CHAPTER 7

PROJECT IMPLEMENTATION SCHEDULE

7. PROJECT IMPLEMENTATION SCHEDULE

7.1 OVERALL IMPLEMENTATION SCHEDULE

Figure 7-1 presents an overall implementation schedule of the Phase I Project, indicating the procedures and the implication of time for the implementation of the Project. The schedule is based on the assumption that a large portion of the cost required for the implementation of the Project will be financed through an international lending agency. Given the urgency of the Project, the schedule is aimed to curtail the time normally required for certain procedures, which otherwise will cause a delay in the delivery of service under the Project.

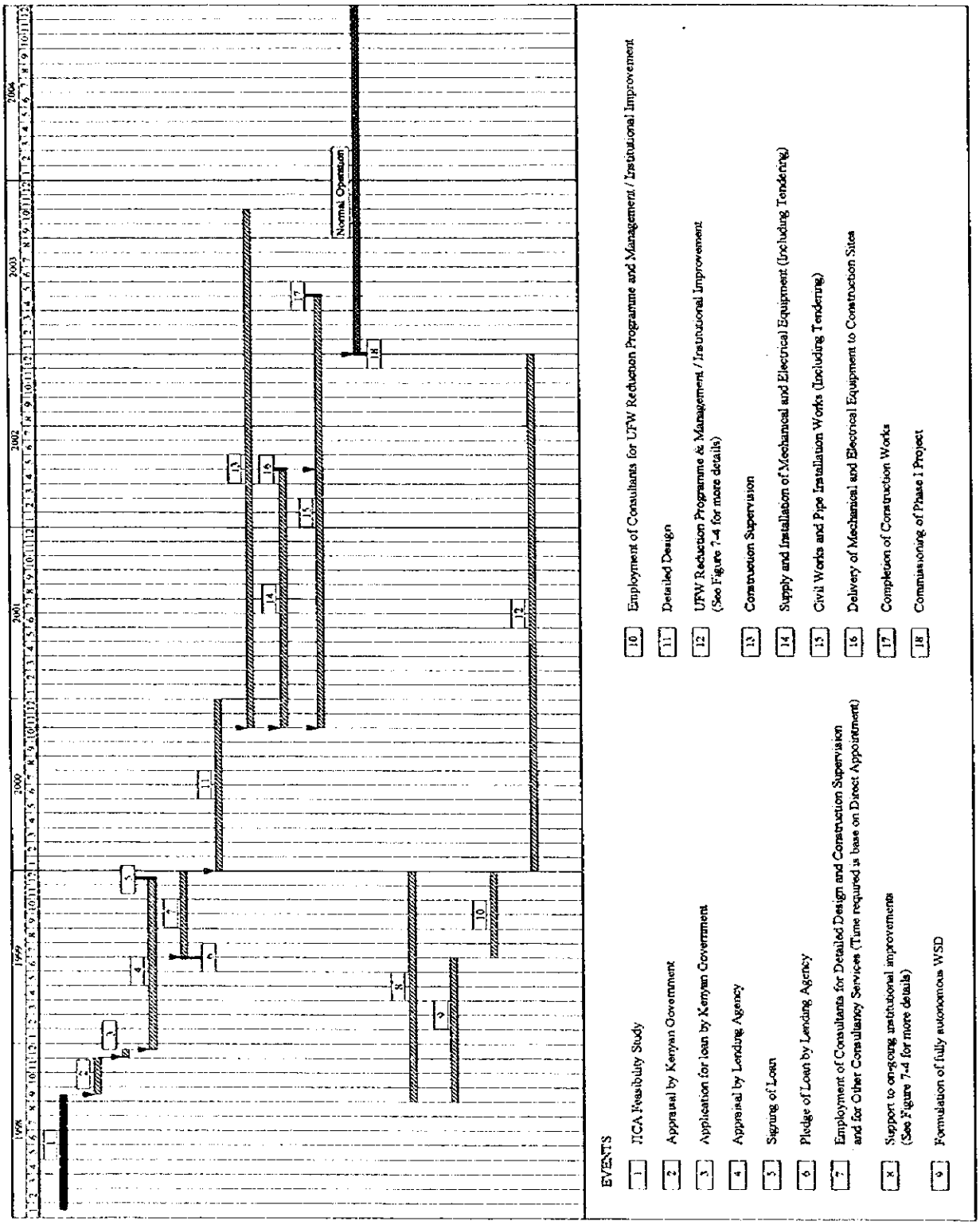
(1) Appraisal of Project and Loan Application

