrows;
- 1 grit scooping facility;
- 1 rake;
- slashers and pangas.

However there is no suitable equipment for de-sludging of the ponds.

5.3.2 Flow measurements

Though there is one flow measuring linear gauge at the inlet works and one at the outfall from the treatment plant, flow measurements are only taken twice in a day. The data is not collected on a regular basis and is insufficient.

5.3.4 Sampling

Under the 1998 Murang'a Sewerage Project, a small building comprising of a store and a laboratory was constructed. The laboratory has not been equipped and therefore monitoring of the system performance by the council is not carried out. It is anticipated that once the laboratory is equipped regular monitoring of the system will be maintained. At this stage the council will have to employ a qualified laboratory technician.

Any monitoring of the system is currently being carried out by the Ministry of Environment and Natural Resources as detailed in Section 5.1 above.

5.3.5 Existing staff houses

There are three one bed-roomed staff houses for the staff at the sewage treatment. These houses accommodate 3 out of the 14 current labourers.

The houses are not connected to the power supply. However, at the time of the study the contractor was installing a 1 phase power supply line to the treatment plant.

5.4 OTHER WASTEWATER DISPOSAL FACILITIES

Premises that are not connected to the municipal sewerage system are served by septic tanks or pit latrines. The council owns septic tank exhausters and the septage from on-plot sanitation facilities is discharged into the municipal sewerage system. This is normally discharged into the trunk sewer draining to the sewage treatment plant.

5.5 ON-GOING OR PLANNED EL NINO WORKS

No improvements are being carried out under the ongoing El Niño project.

5.6 OTHER WORKS AND PROJECTS

There are no on going related works apart from the outstanding work in the sewerage project.

5.7 SUMMARY OF SHORTCOMINGS AND PRELIMINARY RECOMMENDATIONS FOR REHABILITATION

The schedule of rehabilitation works for the sewerage and sewage treatment plant is given in Table 5.2 below.

Table 5.2
Schedule of rehabilitation works

Item	Unit	Ref.	Component	Repairs needed	Comments/recommendations
1	Sewers	1.1	150mm dia. sewers	Augmentation	The sewers are undersize leading to frequent blockages. Improve collection
2	Sewage treatment plant	2.1	Inlet to primary facultative ponds	Relocation	Eliminate short circuiting
		2.2	New sludge drying beds for anaerobic ponds	New	To provide sludge treatment

It was noted during the survey that there is likelihood of short circuiting in the facultative ponds due to the relative positions of the inlet and outlet structures. This will cause part of the ponds not to be effective in treating the wastewater. It is recommended that the inlets to the primary facultative ponds be relocated to ensure maximum distance between the inlet and the outlet structures i.e. the conventional diagonal approach be adopted. The existing conduits should be maintained for use in the event that isolation of a pond is required.

Anaerobic pond acts mainly as sedimentation units and therefore de-sludging is necessary in order to maintain the effective design volume. Normally the ponds should be de-sludged once in every two years.

Details of the recommended rehabilitation works are presented in Section 6 of this report.

In addition to the above rehabilitation works, we would recommend that the council sensitise people on the need to connect to the sewer system and also enforce the existing bylaws.

6 PROPOSED STRATEGY FOR WASTEWATER DISPOSAL AND SANITATION REHABILITATION

6.1 DEMAND FOR SANITATION SERVICES

The ground water table in Murang'a is deep and is in a confined aquifer and therefore providing if the underlying rock is not fractured, pollution from on plot sanitation facilities is unlikely. Therefore use of on-plot sanitation in low densely populated areas is appropriate. In high density areas and the central business district a sewerage system is recommended in order to safeguard public health.

Extension of the sewer system to cover the densely populated areas and the central district was completed in 1998. However, the rate of new sewer connections in these areas is low.

The existing sewers have been laid to cover about 32% of the water coverage area which constitutes the main town population. The population that has been connected to the sewer network is therefore low. It was planned that the plot owners will connect to the new sewer system but the rate of new connections has been disappointing.

6.2 DEMAND FOR WASTEWATER DISPOSAL SERVICES

The existing sewage treatment works is operating far below its design capacity of 1,564m³/d ADWF and therefore no expansion is anticipated in the near future until augmentation of the water supply is carried out.

6.3 REHABILITATION REQUIREMENTS

The existing treatment plant system is operating below the design capacity and as indicated in Section 5 of this report, the plant can serve about 25% of the current municipal population.

The key rehabilitation work will therefore be on the sewer network with the aim of increasing the sewage flow to the treatment plant. It is recommended that the following actions be carried out:

- Strong emphasis on increasing the number of sewer connections in the sewer area.
- Augmentation of the under sized sewers.

In addition to the above proposals it will be necessary to construct sludge drying beds under the rehabilitation works. A septic tank exhauster should be provided under the rehabilitation works to serve the existing on-plot sanitation facilities. The septage from these facilities should be discharged into the proposed sludge drying beds.

6.3.1 Remedial works to be carried out by the current contractor

The sewage treatment plant is relatively new and no major rehabilitation works are required. We recommend that the following defects observed during the study be rectified :

- Reinststate the water line protection slabs.
- Repair cracks on the inter-pond connection channels.
- Supply power to the staff houses.

6.3.2 Proposed rehabilitation works

The rehabilitation works required to improve the performance of the existing sewerage system and the treatment plant are:

- Replacement of the old 150mm diameter sewers.
- Relocation of the inlets to primary facultative ponds.
- Construction of sludge drying beds at the newly constructed sewage treatment plant.

The old 150mm diameter sewers constructed in the first two phases will require to be replaced with 225mm diameter concrete pipes.

6.4 PRELIMINARY DESIGN OF RECOMMENDED IMMEDIATE MEASURES

Though some of the 150mm diameter sewers are hydraulically adequate, it will be necessary to replace them with 225mm diameter size sewers to minimise blockages.

The sludge drying beds should be sized on the basis of the capacity of the existing treatment plant. They will then be of sufficient size to cater for the sludge anticipated from the ponds and from the on-plot sanitation facilities.

6.5 COST ESTIMATE OF RECOMMENDED REHABILITATION PLAN

An indicative cost estimate for the immediate rehabilitation works for Murang'a sewerage system is given in Table 6.1.

Table 6.1
Cost estimate for the rehabilitation works

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

6.6 FUTURE EXPANSION NEEDS OF THE MUNICIPALITY

In addition to the commercial areas of the town, all areas designed as high density and medium density residential areas with a water supply network should be served with a sewerage system. The current sewered area is 3.2 km² while the existing water supply system covers an area of about 10 km².

Under the *Aftercare Study for the National Water Masterplan*, it was estimated that about 10,500 persons were connected into the sewer network through 500 connections in 1998. The current number of sewer connections is about 1,000 and based on the same number of persons per connection this equates to 21,000 persons. The average rate of new sewer connections over this period was about 1 per day while the current rate is about 2 per day. The projected year 2000 population is estimated to be 60,000 and this shows that about 35% of the current population is connected to the sewer network.

Based on the population distribution and the water consumption rates given in Chapter 2 of this report, the average per capita water consumption is estimated to be 131 litres per day. Assuming a sewage generation rate of 80%, the estimated sewage generation from the current population is estimated to be 6,276 m³/d ADWF. The current sewage treatment plant has a capacity of 1,564 m³/d ADWF equivalent to 25% of the estimated municipal sewage generation. This implies that if there is adequate water supply in the current sewered area and 100% connection is achieved, there will be need to expand the existing sewage treatment plant.

The proposed areas that require a sewerage system in the near future are shown in Figure 5.1. These areas have a total area of 2.1 km². Using a standard plot size of 15.24 m by 30.48 m and assuming that 15% of the total area will be used for road network etc, the total length of branch sewers required will be about 30km. It is proposed that additional sewers in some parts of the town will be required.

The estimated municipal population in the year 2010 is 84,700. This will generate about 8,860 m³/d ADWF. According to the economic survey carried out in this study, 87% of the population is in the medium and low income groups category. This population requires a sewerage system unlike the high income group which occupies large plots where use of on-plot sanitation facilities is sustainable. The extension of the sewage treatment works should therefore take into consideration that 100% of the population in the medium and low income groups stay in sewerage areas and 100% sewerage connection is achieved. The estimated sewage generation from this population by the year 2010 is estimated to be 6,657m³/d. It will therefore be necessary to increase the treatment plant capacity by 5,100m³/d to cater for this population.

There is sufficient land for this extension since the existing treatment plant occupies only 20 acres out of the reserved area of 100 acres.

The existing trunk sewer has a an average daily capacity of 28,400 m³/d and therefore no augmentation of this sewer is required.

6.7 COST ESTIMATES FOR FUTURE EXPANSION NEEDS

An indicative cost estimate for the phased development of the sewerage and sewage treatment plant extensions are given in Table 6.2 below.

Table 6.2 : 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

6.8 OPERATION AND MAINTENANCE COST FOR THE REHABILITATED SYSTEM

It will be necessary to increase the current number of the operation and maintenance staff in order to ensure effective performance of the sewers and sewage treatment plant. The existing and the proposed staffing are given in Table 6.3 below. The same table gives the estimated operation and maintenance cost of the proposed staff for both the sewerage and the treatment plant as well as the necessary operation and maintenance facilities.

Table 6.3
Estimated operation and maintenance cost

Item description	Number of staff		Annual cost per person, (Kshs)	Total annual cost (Kshs)
	Current	Proposed addition		
Labourers for sewer maintenance	3	4	144,000	1,008,000
Labourers for sewage treatment plant	14	-	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
Exhauster attendants		2	144,000	288,000
Driver		1	168,000	168,000
Driver/mechanic		1	168,000	168,000
Total staff cost				4,608,000
Add 25% for protective garments, consumables and maintenance equipment				1,152,000
Grand total				5,760,000

7.0 LAWS AND REGULATIONS OF ENVIRONMENTAL IMPACT ASSESSMENT

7.1 GENERAL

The current Government of Kenya policy requirement stipulates that before any major development project is undertaken in the public or private sector, there is need to carry out Environmental Impact Assessment (EIA) on the project in order to ensure that each component conforms to good environmental management. This study involves mainly the identification of laws and regulations that govern the environmental impact assessment of water supply and sanitation projects.

7.2 LEGISLATION/REGULATIONS GOVERNING ENVIRONMENTAL IMPACT ASSESSMENT

7.2.1 General

A large number of Acts and organizations deal with issues of pollution, environmental degradation and conservation. These include among others:

- Constitution of Kenya (especially Section 71)
- Water Act (Cap 372)
- Agriculture Act (Cap 318)
- Irrigation Act (Cap 347)
- Forests Act (Cap 385)
- Lakes and Rivers Act (Cap 409)
- Maritime Zone Act (Cap 371)
- River Basin Development Authorities Act (e.g. Cap 443)
- Land Tenure and Land Use Legislation
- Wildlife (Conservation and Management) Act (1976 and 1989 Amendment)
- Public Health Act (Cap 242)
- Local Government Act (Cap 265)
- Environmental Management and Co-ordination Act (1999)

Effectiveness in enforcement has not been commensurate with the many acts and regulations; in some instances there have been contradictions when an institution has evoked its act at the expense of proper operation of facilities belonging to another institution. The reason for the foregoing situation is that each sector utilizing water, apart from the water authority, has a different mandate; their primary focus is not water development. The need to harmonize the application of the various Acts and Regulations, for effective protection of the environment, has been felt and expressed for a long time; hence the birth of the Environmental Management and Co-ordination Act of 1999.

7.2.2 Environmental Management and Co-ordination Act (1999)

The most significant Act that specifically addresses environmental impact is the newly enacted Environmental Management and Co-ordination Act, 1999. Among the specific issues related to EIA procedures are stipulated in the Act as follows:

- Establishment of Environmental Management Authority (NEMA) to administer the Act.
- Submission of an EIA Report to NEMA by developers before undertaking any new project specified in the Act.
- Issue of an Environmental Impact License by NEMA if it is satisfied with the EIA Report.
- Environmental Impact Assessment to be conducted in accordance with the EIA guidelines and procedures provided in the 4th schedule of the Act.

7.2.3 Laws Relating Specifically to Water Supply and Sanitation

Within the Environmental Management and coordination Act, a number of sections dealing specifically with water and sanitation can be identified as follows:

- Part V Section 42 dealing with protection of rivers, lakes and wetlands,
- Part VIII Section 72 dealing with water pollution prohibition,
- Part VIII Section 74 dealing with effluents to be discharged into the sewerage system,
- Part VIII Section 86 dealing with standards for waste,
- Part VIII Section 87 dealing with prohibition against dangerous handling and disposal of wastes,
- Part VIII Sections 88 and 89 dealing with waste licenses and licensing of waste disposal sites,
- Part VIII Sections 91 – 93 dealing with hazardous wastes and their disposal,
- Part XIII dealing with environmental offences and related penalties.

In order to minimize the conflicts in enforcement (due to the many different Acts and Regulations) as mentioned before, the Environmental Management and Coordination Act stipulates that where the provisions of any existing law conflicts with the provisions of this Act, then the provisions of this Act shall prevail. The foregoing proviso, in conjunction with the multi-disciplinary or composition of the Environmental Committees will hopefully enhance the effectiveness of administration and enforcement of the Act.

7.2.4 Environmental Impact Assessment (Guidelines and Administrative Procedures)

The format of the EIA Report has been set out in the guidelines and should include the following sections:

- Introduction
- Title of the Project
- Project Initiator
- Statement of Need
- Project Description
- Project Options
- Description of Existing Environment
- Results of Preliminary Assessment
- Detailed Examination of Impacts
- Suggested Mitigation and Abatement measures
- Residual Impacts
- Project Evaluation
- Summary Conclusions

In addition, the EIA guidelines and procedures describe procedures to be used in environmental planning and management in Kenya. It also gives a checklist of sectors, which can provide guidance to the public and private sector agencies involved in initiating development projects.

7.2.5 Objectives of Environmental Impact Assessment

The objectives of Environmental Impact Assessment Study for this project are identified as follows:

- To identify the existing environmental concerns which need to be taken into account in the proposals for rehabilitation of water supply and sanitation system.
- To evaluate the environmental impacts of the proposed rehabilitation works.
- To propose the counter measures to mitigate the impacts.
- To make recommendations for environmental conservation.

7.3 INITIAL ENVIRONMENTAL EXAMINATION

7.3.1 Water Quality of Existing Supplies

The programme for monitoring water quality both at source and within the distribution systems is in place in the town, however, implementation is generally poor because of lack of appropriate and adequate laboratory equipment and reagents. Water quality analysis results were not available at the station except pH and residual chlorine. The river sources for Murang'a are subject to pollution from agricultural activities upstream of the intakes. The streams are also heavily coloured and laden with sediment.

7.3.2 Existing Sanitation Situation

Murang'a has a new sewerage system that is under-utilized because the sewer coverage is very small; river water has to be diverted into the trunk sewers to achieve self-cleansing velocities. The bulk of the town depends on on-site sanitation systems, which generally provide inadequate service especially in public places like markets, institutions and bus parks.

Algal blooms in the Murang'a waste stabilization ponds affect the water quality in the outfall stream and there has been an outcry from the public that draw water from the stream. It is suspected that the blooms are resulting from either fertilizers carried back into the stream by irrigation water or abnormally long detention time in the maturation ponds.

7.3.3 Screening and Scoping for Environmental Impact Assessment

Many guidelines have been used in Kenya for EIA, especially those of the World Bank. Often, the sponsor of a development has stipulated the standards to be met, because in the past Kenya did not have specific guidelines. However, as mentioned before, the Environmental Management and Coordination Act (1999) has set out the guidelines for EIA in its 4th Schedule. The guidelines propose the checklist method for screening and scoping for EIA.

The general environmental concerns and a checklist for Murang'a town have been summarized in the following sections. Most project components at the rehabilitation stage will be of such small scale that their impacts will not be serious. Impacts arising from construction activities will mainly affect the human environment but can be minimized by proper construction methods. However, areas that require detailed environmental impact assessment study have been identified.

7.4 EXPERIENCES IN APPLICATION OF EXISTING LEGISLATION AND REGULATIONS IN WATER AND ENVIRONMENTAL MANAGEMENT IN MURANG'A TOWN.

1. There is a good cooperation between the pollution control section of DWO's office, Public Health Office and the office of the Environmental officer based in the Forests Department.
2. Water quality monitoring is hampered by unavailability of transport so there are only 5 river stations being monitored regularly.
3. Only a limited number of tests can be undertaken in the MENR water laboratory in Murang'a because of lack of equipment.
4. Monitoring of water abstractions from the main river source (Kayahwe) is difficult especially during the night when very low flows have been experienced at the waterworks intake as a result of upstream abstractions for irrigation.
5. The DWO's personnel are aware of the new Environmental Management and Co-ordination Act (1999) but they are not conversant with its provision.
6. The District Environmental Committee has been formed but it has not started its work.

7.5 ENVIRONMENTAL CONCERNS IN MURANG'A TOWN

1. Water sources are turbid as a result of sediments due to erosion.
2. Fertilizers used in farms give some colour that persists in treated water.
3. Coffee factories discharge their wastes to some extent to the rivers because the factories are next to the rivers and there is very little space to provide pits for disposal.
4. Major problems and threat to the water quality in the district is discharge from coffee factories.
5. The discharge from STW had raised complaints from downstream users and discharge channels had to be constructed to further reduce algae pollution load reaching the stream.
6. No major pollution potential from on-site sanitation systems has so far been experienced in the town.

7. Hospital waste is dumped with domestic refuse because the hospital incinerator has not been working for sometime.
8. In terms of pollution from activities of the town Murari stream is most threatened and sewer connection would save the stream.
9. The major environmental concern is waste disposal for areas not connected to the sewerage system.
10. Lack of adequate water is a major concern, but improvement of the water supply should go hand in hand with the expansion in the sewerage system to cater for the increased flow.
11. There are only 2000 connections to the sewerage network. The rest of the town uses septic tanks but there is no exhauster; those who need exhauster service have to go to Thika to get the service.
12. A change of the raw water intake to a position much higher away from the small-scale farmland areas to the upper tea zones would reduce risk of pollution.
13. Unsewered areas discharge sullage in open drains, these should be sewered.
14. DC's offices (Milimani Estate) should be sewered because of reduction in plot sizes.
15. Developed areas e.g. Mukuyu, Kabue, Kaduchu areas should be sewered – they are highly developed, water is regular, and population is high.
16. The recently commissioned sewerage project provided for an exhauster, which was never delivered to the council. Other concerns with respect to the sewerage system are:
 - No rodding tools and maintenance machines for the sewer line although these tools were supposed to be provided for under the sewerage contract. Unblocking of the sewers is now very tedious.
 - No vehicle for inspection of the sewerage system and transportation of workers to site.
 - Storm-water management has not been provided for and presents a serious problem.
17. There are 20 registered abstractions from Kayahwe River upstream of intake for coffee factories, other water projects, institutional supplies and small individual abstractions exerting demand on the river flow.

18. Low flows are being experienced during the night because of illegal water abstractions for irrigating vegetables and the intake is threatened although the stream flows have generally been sufficient to meet current waterworks withdrawal rates.
19. Water catchments are threatened by farming. There is conflict between the Water Act and Agricultural Act. The former requires a riparian way-leave while the latter does not. Agricultural extension officers encourage farming up to the edge of the river.
20. Water borne systems don't work well because water supply is inadequate, e.g. for food preparation services.
21. Public toilets in markets and other public amenities do not work well with inadequate water.
22. There is inadequate water to flush the sewer system so water has to be introduced from the river into the main sewers to achieve self-cleansing velocities.
23. 50% of business premises have not connected to the sewer network.
24. Current sewer pipes are located at higher elevation than some premises especially at Mukuyu market so premises cannot join into the system.
25. Open drains are fed with wastewater in some areas of the town.
26. There is no organized company to educate the people on sanitation matters but people are aware generally.
27. There is a rising incidence of water borne diseases especially diarrhoea because of inadequate water for proper sanitation rather than pollution.
28. Contamination of water has been noticed in Mukuyu estate.
29. Typhoid cases are received from the hospital perhaps as a result of people drinking water from untreated sources.
30. Kiosks erected at the old bus stop do not have water and sanitation facilities.
31. Absence of water kiosks leads to reverting to traditional sources and hence chances of disease outbreak.
32. Solid waste management is inadequate – no dustbins are provided, people provide their own containers.

33. Overflowing septic tanks are exhausted manually if people cannot obtain the exhauster from Thika.
34. People were promised piped water as an alternative to the river where the ponds are discharging, but the water supply has not been extended to these areas.

7.6 RESULTS OF INITIAL ENVIRONMENTAL EXAMINATION

Murang'a town has a fairly new sewerage system, which however, covers a very limited section of the town with only 2000 connections. The sewage stabilization ponds cannot be filled up with sewage from the current connections and the sewers have to be flushed using river water. The bulk of the town is served by on-site sanitation facilities including septic tanks and pit latrines. The water supply system covers a substantial section of the town and for the areas served all plots are connected to the supply. There are no water kiosks.

Checklists of initial environmental examination are presented in Table 7.1 for water supply and Table 7.2 for sewerage component.

Table 7.1 IEE Checklists - Water Supply Component

ITEM	EVALUATION	COMMENT
1. Human Settlement	3	No negative impact expected
2. Economic Activities	5	Improved water supply will have a positive impact
3. Transport	4	Attention needed during construction
4. Water and Common Rights	3	This may be affected once the intake is complete on Kayahwe River
5. Sanitation	4	Improved water supply should lead to improved sanitation
6. Waste	4	Will need attention during construction
7. Hazards / Dangers	4	Will need attention during construction
8. Topography and Geology	5	No impact expected

9. Soil Erosion	4	Will need attention during construction
10. Groundwater	3	May be affected if existing boreholes are rehabilitated for production
11. River and Wetlands	3	Main source is Kayahwe and Kaihugu rivers whose catchments need protection
12. Coastline and Sea	5	Such areas do not exist in the project area
13. Flora and Fauna	4	No negative impact expected with proper construction methods
14. Weather	5	No impact expected.
15. View	5	No impact expected.
16. Air Pollution	4	No negative impact expected with proper construction methods
17. Water Pollution	1	Sewage flow will increase with improved water supply to create overflow of on-site sanitation systems unless sewerage service is also improved
18. Soil Contamination	3	No impact expected from water supply but solid waste dumping may have effect on soil
19. Noise and Vibration	4	Will need attention during construction
20. Ground Subsidence	5	No impact expected.
21. Noxious Odours	5	No impact expected.
22. Cultural and Archeological Assets	5	No impact expected.
23. Conflict with Community Aspirations	5	No impact expected

KEY:

1. Serious impact expected

2. Minor impact expected
3. Uncertain (investigation needed to clarify)
4. Almost no impact expected if proper construction procedure are used.
5. Almost no impact expected (no need for EIA)

Table 7.2 IEE Checklist - Sewerage Component

ITEM	EVALUATION	COMMENT
1. Human Settlement	4	No negative impact expected.
2. Economic Activities	4	No negative impacts expected
3. Transport	4	Needs attention during construction
4. Water and Common Rights	2	STW affluent may affect water quality for downstream users if proper treatment is not achieved.
5. Sanitation	5	Sanitation conditions will greatly improve by expanding sewer connection.
6. Waste	5	Need for sludge exhaustion shall be reduced by sewer connection
7. Hazards / Dangers	4	Will need attention during construction.
9. Topography and Geology	5	No impact expected
9. Soil Erosion	4	Needs attention during construction.
10. Groundwater	3	Reduction of on-site sanitation systems by sewer connection will reduce possible groundwater degradation
11. River and Wetlands	3	Sewer connection will protect the rivers and wetlands from discharges from on-site sanitation systems
12. Coastline and Sea	5	No such sites exist in project area.
13. Flora and Fauna	3	No negative impact expected.