The JICA Feasibility Study is scheduled to be completed in late August 1998. It will be then subjected to an appraisal by the Kenyan Government, and, if it gains the government's consent, an application for a financial loan will be submitted by the government to an international lending agency. Appraisal by a lending agency normally takes one year before signing the loan agreement. It is assumed, however, that the lending agency while continuing its internal procedures would pledge the loan in half way, giving the green light for the Kenyan government to initiate the selection of consultants for detailed design and construction supervision and for other consultancy services included in the Project.

(2) Employment of Consultants for Detailed Design/Construction Supervision and Other Consultancy Services

The process of employing consultants normally takes one year if it follows the normal selection procedures recommended by the lending agency's guidelines. Given the time constraint, however, it is assumed that consultants will be selected on the basis of a direct appointment. This arrangement will reduce half the time normally required for this process. It is also recommended that the same consultants be appointed both for detailed design and construction supervision on the basis of one contract. This will also reduce administrative works and the corresponding time to some significant extent.

Figure 7-1



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(3) Detailed Design

Detailed design for this magnitude of project normally takes one year to complete. It is assumed, however, tender documents for certain contract packages can be completed by the end of the tenth month. In the preparation of tender documents, priority should be given to the contract packages which require a longer length of time to complete than others or which include supply of goods and equipment to be imported from outside the country.

(4) Tendering, Construction and Commissioning

Tendering comprises prequalification of contractors, tender announcement, receipt and opening of tenders, evaluation of tenders and award of contracts. At some stages during the process, an approval of the lending agency will be also required. All of these processes therefore generally require 9 to 10 months to complete. It is assumed in the schedule that a notice to proceed will be issued to successful tenderers at the end of the 9th month, which will eventually leave 9 months for suppliers or 21 months for civil works contractors to complete their jobs. It is further assumed in the schedule that by the end of the 17th month after the notice to proceed or the 26th month after the tendering process started, all the works required for a partial, if not a full, commissioning will have been made ready for use. Such works, however, will not necessarily include construction of small water reticulation or branch sewer pipes in areas remote to water or sewerage treatment works, landscaping and restoration works at construction sites or preparation of as-built drawings, all of which completion can be delayed by another 4 months.

(5) Management and Institutional Improvements

Apart from the physical construction works, improvement works on the management and institutional capacity will also be implemented simultaneously as shown in Figure 7-1. Details of these improvement works are discussed in Section 7.4.