14. Weather	5	No impact expected.
15. View	5	No impact expected.
16. Air Pollution	5	No impact expected.
17. Water Pollution	3	Sewer connection is meant to reduce possibilities of water pollution from on-site sanitation systems.
18. Soil Contamination	3	No impact expected
19. Noise and Vibration	4	No impact expected if proper construction procedures are used
20. Ground Subsidence	5	No impact expected.
21. Noxious Odours	5	No impact expected.
22. Cultural and Archeological Assets	5	No impact expected.
23. Conflict with Community Aspirations	5	No impact expected

7.7 INITIAL ENVIRONMENTAL IMPACT ASSESSMENT

By and large, the proposed rehabilitation project will have positive impacts by providing improved sanitation, reducing incidence of disease, and general improvement of the environment. However, from the results of IEE, four main items of potential impacts of the proposed rehabilitation works could be identified for study as listed below:

- (i) Impacts resulting from abstraction of water from river or groundwater sources during operation.
- (ii) Impacts arising from the increase in wastewater generation that would result from the improved water supply.

- (iii) Impacts resulting from the operation of wastewater management and sanitation facilities.
- (iv) Impacts resulting from construction activities during implementation of rehabilitation works.

7.7.1 Impacts Resulting from Water Abstraction

There is no data on the hydrology of the Kayahwe River to give an accurate picture of the stream flows at the intake to the Kayahwe Waterworks; the water potential of the river system has been derived by reference to the Mathioya River system. Over 20 water abstraction permits have been issued upstream of the Kayahwe intake and currently low flows are experienced at the intake during the night. It is not clear what the impact of increased abstraction at the existing intake will be and this needs to be examined further.

7.7.2 Impacts from Increased Wastewater Generation

Improved water service to be wrought by the rehabilitation will definitely avail more water to the consumers. Given the current low rate of sewer connection, the resulting wastewater flow will present disposal problems. The capacity of the existing sewage treatment works (1564 m³/day) is limited by the capacity of the trunk sewer leading to the works, so expanded sewer connection to deal with the increased wastewater flow will necessitate provision of addition trunk sewer capacity.

A study of the hydrogeology of the area, however, reveals that the groundwater table is very deep, and the risk of groundwater contamination by on-site sanitation systems is low. On-site wastewater disposal will continue in a substantial portion of the town so there is need for intensified public education to manage their wastes properly for protection of the environment.

7.7.3 Impacts from Operation of Sanitation Facilities

Operation of the waste treatment works with increased wastewater flow will add waste load into the receiving stream. There is need to maintain the effluent standards (with respect to BOD, Suspended Solids, etc.) at the legislated levels. There will be need to monitor operation of the on-site sanitation facilities by invoking the Public Health Act.

7.7.4 Impacts from Construction

At the rehabilitation stage construction will be concentrated in the areas of existing treatment works and along the pipelines and these constructions will not be of any large scale as to adversely affect human settlements. Excavations for pipelines may cause interruption to traffic flow but this will be on a temporary scale. Serious traffic inconveniences will be avoided by appropriate construction methods.

Disturbance of the soil during construction may also give rise to soil erosion but this will be minimal because no large-scale earthworks are anticipated in the rehabilitation phase. The noise and vibrations are common features of most construction works and there are no unusual works that need special attention with respect to noise and vibration.

7.8 ISSUES FOR FURTHER INVESTIGATION

1. The effect of agricultural waste discharges, especially coffee wastes, on the long-term water quality changes in Kayahwe river which is one of the main water supply sources for Murang'a town.
2. The effect of illegal (and additional legal) water abstractions upstream of the current intake on the long-term adequacy of Kayahwe River as a main source of water for the town. Although hydrological analysis of flow data obtained at the gauging station RGS4 BD06 shows a catchment yield much higher than the current abstraction rate, already very low flows are experienced at the intake during the night.
3. The reasons for and effects of the excessive algal blooms in the newly commissioned sewage stabilization ponds. It is suspected that the diversion of the river flow into the trunk sewers introduces nutrients carried from the irrigated farms cradling the river. This suspicion needs confirmation and appropriate recommendations on remedial measures made.
4. Since a substantial section of the population is not served by the current water supply scheme and therefore draws water from traditional sources, the full impact of the continued use of on-site sanitation systems on the degradation of water quality in such sources needs to be studied.

8. PROPOSED UTILITY MANAGEMENT PLAN

The 10 study towns visited can be grouped into three different institutional categories or groups under the Ministry of Environment and Natural Resources. District water offices: Narok, Meru, Muranga, Wundanyi, Migori and Lamu report to the Ministry directly, Division water offices: Makindu, Webuye and Mumias are included in the respective District reporting, and Kabarnet Sub Area office reports to the Regional area office, which falls under the jurisdiction of the National Water Conservation & Pipeline Corporation, which again operates as a State Corporation under the same Parent Ministry, the Ministry of Environment and Natural Resources.

8.0. GENERAL APPROACH

The approach for the analysis of the 10 towns was to work with a comprehensive base questionnaire that covers the commercial, financial and technical aspects of a water utility system. Interviews and discussions were held with those staff members that are either in charge or responsible for certain aspects of the day to day operation.

For the commercialised systems in Kenya, three sample towns were chosen: Malindi which is operated under a management contract for the NWC&PC, and Nyeri and Kitale Water Company, which are operated on the basis of an agency agreement for and on behalf of the respective municipal councils. Different questionnaires were used in order to obtain information about the problems that they have experienced since commencement of their operation.

The current system of Government reporting and record keeping has made it very difficult to obtain reliable and meaningful data within the given timeframe. The prevailing situation in all systems is that details are available, but neither instantly ready, nor summed up. Consequently numerous figures had to be compiled and abstracted from various ledgers and folders, in order to draw a picture of the current situation. At system level, the consumer ledger was found to be the most resourceful book of information concerning number of accounts, their condition (metered, non-metered, active, in-active), monthly consumption, arrears and payments received. It was therefore decided to use the consumer ledger information and take a snapshot picture of the situation for the month of June 2000. Where annual figures and records were available, those were absorbed for the Financial Year 99/00 in order to calculate monthly averages for comparison with the snapshot month June 2000. To substantiate procedures in place, it was considered essential, to question the figures and details that are routinely forwarded to the Head Quarter.

As procedures do continue at Head Quarter level it was as well attempted to find out, what procedures have to be undergone and is the information that is provided from Divisional or District Offices analysed in order to make planning assignments possible.

The details and procedures representing the NWC&PC area office in Kabarnet have been analysed upto the Regional Office level only. Operational decision making, funding and most personnel related issues are vested in the powers of

the Regional Manager. Instructions and procedural requirements, retained by the Head Office or vested in the State Corporation Act, are however considered for the analysis.

8.1. EXISTING WATER SUPPLY & SANITATION SYSTEMS

8.1.0. Overview Of All Systems Visited

All records and details abstracted in or compiled for the ten towns visited, are compiled in Appendices: A3 for Narok Town, B3 for Meru Town, C3 for Muranga Town, D3 for Kabarnet Town, E3 for Makindu Town, F3 for Wundanyi Town, G3 for Migori Town, H3 for Lamu Town, I3 for Webuye Town and J3 for Mumias Town. System situation description has been prepared for every town visited. Appendix K 3 holds questionnaires used for the commercialised systems and all summary statistics. Summary Table ST 8.2. contains the verified statistics for all 10 towns, using the month of June 2000 as the month for which verification could be done, based on the information abstracted from the various consumer ledgers. Comparisons between the towns are drawn from the same overview called "verified statistics summary" on details considered most relevant.

8.1.0.1. Utility Systems Organisation

8.1.0.1.1. Staffing:

All systems have a high number of unskilled Subordinate Staff being employed with different responsibilities. The O&M department integrates not only the source, treatment and distribution aspect of the water systems, but it is also responsible for billing and revenue collection. Within the billing and revenue collection department, majority of all staff have a technical background. Training, if offered, is within the technical field, financial or commercial training is not really considered. The staff assigned to the distribution system do as well undertake meter reading for which no schedules are available. Control over staff activities and whereabouts becomes very difficult. The number of consumer accounts per staff ranges from 23 in Migori to 110 in Mumias. Organisation Charts have been drawn for all 10 towns, based on the information collected and are to be found under the Appendix of the respective town.

The managers responsible for the various systems have no commercial or managerial, but technical background. There is no training offered to prepare officers into their managerial responsibilities, even though the assignment described in The "Schedule of Duties for the Ministry of Water Resources" – January 1999, issued by the Permanent Secretary, describes the duties of every District Water Officer as:

Representative of the MWR in the District and responsible to the PWO/Central for the following duties and responsibilities:

- Overall planning, control and management of all water related matters in the District, including financial management thereof
- Any other duties as may be assigned

8.1.0.1.2. Office Set-up, Facilities and Transport:

While some District offices have adequate space, Division offices visited are in dire need of a decent working- and consumer-receiving-environment. Hard furnishing can be termed as basic, but storage facilities for keeping and archiving documents reflect additional requirements in all places visited. Shortage of stationary or calculators is common everywhere.

The new NWC&PC office in Kabarnet has been taken over from the contractor just recently and basic requirements are still in very good condition.

The transport situation of all systems visited is below requirement. Water systems that are shared with the District water operation do have the advantage that transport can at least be shared in case of an emergency. All other systems do depend on well wishers, public transport or they walk.

8.1.0.1.3. Consumer and Meter Information:

The existing level of information concerning the status of the meters, disconnection/ re-connection or new connection statistics or their operability, must be termed as low. In a number of towns, the available though estimated figures are not diverting too much from the snapshot situation taken for the month of June 2000, but others are completely "off-track" and reflect that the value of information has to be more emphasized.

Ad hoc information was difficult to obtain anywhere. The statement that everything is available somewhere, somehow, but not in a comprehensive and meaningful format, easy to analyse, applies to all systems. As an example can be taken that the cost for maintaining a vehicle cannot be abstracted from one ledger card, but different kind of items are reflected on different ledger cards for certain expenditure categories. This means, that the cost determination could only be made by going through a number of ledger cards and then compiling the same information.

8.1.0.1.4. Production and Consumption:

For a number of systems, neither production nor consumption figures can be determined with certainty.

Where master meters were either not working or simply lacking, pumping hours were used to calculate the production; where gravity flow does not provide meter information, the situation was reflected, based on the assessment offered by the staff of the respective water system and then compared with the engineer's information. All systems operate well below their capacity, which can be related to:

- Limited use of power, because more pumping cannot be justified with equally increasing billed consumption
- Weak distribution systems, which cannot take the increased pressure and result in higher UfW
- Faulty pumps
- Reduced source capacity

To confirm consumption details is even more difficult, as the majority of consumer meters are not operational. The number of estimated accounts range from 31% in Wundanyi to 99% in Mumias. The verification of consumption details was only

possible for the month of June 2000, by abstracting consumer ledger information in a uniform format for all systems. While the information still reflects a number of discrepancies, it was considered the closest one can get, within the scopes and limited timeframe of the study.

While Migori, Webuye and Mumias have a very high estimated number of accounts (88% - 99%), the consumption abstracted exceeds the production considerably or is almost the same and raises the question of: what is the assessment tool for estimating accounts, or better their consumption?

8.1.0.1.5. Un-accounted for Water (UfW):

Where production and consumption details are not very reliable, the determination of UfW is difficult and equally unreliable. While most systems do fill monthly returns with arithmetical calculations on the UfW, the verified information reflects differences. Where a calculation of UfW was possible, the percentages range from 1% for Webuye town to 77% for Kabarnet town (excluding Mumias and Migori towns which reflect a higher consumption than production).

The overall calculated loss, expressed in Kenya Shillings is considerable. The verified month of June 2000 calculates for 8 out of the 10 towns, for which UfW calculation was done, a total of approximately Kshs 6,374 million per month, or extrapolated: Kshs 76,492 million per calendar year.

As the calculation is based on water lost and the average tariff calculated for every town, this calculation should serve as a guiding figure only, as the figures used for the calculation are based on the month of June 2000 information and might vary, when a deeper analysis is carried out. The loss furthermore does not yet capture the full cost of the loss, because the current tariff is considered as not cost covering.

The determination of cost represents one of the most basic problems again applying to all systems, which starts by trying to establish the actual expenditure. With the current level of information cost can only be assessed but not established.

8.1.0.1.6. Billing and Revenue Collection:

Many monthly billing records and returns were found to be estimated. Various explanations were offered, but all centered around the fact, that the information has to be monthly and manually abstracted from all consumer ledgers after the billing has been completed. The time available between completion of billing and submission of the monthly return is considered too short to complete the time consuming exercise. As monthly returns do not seem to be returned by the Head Quarter, the estimation is seen as an accepted practice. While the practice of estimation could be accepted for the given reason, the reconciliation at the end of the FY is missing, and annual details for the Head Quarter are simply wrong. Only Muranga town and possibly Makindu seem to be reporting actual monthly records. The tariff increment effective November 1999 could not be seen in many of the estimated billing figures for most systems, neither was it apparent for some of the revenue officers, that delayed implementation of the tariff increment should be captured with a retro-active adjustment.

The issue of estimation of monthly billing returns was not applicable for Kabarnet, as the water system only obtains meter readings and the Regional Office prepares computer generated bills. Monthly information about what was billed to the consumer should be correct.

For the verification exercise of June 2000 bills, the consultant filtered out consumers with the same actual consumption and noted, that different billing amounts seem to be calculated for the same consumption. As the majority of the billing officers do not have a calculator, this can be seen as a possible explanation for the variations. Appendix K 3 – ST 1.1. shows the analysis and reflects the situation for a few sample towns. The same bill variation seems to be the case for Kabarnet however limited in number, explanation for which should relate to the billing program.

Revenue collection records and returns are based on records obtained from the District Commissioner's office. Only minor discrepancies were noted, which can be explained by the fact, that report preparation does not necessarily fall together with calendar end month.

The attempt, to verify consumer payments against reported revenue collection, failed. The payment situation abstracted from the consumer ledgers for the month of June, 2000 was explained to reflect the situation as at 30.06.00. Unfortunately ALL the 9 water systems (excluding Kabarnet) involved in the exercise, misunderstood the information requested for and reflected last payments up to December,2000.

The billing efficiency for the various towns ranges between 22% in Kabarnet town and 64% in Narok town, while the collection efficiency ranges between 22% and 87% for Muranga. It should be noted that Migori and Mumias have not been considered for this comparison, as their billing efficiency is exceeding 100 % and unrealistic, as consumption should not be higher than the production.

The combined billing and collection efficiency ranges between 15% and 49% and is suggested to be used as one of the criteria for selecting priority projects.

Muranga is the only town where consumers voluntarily come to the DC's office to ask for the amount due for payment, which they then pay, without even having received the bill. Bills are only issued for GOK institutions, schools or companies on request. While Lamu operates in a similar way, it must be noted that Muranga merges this fact with a high billing and collection efficiency.

8.1.0.1.7. Average Tariff:

The average tariff had not been calculated in any of the towns visited, because it is not required for any of the GOK returns, hence not a commonly used term. The calculation of the average tariff, where possible, was prepared for the month of June 2000. It ranges between 16.57 Kshs for Migori and 42.31 Kshs for Wundanyi.

The June 2000 average tariff read in conjunction with the percentage of consumers billed on 10 cbm minimum charge, indicates which towns have a substantial base of minimum consumers. The minimum charged consumers

range from 12.37 % in Webuye to 78.14 % in Lamu. An analysis for the number of consumers falling into the various consumption brackets is commented on in the report for the various systems and gives an indication of the revenue base and the consumer portfolio.

8.1.0.1.8. Debt Situation:

The monthly debt situation is reported to the Head Quarter, whereby brought forward balances are increased by the monthly ("averaged or estimated") billed revenue less revenue collected. For all towns it was therefore found, that balances abstracted from the consumer ledgers did not correspond with the reported information. Discrepancies reflected are substantial in some cases. It can however not be established where or when those differences slipped into the system. An analysis was undertaken to split between GOK, major and minor consumers where possible. The one consumer taking the biggest share of unpaid bills in District towns, is the Government of Kenya. While the debt situation increases on a monthly basis, no effective measures seem to be in place to improve on the prevailing situation. Collection targets are set for the WS systems, but collection of GOK debt must be termed as very difficult and the possibility of involving the MENR Head Quarter should be considered after verification and substantiation of existing GOK debts.

Verified debt, as abstracted from the consumer ledgers, for all the towns visited amounts to: Kshs 61,899 million as at the end of May, 2000 and Kshs 64,678 million as at the end of the Financial Year 99/00. This can be interpreted such that the debt outstanding, increases by approximately 3 million per month for all the ten towns. Even though this information has been abstracted from the respective consumer ledgers, it must be pointed out, that a much more intensive analysis will have to be done, to confirm the collectable debt, as it includes disputed bills relating to wrong billing calculation, wrong meter reading or no water situations. The abstracted figure can however be used as an indicator. When comparing the total outstanding at the end of the Financial Year with the value of the annual water loss of approximately Kshs 64,8 million, the need for intervention concerning UfW, becomes even more apparent. Remedial efforts should concentrate and start with the attempt to reduce this aspect of water lost.

8.1.0.1.9. Funding:

Salaries, power and chemical expenses are paid through MENR Head Quarter. All other expenses at District level are funded through A.I.E. (Authority to Incur Expenses).

The A.I.E. earned during the FY is not automatically the A.I.E. received. Any application, pending approval at the end of the FY, is not returned for resubmission in the new year, but null and void. It appears, that the 10 towns have earned a total of Kshs 17,930 million in A.I.E., but only received and incurred expenditure amounting to Kshs. 17,182 million. When a comparison is drawn between A.I.E. earned and A.I.E. received on a town by town basis, it shows that some towns managed to receive more A.I.E. then they have actually earned while others received considerably less. It could not be established with certainty how the procedure of "receiving more" operates.

8.1.0.2. Utility System Procedures

Existing procedures were analysed against the facts, figures and details obtained. Statements were questioned against the background of facts established.

8.1.0.2.1. Administration:

8.1.0.2.1.1. Staff:

No personnel management, training or recruitment procedures are in place and the approach of utilising staff where and when needed, results in a situation of no control over staff movements. Moving the technical staff into billing and revenue, instead of recruiting qualified and trained staff for the commercial aspect of the utility operation reflects on the system efficiency. The staff morale is equally affected and the low salary structure and delayed promotions attribute to the often understandable "not really concerned" situation. Sanctioning within the civil service structure has not been very effective in the past. The worst to happen was a transfer with no financial repercussions. At the same time positive efforts are not appreciated which often leads to the above indifference.

The recent retrenchment exercise has however changed the prevailing opinion concerning job security. The criteria for the recent retrenchment has not been understood by the staff, as in a number of systems, important and knowledgeable staff members were removed.

8.1.0.2.1.2. Consumer Accounts:

Clear guidelines on new connection, dis-connection, re-connection and any other routine procedure, are not in place. Especially for cases of recently gazetted changes, the gazette notice seems not sufficiently explained with the consequence, that every system handles the issue differently. Concerning new meters, deposit levels or delayed tariff implementation, wrong implementation of the gazetted notice translates into loss of revenue. If for example the tariff adjustment information and implementation instruction reaches the systems with a certain delay, the gap between gazettement and implementation should be closed. Some systems did so, others did not.

The maintenance of consumer and connection records must be considered as vital for any utility system. All systems lack however clear guidelines and control at system level. The ever prevailing shortage of stationary or operating material is the excuse and/or explanation for messy filing or files and books not found or records not kept. Clear guidelines on consumer record keeping were not found and the recording varies from application form to meter reading book to consumer ledger, depending on the WS system.

8.1.0.2.1.3. Meter Reading, Billing and Revenue Collection:

Meter reading schedules and procedures are not in place and there is no control over the process, neither the staff entrusted the exercise. Wrong or no meter reading affects the billing efficiency and eventually revenue collection, as consumers dispute by simply not paying. When wrong or over estimated bills go along with no supply and service, the payment morale drops and illegal activities increase. While all District water offices have water bailiffs on their staff list, they

are not used to handle cases of illegal water consumption, but only deal with water rights and granting permits for water abstraction.

All systems operated by the MENR issue manual bills and varying bill formats are used. Formats of the system have not been improved for years and some reflect for example consumption stated in gallons, while almost all consumer meters are read in cbm. This increases the risk of error calculations. Majority of consumer bills are hand delivered or collected from the water office, as no funds are available for mailing.

Systematic dis-connection and control procedures were not found to be in place. Explanations given relate always to shortage of funds and/or lacking plugging material, no transport or shortage of staff. Once an account is dis-connected, the consumer retains this status, unless he comes forward to regularise his/her account. Routine checks on long dis-connected accounts, are not practiced or not really possible, because the transport or staff necessary, is not available. This fact bears a high risk of undetected illegal re-connections and contributes into the high UfW.

8.1.0.2.1.4. A.I.E. and Procurements:

An A.I.E. is calculated based on the monthly revenue collection and a certain A.I.E. percentage, determined by MENR, and varying from town to town. In the case of the towns visited, the percentage ranges between 60 % and 90 %. The basis for the different percentages could not be established.

The receipt of an A.I.E. is affected by many factors and in all cases causing delays for procurements and the day to day operation. Appendix K 3 – Figure 8.2. illustrates the 17 steps between revenue collected at the DC's office and the approved authority to spend. The approved A.I.E. can only be used for procurement, if the Local Purchase Order (L.P.O.) processing procedure has been complied with. Suppliers often reject to supply against an L.P.O., because the payment processing procedure is another lengthy procedure to follow. Appendix K 3 – Figure 8.3. illustrates the path a pro-forma invoice has to take, before a cheque can be issued. Supplies are limited to listed suppliers within the District and the District Tender Board has to approve such suppliers.

The issuance of a cheque to a supplier is furthermore dependant on District Office liquidity and priorities set by the District Administration. As the District Administration is not only responsible for A.I.E. of the water department, but all the other GOK departments represented within the District, priorities might be given to other departments, depending on the situation. Collection efforts from the water department can be frustrated by such factors, which are beyond their control.

As long as quotations are obtained as required, and vouchers are signed by the respective signatories, expenditure seems the responsibility of the respective District Water Officer. It must only be ensured that it can be booked against votes that have been budgeted for. Finally, the District Administration has to account for the expenditure incurred, while the Ministry concerned is no longer involved. The complicated and lengthy procedures do not seem to relate to Financial Control at the end of the process.

Transport and staff related expenditure absorb a relatively high percentage of the approved and received A.I.E., while stationary or other inexpensive items are said to be lacking. It could not be established based on which criteria approved A.I.E. are spent and whether quotations obtained, reflect a realistic market price, when

compared. The process shows that Water department requirements are not only at the discretion of the water department through its representative the District Water Officer, but mainly depend on the District Administration, which is answerable to the Office of the President and the Treasury/Ministry of Finance.

Divisional Offices are affected by the same procedure, but their requirements have to undergo an additional step in order to be incorporated into the District requirements.

The Kabarnet area office submits all its requirements through the Regional Office, which in turn still has to follow the same or similar GOK procurement procedures.

8.1.0.2.2. Operation & Maintenance:

No preventive maintenance is in place, neither are technical manuals available. There is no guidance on standards and no procedure control over quality of water. Consumer meter servicing is neither scheduled, nor controlled or guided. Master meter preventive or routine maintenance is not covered by any procedure, and servicing lacks skill and the necessary tools. While some provincial water offices do have the necessary equipment, they lack spares. The reason for all shortcomings is said to be the lack of funding.

Chronically empty stores are explained by the same lack of funding. Only Lamu town had stock balance records available, which could relate to its location and island status. In most cases it was explained that procurements mainly relate to a technical problem that has to be attended to and parts are used as soon as they are available.

The WS Operators Handbook was found in the Webuye WS system, but the available version seemed very old (without any printing date) and not reflecting any system specific information or guidance.

8.1.3. Muranga Water Supply & Sanitation System

Muranga is a District Head Office, and at the same time provides the urban water supply for Muranga town, currently serving a population of approximately 60.000 people. Muranga town falls under the Central Province, with Nyeri as its Provincial Headquarter.

The water demand for Muranga cannot be met by the current sources. Consumers of Muranga get no water bills, but voluntarily come to the DC's office, where the Water Supply collection office is located and ask for the charge. A water rationing schedule is in place, whereby the higher areas get water Monday, Wednesday and Saturday, while the lower areas get water the other days of the week.