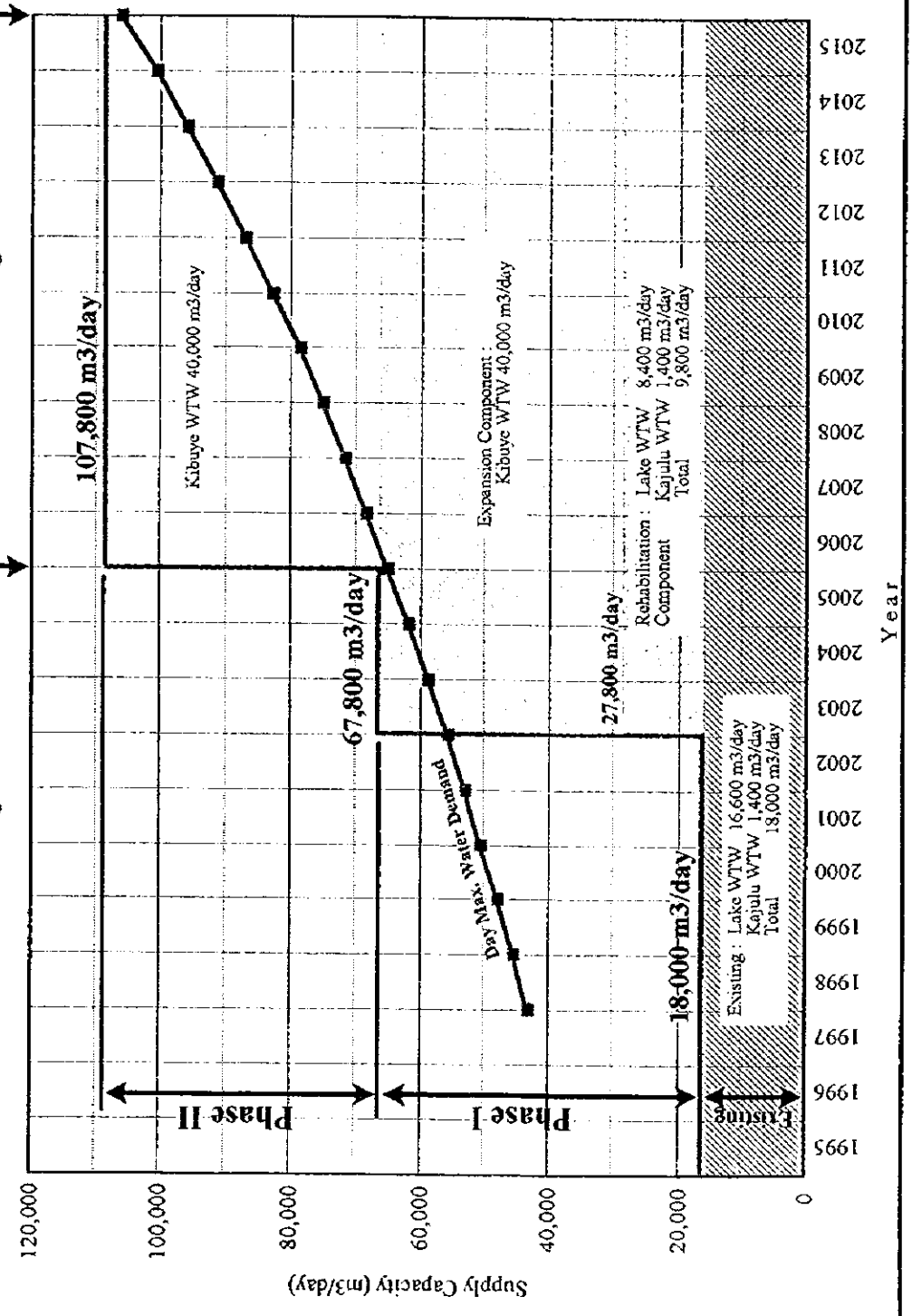
7.2 WATER SUPPLY IMPROVEMENTS

As already discussed in the previous section, it is envisaged that the earliest possible timing for the municipal water supply system to increase its supply capacity will be the beginning of the year 2003, and that, in that context, there will be no difference between rehabilitation and expansion components.

Figure 7-2 presents an overview of the projected municipal water demand versus municipal water supply capacity in terms of water treatment.

It should be noted that the increased supply capacity (67,800 m3/day) after the Phase I Project would be able to meet the projected municipal water demand for only the next three years until the end of the Phase I target year 2005, and that the situation, if it is the case, would require an urgent implementation of the next Phase II Project. In any case, however, the completion of the Phase I Project will arrest the current severe water supply constraints in Kisumu.

Figure 7-2



NOTE:
This figure has been prepared on the assumption that the major portion of the capital cost required for the implementation of Phase I Project will be financed by an international funding agency in the form of a loan, and that there will be no serious setbacks throughout the stages of loan acquisition, detailed design and construction, which might adversely affect the progress of implementation. If any other forms of funds are available in less time, there will be a possibility to complete the Rehabilitation Components of Phase I Project by 2001, one year ahead of the completion of the entire Phase I Project in 2002.

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7.3 SEWERAGE IMPROVEMENTS

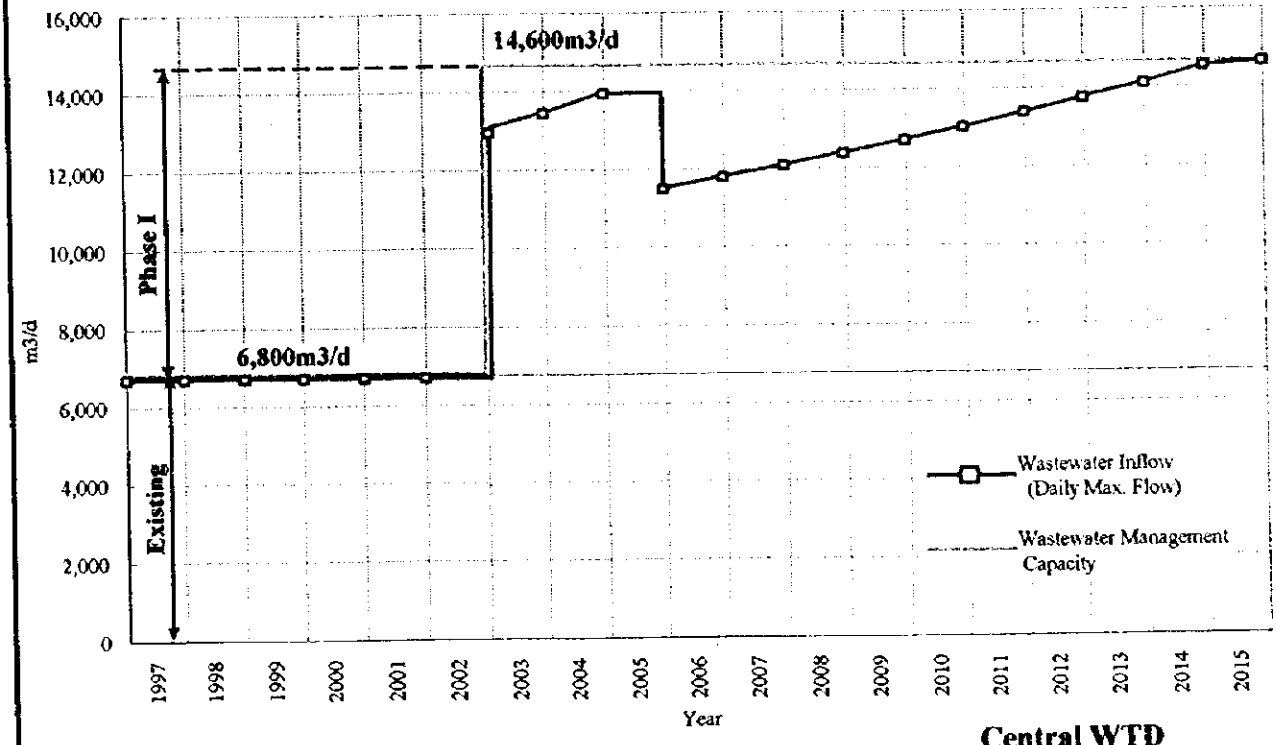
Most of the sewerage improvements proposed under the Phase I Project are designed to focus on the rehabilitation of major existing sewerage facilities to recover functions originally assigned to each of those facilities. For this reason, extension of the existing sewerage service area under the Phase I Project will be minimal in comparison with that of water supply. Despite this, however, it is envisaged that the sewerage system after the Phase I Project will be able to collect approximately 60 % of wastewater to be generated within the municipal water supply system.

The ratio is projected to further increase to 83 % under the Phase II Project. The Phase II Project proposes a major extension of sewerage service area mainly towards the west of the municipality while maintaining the water supply service area as it is after the completion of the Phase I expansion.