8.1.3.1. Utility System Organisation

8.1.3.1.1. Staffing:

The total number of staff is 56, of which 18 members, including the District Water Officer, are shared between District and Muranga Water Supply activities. Refer to Appendix C3 Figure 8.1.3. – Organisation Chart. The comment of the DWO to the "draft final" was that actual staff numbers are 67, however no names or other details were provided and therefore the existing chart is retained until more information can be obtained.

The Deputy District Water Officer is in charge of O&M, Source, Treatment, Distribution, Billing and Revenue Collection and Accounts. The Accounts section processes A.I.E. and forwards procurements. There is a total of 13 staff members in the Accounts Department, including 2 officers relating to stores and supplies. 26 staff members are assigned to the production and distribution network, and the allocation in the organisation chart has been reflected as understood by the consultant.

The officer in charge of Billing and Revenue is a hydrologist by profession and other support have a technical background apart from the collection officers, who are clerical officers. Meter reading is done by various people. There is however no specific task-team for meter reading in place. The number of Subordinate Staff in relation to other skilled staff is limited. Refresher courses, if offered, remain technical and within the line of the initial training. There is an absence of skills in commercial and managerial aspects.

A departmental organisation chart is available for the District only. Job descriptions are not available. Job-category descriptions are said to be available, but were not readily available.

A clear delineation between District and Muranga WS staff has been difficult and is reflected in the organisation chart to the best of the understanding of the consultant. The index of number of accounts per staff member is:

Staff	Consumer Accounts	Accounts/Staff
56	2.933	52.38

8.1.3.1.2. Office Set-up, Facilities and Transport:

The office is located in a fair sized compound with several small stone buildings and the office blocks are shared between District and Muranga WS staff. Two offices and a secretarial room are allocated to the DWO and his Deputy, two small offices are allocated to the Billing Officers, and another 7 offices are partly shared with other District staff. Basic furnishings are provided including tables, chairs and cabinets. There are three typewriters (2 electric, 1 manual), but no calculators are available for the Billing office. Two working telephone lines are available.

One Bedford lorry, three Landrovers (over 20 yrs old) and one motor-bike, however currently grounded, are shared with the District. No direct allocation to Muranga WS could be made.

8.1.3.1.3. Consumer and Meter Information:

All information is available somewhere, but in most cases not in a compiled or summarised format.

The decision was therefore made to obtain as much information as possible for June 2000 from the consumer ledgers, and use that "Base Verification Month" as a representative snapshot. This information was then related to figures and returns that are normally sent to the Provincial Water Officer (PWO) and MENR Head Quarters.

An abstract of the comparison between information available or provided, with the verified information, is shown here below. Complete information is available in Appendix C3 Table 8.1.3. and Table 8.4.3.

Detail	Provided from Muranga	Verified for June 2000
Registered Consumers:	2,851	2,933
Never Connected:	Not available	556
Metered:	1,112 in-active, 1,739 active	
Working:	1,851	1,449, but 1433 actual bills
Not-Working:	1,000	1,441, but 1453 estimate bills
Un-metered:	Not readily available	2
Disconnected:	Not readily available	36*
Major Consumers:	Not readily available	28
Minor Consumers:	Not readily available	2,858

- *Information on dis-connected accounts needs re-confirmation with the consumer ledgers, as 549 disconnected accounts were at the same time marked as "Never Connected" in Table 8.1.3. and hence filtered out, leaving 36 dis-connected accounts.

The splitting between minor and major consumers is determined by consumption exceeding 100 cbm during the month of June.

There are no water Kiosks in town.

8.1.3.1.4. Production and Consumption:

Production:

Production figures as used for the monthly O & M Monitoring returns, could not be obtained, as the O&M monitoring file was temporarily not available.

The production average per month, based on the information received and relating to the pumping capacity (140 cbm/hr), is reflected below:

Detail	Average as provided
Design Capacity / Month	100,800 m ³
Production / Month	82,500 m ³
Production / Day	2,750 m ³

Based on the available production information, the **Production Efficiency is calculated as 81.85 %**

The actual production in Muranga cannot be established, as the only existing 8" master meters is non-functional. The production of 82,500 cbm is based on information obtained from Muranga staff and calculated as 125cbm for 22 hours pumping for 30 days.

Consumption:

Consumption records are available in Appendix C3 Table 8.3.3. and compared with the verified details from Appendix C3 Table 8.1.3.:

Detail	%	June 2000 as provided	%	Average as provided	%	June 2000 verified
Actual Consumption	53	21,334 m ³	57	24,850 m ³	51	21,114 m ³
Estimate & Flat Rate	47	19,178 m ³	43	18,403 m ³	49	19,914 m ³
TOTAL:	100	40,512 m³	100	43,253 m³	100	41,028 m³

Consumption records were obtained from the meter reading book summary and are as well reflected in the monthly report forwarded to the HQ. Muranga billing and revenue department does abstract monthly billing records from the consumer ledgers and compiles the same for this report.

The analysis of Appendix C3 Table 8.1.3. gives the information of the current consumer portfolio in Muranga and equally indicates where the bulk of revenue is coming from. With such information available, any tariff adjustment can now be modified in such a way that the social aspect of tariff adjustments is considered and the most solid part of the revenue base gets the necessary attention. This equally reflects how meaningful a good consumer database can be used.

Consumption Steps	Number of Bills		Revenue Earned (June 2000)	
	Actual	Estimate	Actual Kshs	Estimate Kshs
0 to 10 cbm	927	1,295	224,898	258,645
11 to 20 cbm	294	62	84,957	21,840
21 to 40 cbm	139	59	72,705	87,850
41 to 60 cbm	27	23	25,630	32,7733
61 to 100 cbm	21	11	35,185	28,035
> 100 cbm	19	9	300,686	101,840
TOTAL:	1,427	1,459	744,061	530,983

8.1.3.1.5. Un-accounted for Water (UfW):

The main problem relates to weakness in the transmission line, where 8 major bursts are said to be attended to on a monthly basis. As the production figures cannot be confirmed with certainty, the available information is used to calculate the UfW.

Muranga WS monthly losses, which would have been in the O&M Monitoring Report, were not available. The loss is therefore calculated as 50.27 % for the month of June 2000, while no information could be obtained from Muranga due to the missing O&M Monitoring report.

The value of UfW, calculated for June 2000, using the calculated average tariff of Kshs 31.07, and amounts to Kshs 1,288,842.37 and represents 41,472 cbm of treated water.

8.1.3.1.6. Billing and Revenue Collection:

Billing:

The Billed and collected revenue is reflected in Appendix C3 Table 8.3.3 and abstracted from monthly returns to the PWO and MENR. The billed revenue does reflect the correct picture, because the monthly figure is abstracted from the consumer ledgers.

The approach of the consultant was to verify using Appendix C3 Table 8.1.3, which contains the information abstracted from the consumer ledgers for the month of June 2000. This exercise indicated the amount of Kshs 1,275,044.00 as the billed revenue, whilst the monthly return to PWO and MENR abstracted from Appendix C3 Table 8.3.3 states the June figure as Kshs 1,211,226.00. The discrepancy can not be explained, but could relate to bills issued after the monthly figure had been compiled.

While the MENR Tariff was adjusted effective November 1999, the information only trickled down into the Districts by February 2000. The adjustment is clearly reflected in the billed revenue effective February 2000. An increment in the revenue collection is equally reflected from February 2000 onwards.

Based on the production details obtained from the meter reading book summary, verified and compared with Appendix C3 Table 8.1.3. records, a billed consumption of 41,028 m³, the verified **Billing Efficiency for June** stands at **49.73%**

Revenue Collection:

The revenue collected is reflected in Appendix C3 Table 8.3.3 as provided through the Muranga WS office return and the District Treasury. This amounts for the whole FY to Kshs 9,247,457.50, resulting in an average of Kshs 770,621.00 per month.

Detail	June 2000 as provided	Average FY 99/00 As provided	June 2000 Verified
Billed Revenue:	1,211,226.00	1,086,365.00	1,275,044.00
Collected Revenue:	1,108,326.00	770,621.00	1,108,326.00

The attempt to verify payments with the information contained in Appendix C3 Table 8.1.3. must be termed as futile because the officers abstracting the information from the consumer ledgers, not only did consider payments up to 30.06.00, but also any payment that was in their records by the time the exercise was undertaken. The amount absorbed for the month of June payment in the analysis in Appendix C3 Table 8.1.3 does not reflect what was the situation AS AT 30.06.00.

The amount used for calculating the Billing efficiency will be the collected revenue, as reported and verified with the District Treasury.

The verified **Collection Efficiency for June 2000** stands at **86.92 %**

Considering the fact that consumers come voluntarily forward to ask for their amounts due, this collection efficiency must be termed as very encouraging.

8.1.3.1.7. Average Tariff:

As the average tariff is calculated for all analysed towns, based on June 2000 records from Appendix C3 Table 8.1.3, the same approach is taken for Muranga:

Billed Revenue Kshs 1,275,044.00 / billed consumption of 41.028 cbm =
verified **Average Tariff for June 2000 Kshs 31.08 per m³**

8.1.3.1.8. Debt Situation:

The debt arrears situation as provided by Muranga is the computed total, forwarded on a monthly basis in the format of Appendix C3 Table 8.3.3. The Muranga basis of calculation shows a difference of approximately 1 Million Kshs, but it can not be determined whether this relates to the brought forward balances from the previous or any other FY.

Using information from Appendix C3 Table 8.1.3., the situation **prior to the June 2000 bill** is:

Detail	Muranga Debtors as provided	%	Verified Debtors	%
Total Debtors	13,808,023.90	100	12,841,260.80	100
Major Consumers				
GOK	Not readily available		7,887,342.00	61
Others	Not readily available		1,409,835.00	11
Total Major	Not readily available		9,297,177.00	
Minor Consumers	Not readily available		3,544,083.80	28

Using the outstanding debt at the end of May 2000 as 12,841,260.80, adding the June 2000 bills issued with 1,275,044.00 Kshs and deducting the collected revenue for June 2000 of Kshs 1,108,326.00, we arrive at a debt situation of 13,007,978.80 Kshs as at the end of the Financial Year.

Efforts are made to reduce the outstanding balances, by attempting disconnecting 50 to 60 accounts per month, but monthly disconnection and reconnection records could not be obtained.

8.1.3.1.9. Funding:

Based on the collected revenue and an A.I.E. (Authority to Incur Expenditure) of 65% , funds are sent from Treasury to the District Treasury. The process, which is applicable for all District offices, involves the MENR Head Office and is explained under 8.4.4. of the main report. The A.I.E. percentage is determined by the MENR Head Office with no involvement of Muranga WS. Appendix C3 Table 8.5.3. reflects that the A.I.E. earned and A.I.E. received. District water offices include in their A.I.E. application the request relating to the Divisions covered by the respective District.

A.I.E. Earned FY 99/00	A.I.E. Received FY 99/00
6,010,847.40	6,022,560.00

The A.I.E. received is to be utilised by all Water Divisions within the District. A separation between Muranga WS and the other Divisions was not readily available. An approved A.I.E. does not translate into instant liquidity or the ability to procure, because it equally requires the District Treasury to be liquid. The District Treasury Muranga has a revolving imprest of Kshs 1 million, meant to cater for all GOK Departments within the District and spending priority is not determined by the Water Department but the District Administration. The shortfall in expenditure incurred could relate to cash flow constraints within the District Treasury prior to closure of the FY. Total expenditure below represents the whole District and was abstracted from the votebook:

Details:	Expenditure FY 99/00
A.I.E used for O&M	4,947,421.40
Salary	Not readily available
Power	Not readily available
Chemicals	Not readily available
Total	Not readily available

8.1.3.2. Utility System Procedures:

All current procedures, as far as the office and field operations are concerned, are covered in the Appendix C3 Questionnaire 8.1.3. It was the approach of the consultant to verify as many as possible technical, financial and commercial details to substantiate procedures with the facts obtained.

Procedures that continue at Head Office level, and apply to all towns analysed, are investigated separately and covered under header 8.4. of the Main Report.