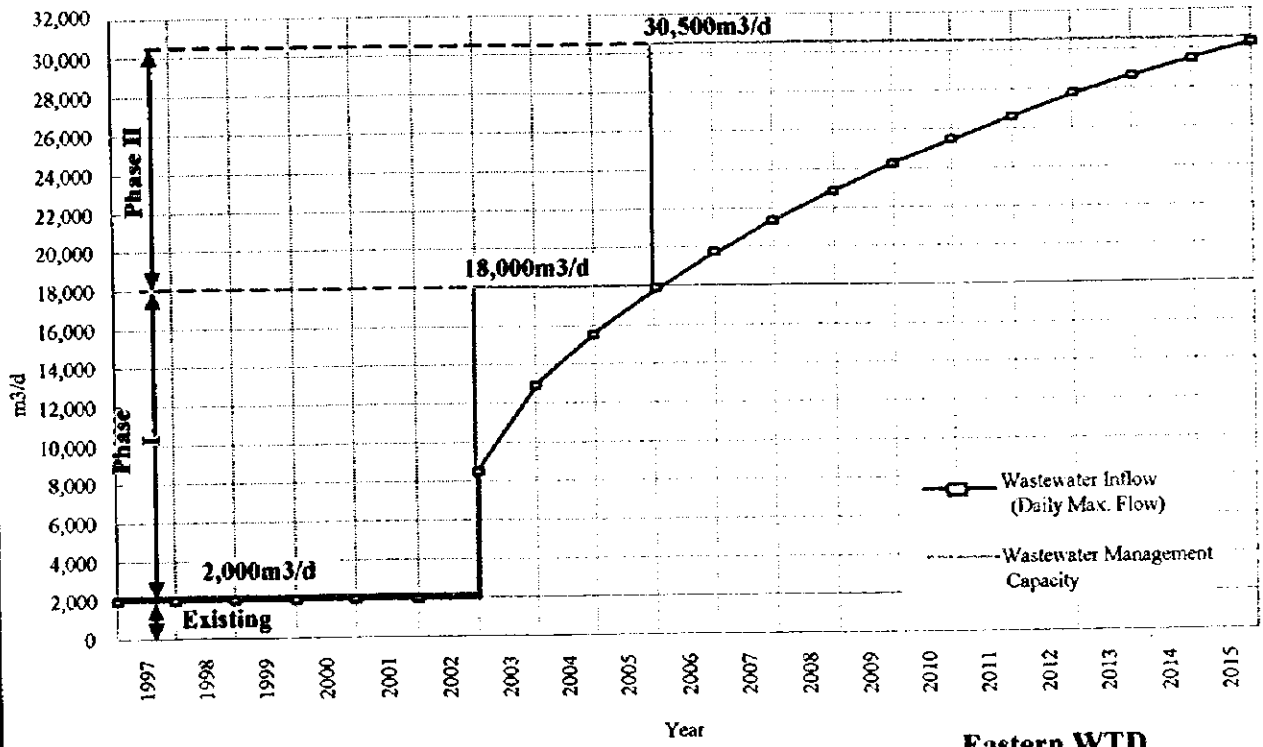
As shown on Figure 7-3 , the present total wastewater management capacity of the existing municipal sewerage system, i.e. 8,800 m3/d will be increased by 23,800 m3/d to 32,600 m3/d under the Phase I Project. This increment will comprise an increase of 7,800 m3/d in the Central WTD and an increase of 16,000 m3/d in the Eastern WTD.

Under the Phase II Project, the total wastewater management capacity of the municipal sewerage system in Kisumu will be further increased by 41,900 m3/d from 32,600 m3/d after the Phase I to 74,500 m3/d. This increment will comprise an increase of 29,400 m3/d in the Western WTD to be newly formulated and an increase of 12,500 m3/d in the Eastern WTD.

Figure 7-3



Central WTD



Eastern WTD

THE REPUBLIC OF KENYA THE MINISTRY OF LOCAL AUTHORITIES KISUMU MUNICIPAL COUNCIL	THE STUDY ON KISUMU WATER SUPPLY AND SEWERAGE SYSTEM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE : WASTEWATER INFLOW VS MANAGEMENT CAPACITY

7.4 INSTITUTIONAL IMPROVEMENTS

7.4.1 General

Institutional improvements must be geared to the formation of an autonomous Water and Sewerage department (WSD), progressing to a commercialised company (WSC) in a logical progression with capacity building and financial improvement.

It is most important to ensure that both KMC and the WSD are able to improve their financial standing to provide for a successful separation. Full details of recommended Financial Management Reforms and Management/Institutional Improvements are given in Volume 5, Appendix K. Improvements must take place in two stages, being pre-Phase I and during Phase I. The following sections summarise the improvements which are shown in Figures 7-4, and 7-5.

7.4.2 Improvements during 1998/99 (Pre-Phase I Project)

From now until the commencement of Phase I in year 2000, it will be the entire responsibility of the Kenya side to form an autonomous WSD. It is essential that KLGRP, through its secretariat in MOLA, supports KMC in financial and management capacity building and to maximise council's revenue by transfers of the share of the fuel levy and income tax , and any other transfers that become available through the reform programme.

The WSD needs continuing support from the UDD of MOLA in a similar manner to the provision of counterpart staff from MOLA during the study period. The UWASAM/GTZ phase 4 programme, which is scheduled for completion by the end of 1999, should continue to provide services that will assist the WSD with preparations for autonomy and commercialisation.

From the "stop-start" nature of all attempts so far to create an autonomous WSD it is clear that concerns over revenue transfers to the General Fund and WSD management capabilities have stalled the matter.