8.1.3.2.1. Administration:

8.1.3.2.1.1. Staff

Staff members are transferred and/or promoted based on decisions made at HQ level and local recommendations or requests are not considered. The processing of transferrals and promotions in Nairobi seems to be extremely protracted. Promotions are for a number of staff overdue and not really expected anymore. Salary adjustments commensurate with promotion are not forthcoming and affecting the morale of staff members.

While there is provision for annual forms to be completed by staff members requesting promotion and training, such requests have not materialised for many years.

The constraints experienced in every level of operation affect staff morale. Salary levels are considered as being too low.

Staff working in the Billing and Revenue Department have a technical background, and have been placed in positions that bear no relation to the job category for which

they were trained, employed and are paid for. When placed into these non-technical positions, staff do not get training, but are expected to learn from the others on the job.

8.1.3.2.1.2.2. Consumer Accounts:

Consumer information is held in the application form and the consumer ledger, which is up-dated with the monthly meter reading, which is first entered into the meter reading books. New application forms are used, but they do not contain sufficient information which results in follow up problems, especially in the case of civil servants, who are transferred. Consumer ledgers are organised on a zonal basis and the consumer is given an account and connection number. Since a few years (approx. 1995) new consumers are advised to bring their own meter, an information not recorded on the consumer application form. Therefore it cannot be determined clearly which meters have been provided by the MENR or were brought by the consumer. No meter rent is therefore charged on all the accounts. Account numbers do relate to the area in which the connection is located and are split over 17 zones, represented by 43 volumes of consumer ledgers.

Change of address is not applicable in Muranga, as all consumer bills are collected and/or asked for.

8.1.3.2.1.3. Meter Reading, Billing & Revenue Collection:

Meter Reading:

Meter reading is undertaken monthly and commences around the 10th of the respective month, using meter reading books. Meter reading books reflect a considerable number of stalled meters, which after being read reflect a movement, possibly due to the meter not having been read but estimated. Others reflect a reading below the calculated average. Depending on the officer adjustments are made or not. A re-organisation is planned. The meter reading information is transferred into the consumer ledgers and bills are calculated. The calculated bill and payment received, is entered by the three billing clerks, sitting at the DC's office only when the consumer comes for his bill or better the bill information. As billing stationery is short, bills are only issued on request, for Government bodies and organisations. Hence no delay in billing due to non-availability of stationery. Payments made at the DC's Treasury are straight informed back to the billing clerks, sitting in the same building and entered into the consumer ledger. At the same time the information is entered into the collection record book, whereby Receipt number, Zone and Account number and the amount are recorded.

No information was obtained relating to the sewer accounts, charges and procedures as the same is managed by the municipal council.

Disconnection:

The same Revenue collection officers prepare a disconnection list, covering 3 to 4 zones. There is no warning procedure in place. The list is forwarded to the office and 2 to 3 meter readers are assigned the disconnection. Approximately 50 to 60 consumers are said to be disconnected every month. Dis-and re-connection records could not be obtained and consumer ledger information did not reflect a high disconnection number out of the consumer accounts.

New Connection:

Upon a consumer request for a new connection, a site visit/survey is carried out. No old meters are accepted for new connections. Between June and September 2000 an average of 19 new connections per month were effected.

8.1.3.2.1.4. A.I.E. and Procurements:

Authority to Incur Expenditure (AIE)

Monthly revenue returns are prepared to the Head Office and supported by form F.O.17 prepared at the D.C.'s Office, reconfirming the total amount of revenue collected. With this information, the DWO forwards a request to HO to approve the same.

Procurement:

Chemical requests are made through the HO. Appendix C3 Table 8.6.3. has details of the total chemicals received for the Financial Year 99/00. Stock balance as at end of June 2000 and ordered chemical information was not available and the procedure could not be confirmed. Actual consumption could equally not be determined.

8.1.3.2.2. Operation & Maintenance:

Intake

No procedure laid down, staff attend to problem when there is a problem

Treatment

No procedure laid down, and no further information obtained.

Lines and Appurtenances

No routine or preventive maintenance procedures are in place. High rate of burst occurrence on the raising mains and the attendance to it, depends on the availability of parts required.

Master Meters

Only one master meter in place, but non-operational, hence no procedures, service or maintenance in place.

Consumer Meters:

No procedures or records of field activities are in place. If the consumer meter is not working, the meter is analysed and the consumer then requested to replace the same. (As almost 50% of the meters are estimated, it could not be established, whether this procedure is consequently followed).

Stock

No stock information could be obtained.

Operation Manuals:

No manuals for technical procedures were available.

8.1.3.3. Community Projects:

The consultant did not obtain any information about community projects within the Muranga Water Supply area.

8.1.3.4. El-Nino Project:

No information was obtained concerning any on-going El-Nino activity.

8.1.3.5. Recommended Priority Measures:

The reduction of Un-accounted for Water (UfW) must be considered as the overall priority measure, because the water lost can contribute considerably into the current demand and the amount of Kshs lost is equally high.

Un-accounted for Water is made up of:

- Physical losses in the transmission and distribution system
- Wrong meter reading and billing, and
- Water theft

To reduce the said water losses it is recommended to give the following priorities:

- 1) **Full rehabilitation of the existing distribution system, including standardised meter connections,**
- 2) **Replacement or repair of all faulty consumer meters,**
- 3) **Setting up of a consumer data base and a reliable billing program, and**
- 4) **Management- and Staff Training for the relevant staff members**

All other recommended activities are reflected in the comprehensive Utility Management Plan under header 8.10., and given the second priority.

8.1.3.6. Recommended Project Implementation Plan:

To reflect the Action Plan Activity Phases, as reflected in Appendix K3 Summary Table ST 8.4, the following Project Implementation Plan is lined out here below for the 3 different Phases mentioned.

The overall assumption under which the proposed activities will reflect in the expected results, is, that major players and stakeholders ensure that recommended reforms in the water sector are implemented.

Assumption 1:

Funds for replacement and repair of 2.000 consumer meters, computer hardware, printers, billing software, additional transport, funds for remuneration of the proposed staffing organisation, basic office equipment, temporary office and funds for the management consultant are available at the beginning of the management consultant's involvement. Refer to Table 4.4: Cost Estimate for Rehabilitation Works for the Muranga Water Supply.

Assumption 2:

Staffing re-organisation and selection of staff as recommended by the management consultant receives the necessary support from MENR.

Assumption 3:

A reduction of UfW is expected as an immediate result of the meter replacement, meter reading re-organisation and billing improvement and management / training. The high number of consumer meters to be replaced or repaired, will require a period of 9 months, during which time approx. 220 meter are replaced in a standardised manner and on a monthly basis by the Muranga WS staff. The minimum time involvement for the management consultant was taken as 24 months.

Task	Months																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Appointed Management Consultant	█	█	█																								
Setting up of consumer database and billing program				█	█	█	█	█	█																		
Management and staff training for the relevant staff																											
Replacement / repair of all faulty consumer meters																											
Implementation of other Action Plan activities																											

PHASE I

Phase 2 concentrates on de-centralisation changes, for which the more detailed activities are described in the Action Plan of Appendix K3 Summary Table ST 8.4

Task	Months																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Review and initiation action on staff performance criteria	█	█	█	█	█	█	█																				
Implementation by MENR																											
Initiate de-centralisation recommendation																											
Implementation by MENR																											
Initiate control, monitoring and MIS reporting system																											

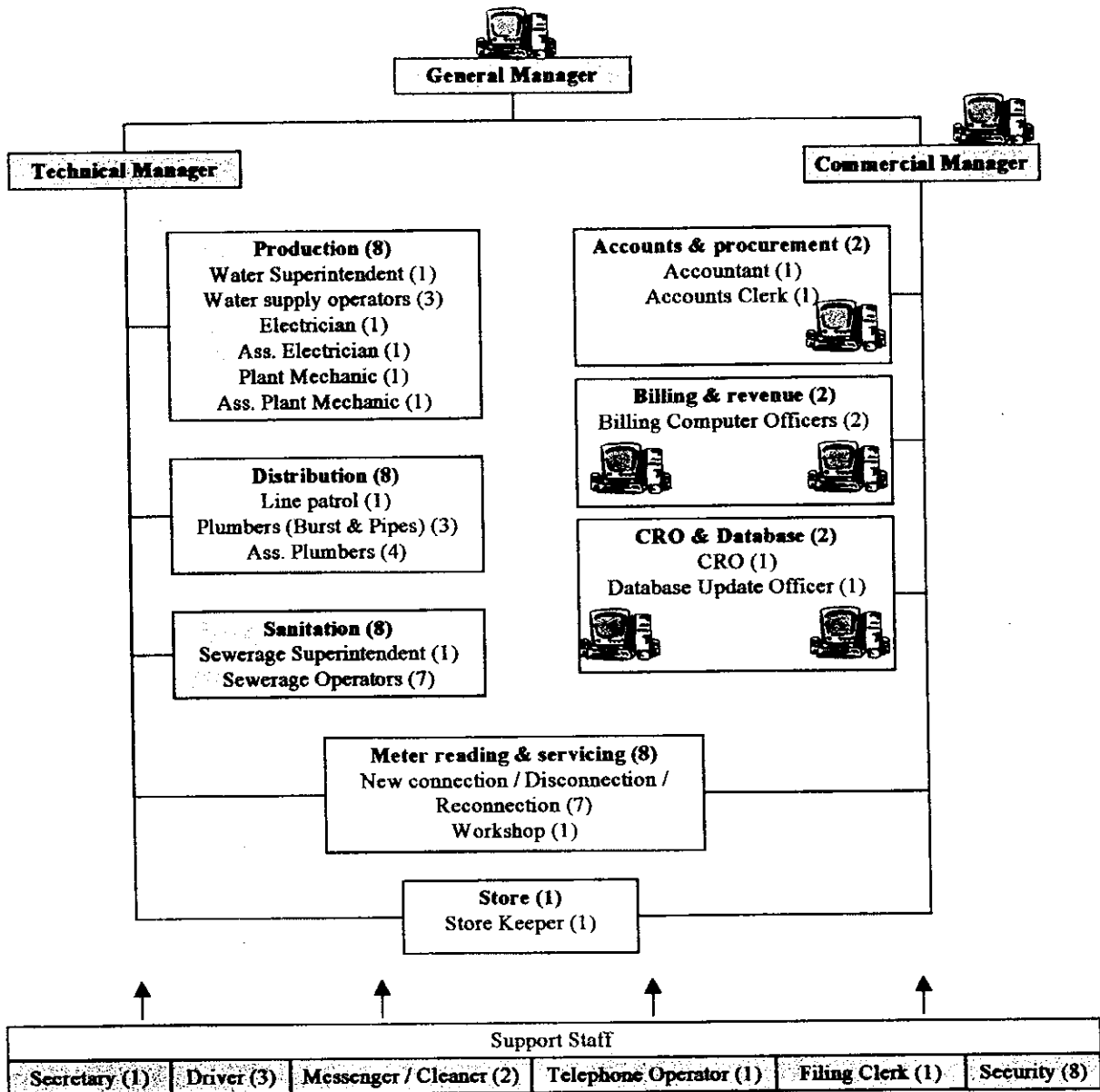
PHASE II

Phase 3 relates to legal changes recommended for which the more detailed explanations are listed and described in the Action Plan of Appendix K3 Summary Table ST 8.4

Task	Months																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Speeding up water amendment	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Simplify debtor write-off procedures																											
Initiate retention / quality control system recommendation																											

PHASE III

8.1.3.7. Recommended Muranga Organisation Chart:



Total recommended number of staff = 58

The possibility of out-sourcing security services, master meter maintenance and pump maintenance should be surveyed and assessed during the management consultancy contract. Implementation should be considered during the preparation of the rehabilitation works.

Casual labour to support trenching or cleaning of blocked sewers will be sourced from the labour market, whenever the need arises.

It is further recommended that consumer payments be received through existing Financial Institutions.

8.2. COMMUNITY SYSTEMS WITHIN THE EXISTING UTILITY SYSTEMS

Only three towns had community maintained systems within their supply area. Western Province, unlike any other province visited, has enjoyed massive support of community projects through Finnish Aid. Phase 1 of the KIFINCO project initiated and financed between 1981 and 1995 almost 4000 community projects. The current Phase 2 has now 4 main components under the overall objective of “increasing access to safe water for improved health and well being of the communities in Western Province, by increasing community management skills for maintenance, operation, improvement and replication of water facilities and for the protection of water resources”:

- Monitoring and evaluation whether systems are functioning
- Support to those communities that approach the project and are prepared to contribute
- Provincial/District capacity building
- Water Resource Management

Implementation of new or rehabilitation projects are done through external contractors, while MENR staff is involved in the technical supervision. During Phase 1 all work was done through external staff, which led to frictions between MENR staff and those employed from outside.

Phase 2 concentrated at the onset on awareness creation amongst all District and Divisional Offices, using the ToT approach (Train the Trainer), and then involved other leaders and representatives of communities, to disseminate the new approach.

8.2.1. Makindu

There are four operational and functioning community systems within the Makindu water supply area, but information could only be obtained from three.

Kikumbuli Community took over 136 accounts in 1992, because they received water from Umani Springs. No information could be obtained on how it is managed, but community members are receiving water.

Amref financed 2 additional projects, the Kai Water Project and the Nzumi Water Project. Both systems serve approximately 7.400 people. Amref conditions were the involvement of the community in trenching and laying of the pipes and construction of the tanks. Community members were trained in the technical field and bookkeeping, and training included formulation of the By-laws.

Both systems operate smoothly and the Makindu WS system receives payment of bills promptly. Maintenance of the line is the responsibility of the community. Artisans and Kiosk attendants are from within the community and receive a salary for the work they do. The Community plans to use the money on the account for maintenance and expansion of the line.

The Mulili Water Project was financed by German Agro Action and started its operation just recently. It serves approximately 3.700 people. The approach for the project was similar to Amref's, whereby the community is actively involved in

the work during and after the completion.

Bulk supply from Makindu WSS to all communities at Kshs 15,00/cbm and no problems have been experienced so far.

8.2.2. Migori

The Nyasare Water Supply community project is registered under the Society Act and has been in operation since 1994. The project was financed by the Austrian Government and serves the rural and part of the urban population of Migori town. The community has 989 paid up members.

The management and operation of the system is paid for work done and O&M cost incurred monthly are covered out of the collected revenue. The management comprises of the Chairman, Vice chairman, Secretary, Ass. Secretary, Treasurer and Ass. Treasurer.

Since 1997, the organisation has been operating without donor funds. Even though the community faces problems in revenue collection, there are efforts to increase the tariff. The organisation works closely with the District Water Officer Migori.

The community intends to come up with a phase 2 project, to develop other water sources and the Institute for International Co-operation (Austrian Aid) is willing to assist. They have also applied to take over Migori Water Supply under the Ministry.

8.2.3. Webuye

Webuye has one community project for which no information could be obtained. The Muchi Milo Community project, initially financed by KIFINCO, is non-operational since 1995. Electrical fittings were vandalised twice, now the project seems completely stalled. KIFINCO in Kakamega had information that chairman of the project has political ambitions and is therefore suspected to have political enemies, who could be responsible for the vandalism. The new approach of KIFINCO is the "demand driven approach", i.e. communities can come for help, if they are prepared to contribute 50% into the cost.

Muchi Milo treasurer did not seem to know, neither did the Divisional Water Officer, even though KIFINCO had informed all Districts and Divisions creating awareness down to the communities through leaders and representatives. Consumers are now neither receiving water from the mains nor through the community project.

8.3. PROBLEMS AND SHORTCOMINGS OF THE EXISTING SYSTEMS:

All systems visited suffer from a number of problems which in turn lead to more shortcomings, ultimately translating into:

- Low efficiency on production,

- Limited supply situation,
- Billing below expectation, and
- Revenue collection, which cannot sustain the operation.

An assessment of the problems seen and experienced in the various systems visited, is represented in the Problem-Symptom-Cause Matrix under Appendix K 3 – ST 8.3. To various degrees the systems show that neither the Head Quarter nor the water systems do know what they produce, what is in place, what is outstanding, what are the actual cost for the water production and/or what is the financial position they are in.

Community systems established with the involvement and / or contribution of the community, combined with training into the management and operation, seems more successful, than those systems that have been simply handed over to the people. This equally reflects in the second phase approach of the KIFINCO project, which is demand driven and with financial involvement of the community.

8.3.1. Division Specific Problems:

Divisions operate under the District offices. The systems visited operate under even more difficult circumstances. All problems are similar to the problems experienced in the Districts, because whatever is a problem for the District results in an even bigger problem or longer delay for the Division.

The criteria for category Division or District does not relate to the population served. While Mumias is a Divisional office, with less than a decent office and the necessary skilled staff, it serves a population of 110,400 people, Wundanyi is a well equipped District office and serves a population of 7,600 people. The same applies to Webuye Division office, serving approximately 73,000 people and lacking the absolute basics.

The Division is run with no imprest at all and the most basic requirement like making a photocopy or using public transport to visit the District office, expects the staff member to pre-finance the expense and claim it from the District in due course. Refund procedures can take weeks, even months.

8.3.2. Districts Specific Problems:

The biggest problem seen at District level is the A.I.E. funding and procurement procedure. While the District Administration is involved throughout the lengthy procedures, the District Administration has to cater for all the Government Departments and does not necessarily give the Water Department priority over other Departments. Special efforts in revenue collection may result in Nil A.I.E. received, as was the case in Narok, where the approved A.I.E. came just before the end of the Financial Year and lacking liquidity at the District Administration office resulted in an approved A.I.E. but no funds. Un-utilised A.I.E can then not be carried forward into the new FY.

8.3.3. NWC&PC Area Office Specific Problems:

The area office is totally dependant on the Regional Office and faces the same problems as the Division Offices under the Districts. Decision making does not take place on the ground and any requirement has to be organised through the

Regional Office.

Recent changes turned a small imprest previously available into a NIL cash flow. The 50% of re-connection and labour charges do not seem to come forward. Even the smallest operational requirement becomes a problem. A further problem is, that billing and consumer related issues face considerable delays as they cannot be dealt with immediately. They have to be forwarded to the Regional office and reply has to be awaited. Disputes are decided by a committee at the regional level, while the recommendation of the area manager seems to be given lesser or often no consideration.

8.4. MENR HEADQUARTER PROCEDURES, SHORTCOMINGS AND IMPEDIMENTS

Every utility system visited had the feeling that the Head Quarter receives monthly forms and returns only to file the same away. No reaction is received. Considering the meaning of reporting, facts and figures should be used for planning, control and management decisions.

As the majority of the information reflects discrepancies or plain gaps and no reaction comes from the Headquarter, it means that either the information is not used for decision making, or the discrepancies are not seen and plans are based on wrong information.

Procedures and tangible details are more difficult to obtain at Head Quarter level than at the District. Efforts by the consultant to get clear and substantiated information, were fruitless in most cases. Similar to the record keeping at District or Division level, information is available somewhere and somehow, but the magnitude of data handled at the Head Quarter makes the search even more complicated.

8.4.1. Personnel Issues and Procedures

All Division, District and Province staff salary matters are dealt with at Head Quarter. The structure seems to be such that within the personnel department at the Head Quarter, one officer is allocated a certain number of staff numbers. Following up several personnel issues for the District, can result in having to see several officers for the same problem relating to several staff members. The attempt to obtain comprehensive remuneration details for the towns visited, failed.

8.4.2. Power

Payment of power bills from the District has been changed during the last Financial Year. The processing procedure at District level had caused a number of power accounts being cut. Current practice is, that power bills for all water systems operated by the MENR, are paid for from the Head Quarter. If the bills are received at District level, they are passed on to Nairobi for settlement. As many bills are paid for many Districts with one payment, to find and obtain details for any particular WS System, requires lengthy searches. The question as to whether credits are correctly reflected on the following power bills, could not be established.

8.4.3. Chemicals

Sourcing and procurement for chemicals is done centrally for all the WS systems operated by MENR. The procedure involves an annual open tender, approved by the MTB (Ministerial Tender Board), followed by the CTB (Central Tender Board). While the District gave the information that chemicals have to be collected from the Nairobi Central store, the information at the Head Quarter was, that chemicals are delivered to the Districts and only additional requirements over and above the planned quantity have to be collected. It is to be analysed, whether the centralised procurement bears any price advantages over the system level procurement, as the existing system does not reflect any other advantages.

As chemical requirements are planned from the Head Quarter and information of chemicals from the Districts is in most cases based on estimated past experience, the question arises also, whether there is a realistic basis for actual chemical requirements, relating to actual production?

8.4.4. A.I.E. Issues and Procedures

The A.I.E. procedure originates from the District and has to be processed through MENR Head Quarter and Ministry of Finance/Treasury, before it can go back for further processes to the District. Appendix K 3 – Figure 8.2. and Figure 8.3. reflect the whole process, which is lengthy and complicated.

8.4.5. Planning and Control

Planning is based on information about the performance of a water supply system. Indices like production-, consumption-, billing- and revenue collection-efficiency or system compiled cost, are necessary tools to control the use of chemicals, calculate a cost covering tariff or determine the right transport requirements or staffing levels. As reported information from the water supply systems lack the correct information or if availed, are not translated into an efficient Management Information System, the question arises as to: Which are the tools, that the Head Quarter plans with?

While the A.I.E. process and involved procedures are lengthy and complicated, the accounting for the money spent, is done by the District Administration to Treasury. The MENR receives only the printed information, against which votes the expenditure has been booked. The question is, whether GOK procurement procedures have been complied with, but not whether the three or five quotations obtained reflected a realistic market price, hence the whole system is more procedure than financial control.

8.5. PROVINCIAL WATER OFFICE FUNCTIONALITY

The functionality of the provincial water offices could not be clearly established. However, the schedule of duties for the Provincial Water Officer is giving the following duties and responsibilities:

- Development, maintenance, control and supervision of all Ministry's operations in the Province
- Any other duties as may be assigned.

Meetings with the district water officers, receiving donors and delegations and general co-ordination, were the comments received. While all technical and

financial returns are as well copied to the Provincial Office, reminders on performance and targets do originate from the MENR Head Quarter. It therefore remains to be explored further, what role the Provincial Office plays in the context of management support, control and/or assistance, when compared with the schedule of duties? Is the Provincial Office an information and control filter for the mass of operational and financial details that are sent to the Headquarter? Is the Provincial Office used as an information dissemination medium? How is the infrastructure, which is in place at the Provincial Office, utilised?

8.6. NWC&PC SHORTCOMINGS AND IMPEDIMENTS

NWC&PC has already a partly de-centralised reporting system, as the Regional Manager only reports filtered information to Nairobi. Decision making remains however an equally lengthy procedure (experienced as well, where commercialisation is involved). AS NWC&PC has to comply with the normal GOK procurement procedures, only slightly modified, problems are of similar nature.

8.7. COMMERCIALISED SYSTEMS IN KENYA

The number of commercialised systems, evolving from former Government operated systems, is limited. Malindi, Nyeri and Kitale were chosen. All systems visited and analysed are currently operated under an agency agreement. The difference in their structure is, that the agent in Malindi is a privately owned company, while the other two companies of Nyeri and Kitale are wholly owned by the former operator, with a Board of Directors representing the stakeholders of the water and sanitation system. Assets remained in all three cases with the former operator of the system.

8.7.1. Malindi: Management Contract (NWC&PC)

The Malindi Management Contract is actually an agency agreement between the National Water Conservation and Pipeline Corporation and H.P. Gauff in association with Gauff Utility Services Kenya Ltd. The Amendment to the State Corporation Act under which NWC&PC has been incorporated, gives NWC&PC the formal mandate to enter into agency agreements, which are accepted by the Attorney General.

The agreement was signed in March 2000, covering a period of 4.5 years. The company is given autonomy for the day to day operation and related decision making. The overall regulations guiding the NWC&PC do however relate as well to the agency agreement. This means that Government procurement regulations and procedures or writing off debt procedures have to be observed and complied with by the agent as well.

Appendix K 3-Q 8.6.1. reflects the interview with the representative(s) of the agent. While the Malindi agency agreement built on an earlier pilot project, where consumer account aspects, billing and revenue collection, Meter reading and O&M aspects had already been systematically taken up in the past, the new agency agreement took off with the experience gained before. The major task is to get procedures and schedules refreshed and close the information gap that was caused by a delay of almost two years between the old project and the new agreement.

As the project was only in operation for a period of 8 months by the time of the visit, comments on the self-sustainability could not be obtained yet. The initial setting up time required must be considered and self-sustainability should be looked at, at a later point in time.

8.7.2. Nyeri: NYEWASCO Private Water Company

Nyeri Water Company, NYEWASCO, operates under an agency agreement which was signed on 19th March, 1999 and amended on 7th April, 2000. The duration of the agency agreement is 20 years. The agreement is between the Municipal Council of Nyeri and the company.

A Core Management Team is in place and all other staff members were taken over. However it was said that the individual staff performance determines whether they will stay with the company. Salary increments of 15% and 7.5% have been effected since the operation started. An incentive scheme for the staff is being worked on.

Appendix K 3 – Q 8.6.2. reflects the interview with the Managing Director of NYEWASCO.

8.7.3. Kitale: KIWACO Private Water Company

The Kitale Water Company operates under an agency agreement drafted, but not yet finalised or signed. The agreement is between KIWACO, the new company and the Municipal Council of Kitale.

A new Core Management Team (CMT) has been recruited and is supported by a Financial Advisor, seconded by CIM (Centre for International Migration). All other staff members were taken over from the Council Water Department, pending finalisation of the agency agreement.

Day to day operation has been transferred to the agent at the beginning of the year 2000, while numerous financial issues have not yet been sorted out with the former operator and creditors of the former operator. Much of the manager's time is therefore spent on issues relating to the past and negotiation concerning the agency agreement. The day to day operation is independent.

Appendix K 3 – Q8.6.3. reflects the interview with the CMT and the Financial Advisor.

8.8. PROBLEMS AND SHORTCOMINGS OF EXISTING COMMERCIALISED SYSTEMS

The problems or impediments experienced in Malindi and adversely affecting the efficiency, can be summarised as follows:

- The line of command is too long and decision making processes take too much time and additional effort

- Government procurement procedures

The problems or impediments experienced in Nyeri seem very limited and reduced to staff related issues. All former problems, concerning interference of some Councillors with the Board, seem no longer applicable.

- Audited Accounts from the Council to start with the Opening Balance of the company are not yet available
- Not clear how consumer balances absorbed? (audited or not)
- Not clear how old creditors to be absorbed (audited or not)

The problems and impediments experienced in Kitale and adversely affecting the current operation of the company, can be summarised as follows:

- The agency agreement should be signed prior to the commencement of the new company
- Liabilities taken over from the previous operator should be reconciled and audited, to enable the company to start of with a clear picture of the Opening Balance situation
- Financial start up help should be available
- Amount or mode of lease for the assets not yet finalised
- Loan balance of assets not yet clear with the council
- Production affected, due to power on cut off, not for current but old KP&LC debt, carried forward
- Staff issues (transfer, provident fund etc) not finalised as agency agreement still pending

8.9. OPTIONS FOR VIABLE MANAGEMENT AND OPERATION

The approach for recommended changes has focussed on the intention to offer viable approaches that can be implemented within the shortest possible timeframe. Achievements should be possible, while more substantial changes touching on the institutional and legal framework are discussed, formalised or registered.

The various degrees of implementation carry the risk that other players involved in the changes do not agree to the recommended changes. To avoid this major risk, which has been experienced in the Kenyan environment, especially in the Water Sector, a gradual approach is recommended.

While the registration of a private company, Water User Association, Trust or Trust Corporation can be done within a few months, it is seen as a very time consuming and involving exercise, to prepare a detailed network condition plan, existing asset and liability information and clarify the position on the consumer accounts. The assessment, training, selection and repeat training of existing staff into a commercial environment requires "change management" in order to build capacity.

The problems caused by not having reconciled or audited data ready, when registering the "commercial" institution, can be learned from the commercialised

systems currently already in operation. The preparation of these details can fall into the operation of the "commercial" institution, provided the mode of establishing and confirming the figures has been agreed upon, prior to commencement of the 'commercial' operation.

Recommended changes have been worked out in Appendix K3 – ST 8.3 and are used as the basis for further analysis, leading to the phased options, reflected in the Action Plan. Refer to Appendix K3 – ST 8.4

8.9.1. Recommended Changes within the current Institutional Framework

Recommended changes for Phase I of the Action Plan are those changes that can be implemented immediately, with the assistance of a consultant and jointly with the client MENR. All recommended changes are vested within the powers of the client.

8.9.2. Recommended Changes for a De-centralised Framework

The analysis of the current situation reflects that the centralised system under which all water systems are managed and operated, accounts for many of the impediments listed. Phase II of the Action Plan indicates, which steps are recommended to be taken.

The decentralisation approach is as well seen as a step-by-step movement towards bringing the systems closer to the communities, pending a gradual approach towards Private Sector Participation. No lead model has been confirmed yet and a countrywide move can only be implemented by a gradual approach, as capacity building will be a lengthy process and not just a decision or declaration.

8.9.3. Recommended Changes for a Transition Approach

It is expected that recommended changes of Phase I will lead into and continue during Phase II and III. Any changes recommended under the institutional framework management, can build on the grass root work that has commenced with the preparatory measures of Phase I, as they are seen as a requirement for any kind of improvement or change towards a commercialised operation.

8.10. RECOMMENDED UTILITY MANAGEMENT PLAN

No.	Action	Narok	Meru	Muranga	Kabarnet	Makindu	Wundanyi	Migori	Lamu	Webuye	Mumias	Utility Management Plan
1.	Arrange for decent office space							X		X	X	
2.	Set up organisation charts with detailed job description and skill requirements.	X	X	X	X	X	X	X	X	X	X	
3.	Arrange for intensive management training for Engineers or recruit well-qualified managers.	X	X	X	X	X	X	X	X	X	X	
4.	Arrange for commercial and technical staff training	X	X	X	X	X	X	X	X	X	X	
5.	Set up positive and negative staff sanctioning system.	X	X	X	X	X	X	X	X	X	X	
6.	Limit recruitment to the system requirement, based on skill and merit.	X	X	X	X	X	X	X	X	X	X	
7.	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	
8.	Redesign consumer recording and reporting formats	X	X	X	X	X	X	X	X	X	X	
9.	Computerise consumer data base and consider billing software	X	X	X		X	X	X	X	X	X	
10.	Obtain field information from all existing consumer using the re-designed application format	X	X	X	X	X	X	X	X	X	X	
11.	Prepare implementation guidelines related to gazette notices and relating procedures	X	X	X	X	X	X	X	X	X	X	
12.	Prepare consumer and connection management guidelines	X	X	X	X	X	X	X	X	X	X	
13.	Design consumer / connection – management guidelines	X	X	X	X	X	X	X	X	X	X	
14.	Design meter reading / servicing / disconnection schedules and guidelines.	X	X	X	X	X	X	X	X	X	X	
15.	Undertake analysis to substantiate and confirm old debts	X	X	X	X	X	X	X	X	X	X	
16.	Propose write off procedure for old debtors	X	X	X	X	X	X	X	X	X	X	
17.	Recommend commercial charges and penalties	X	X	X	X	X	X	X	X	X	X	
18.	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	
19.	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	

3.10 RECOMMENDED UTILITY MANAGEMENT PLAN

No.	Action	Nairobi	Meru	Maranga	Kabarnet	Makindao	Wundanyi	Ngurd	Lamu	Webuye	Mumias	Utility Management Plan
1	Arrange for benefit skills classes for staff up to a saturation point, with detailed job description and skill requirements	X	X	X	X	X	X	X	X	X	X	
2	Arrange for intensive management training for Engineers or recruit well-qualified managers	X	X	X	X	X	X	X	X	X	X	
3	Arrange for non-merit and technical staff training	X	X	X	X	X	X	X	X	X	X	
4	Set up position and negotiable skill wage setting system	X	X	X	X	X	X	X	X	X	X	
5	Limit recruitment to the system requirement based on skill and merit	X	X	X	X	X	X	X	X	X	X	
6	Prepare plans for transport requirements based on size of system coverage, pipe network, number of consumers etc.	X	X	X	X	X	X	X	X	X	X	
7	Redesign plans and re-estimating and re-rating farmers	X	X	X	X	X	X	X	X	X	X	
8	Computerize consumer data base and generate billing software	X	X	X	X	X	X	X	X	X	X	
9	Obtain field information from all existing consumers using the re-designed replication format	X	X	X	X	X	X	X	X	X	X	
10	Prepare implementation guidelines related to data collection and related procedures	X	X	X	X	X	X	X	X	X	X	
11	Prepare consumer and connection management guidelines	X	X	X	X	X	X	X	X	X	X	
12	Design consumer - connection management guidelines	X	X	X	X	X	X	X	X	X	X	
13	Design meter reading, servicing, disconnection schedules and guidelines	X	X	X	X	X	X	X	X	X	X	
14	Undertake an analysis to substantiate and confirm out bills	X	X	X	X	X	X	X	X	X	X	
15	Propose write off procedure for old debtors	X	X	X	X	X	X	X	X	X	X	
16	Recommend commercial charges and permits	X	X	X	X	X	X	X	X	X	X	
17	Invite staff, consumers and stakeholder awareness on cost of production and distribution of water	X	X	X	X	X	X	X	X	X	X	
18	Continue the servicing for private meters and conduct future supply tenders to pre-empt with serious backlog	X	X	X	X	X	X	X	X	X	X	

No.	Action	Narok	Meru	Muranga	Kabarnet	Makindu	Wundanyi	Migori	Lamu	Webuye	Mumias	Utility Management Plan
20.	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	
21.	Decentralise decision making process to station level	x	x	x	x	x	x	x	x	x	x	
22.	Decentralise planning and control of cost	x	x	x	x	x	x	x	x	x	x	
23.	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	
24.	Design MIS reporting system for Povincial to HQ reporting (investment planning, policy making)	x	x	x	x	x	x	x	x	x	x	
25.	Set up stock management system and controls	x	x	x	x	x	x	x	x	x	x	
26.	Set up consumer meter workshop (with volumetric test facilities)	x	x	x	x	x	x	x	x	x	x	
27.	Prepare / update O&M guidelines / manuals	x	x	x	x	x	x	x	x	x	x	
28.	Propose outsourcing criterias for pump maintenance depending on the pump capacity.											
29.	Include consumer lines into the planned network	x	x	x	x	x	x	x	x	x	x	
30.	Clarify and document water wayleafs	x	x	x	x	x	x	x	x	x	x	
31.	Introduce retainer security on contracted civil works and quality control	x	x	x	x	x	x	x	x	x	x	

8.11. RECOMMENDED PRIORITY PROJECTS

The final choice of priority projects is recommended to be made during or as a result of the stakeholders workshop. The utility indices and figures compiled in Annex K3 – ST8.2. allow however to draw conclusions and give a basis for good comparison. There are a number of criteria offered as a selection criteria, like:

- Which town promises the fastest results?
- In which town are the highest savings expected?
- Where is the intervention most urgently needed?
- Billing and Revenue Collection Efficiency highest or lowest? or
- Which town has shown the highest effort under the prevailing circumstances?

8.12. RECOMMENDED PRIORITY MEASURES:

The reduction of Un-accounted for Water (UfW) must be considered as the overall priority measure, necessary for all the systems analysed.

Un-accounted for Water is made up of:

- Physical losses in the transmission and distribution system
- Wrong meter reading and billing, and
- Water theft

For those towns where the calculation showed no UFW, the consultant is of the opinion that the information availed needs further confirmation and more detailed field investigation, because such a situation is unrealistic.

To reduce the said water losses it is therefore recommended to give the following priorities:

- 1) Full rehabilitation of the existing distribution system, including standardised meter connections,**
- 2) Replacement or repair of all faulty consumer meters,**
- 3) Setting up of a consumer data base and a reliable billing program, and**
- 4) Management- and Staff Training for the relevant staff members**