There are two aspects of autonomy for the WSD. The first is to ensure that it keeps the surplus operating revenue and uses it to finance its own operations. The second is the transfer of all management decisions from other council departments and committees to the new WSD.

Council officials must establish and strictly adhere to a set of rules on the financial relationship between the WSD and the rest of the council. It is proposed that up to 40% of the WSD's gross revenue income be considered as the net revenue equivalent, and that this amount be the contribution to the General Fund.

The decision-making authority for all routine matters should be vested in the WSD. The object is to delegate all decision-making powers to the WSD whilst allowing the council to continue with its legitimate functions for the exercise of controls and audit. It is recommended that the council and the WSD start a joint internal review, to identify urgent measures for immediate implementation.

The council and the WSD should agree on a set of performance targets to be met. These targets should include; water production, losses, billing and revenue collection, operation costs and surplus, and measures of service level including supply to previously dry areas.

Increased revenue can be achieved by utilising the information from the block mapping exercise billing and revenue collection. In addition, if one pipeline is reinstated to provide direct pumping to Kibuye reservoir, intermittent supplies can be provided to a large area hence more customers will be paying both the water and sewerage charges. Revenue could increase by about 45% without any increase in supply capacity.

Improved management may be achieved by KMC appointing senior staff, preferably on contract, to allow the M/I consultants to assess their suitability and performance for the running of a commercially oriented service provider.

7.4.3. Improvements during the Phase I Project

Implementation of institutional strengthening and capacity building will form part of the Phase 1 project and will commence during the detailed design period in 1999. Task forces for the leak detection and meter installation, will be formed by the consultants responsible for the UFW reduction programme. The reduction in waste water and replacement of the existing 11,000 meters should provide a steady increase to the revenue base through 2002 from the existing supply capacity, until the Phase I works come on stream at the end of 2002. At this time the WSC should be in a stable situation to cope with the rapid increase in demand that will occur on commissioning of the Phase I project

The M/I consultancy will also commence in 1999 when the WSD will have been running as an autonomous unit for about 9 months. A PIU will first be formed for the co-ordination of the construction works commencing in year 2000. All management and financial issues will be addressed culminating in the formation of a Water and Sewerage Company towards the end of 2001.

To achieve this goal, the existing MOLA/GTZ UWASAM programme will be followed. Under this programme, Terms of Reference were drawn up for a Management Consultancy and a contract was awarded to a local firm to implement sound principles of management, commercial accounting and financial control in the three newly formed Water and Sanitation Companies. It is intended to use this approach, and the experience gained from the consultancy, to effect the necessary improvements to the Kisumu WSD prior to the formation of a commercialised company.

Throughout the design and construction period, staff will be trained on the job in waste detection, meter installation, construction and operation of the works, and in the fields of management and finance. Technical training may be undertaken at KEWI, and financed from the increased revenue flow. Further training needs for senior staff will be identified by the M/I consultants for short courses through JICA as part of the counterpart training programme. Such training should take place in 2002 prior to the commissioning of the Phase I works.

7.5 CONSULTANCY SERVICES FOR DETAILED DESIGN AND CONSTRUCTION SUPERVISION

As already mentioned earlier in Section 7.2, it is recommended that the consultancy services for detailed design and construction supervision be procured on the basis of a direct appointment under one package of contact.

The detailed design will include the packaging of works into contracts, preparation of tender documents including technical specifications and tender drawings. A total input comprising 48 man-months of expatriate engineers and approximately 120 man-months of local engineers and draftsmen will be required for this service.

The initial stage of the construction supervision service will include pre-construction activities such as pre-qualification of contractors, tender announcement, evaluation of tenders, contract awards, preparation of contract documents, etc.

During the construction stage, the service will include review and approval of shop drawings and invoices, issuance of certificates, scheduling and coordination of works, recommendation on change orders and claims, etc.

The final stage of the construction supervision service will focus on the review and approval of as-built drawings, issuing certificates to contractors and preparation of system operation manuals incorporating findings and experience gained through the early stage of commissioning, etc.

A total input comprising 140 man-months of expatriate engineers, 180 man-months of local engineers and 400 man-months of local inspectors, draftsmen and surveyors will be required for this service.

The total cost of consultancy services for detailed design and construction supervision is estimated at US$ 6,000,000.

Figure 7-4

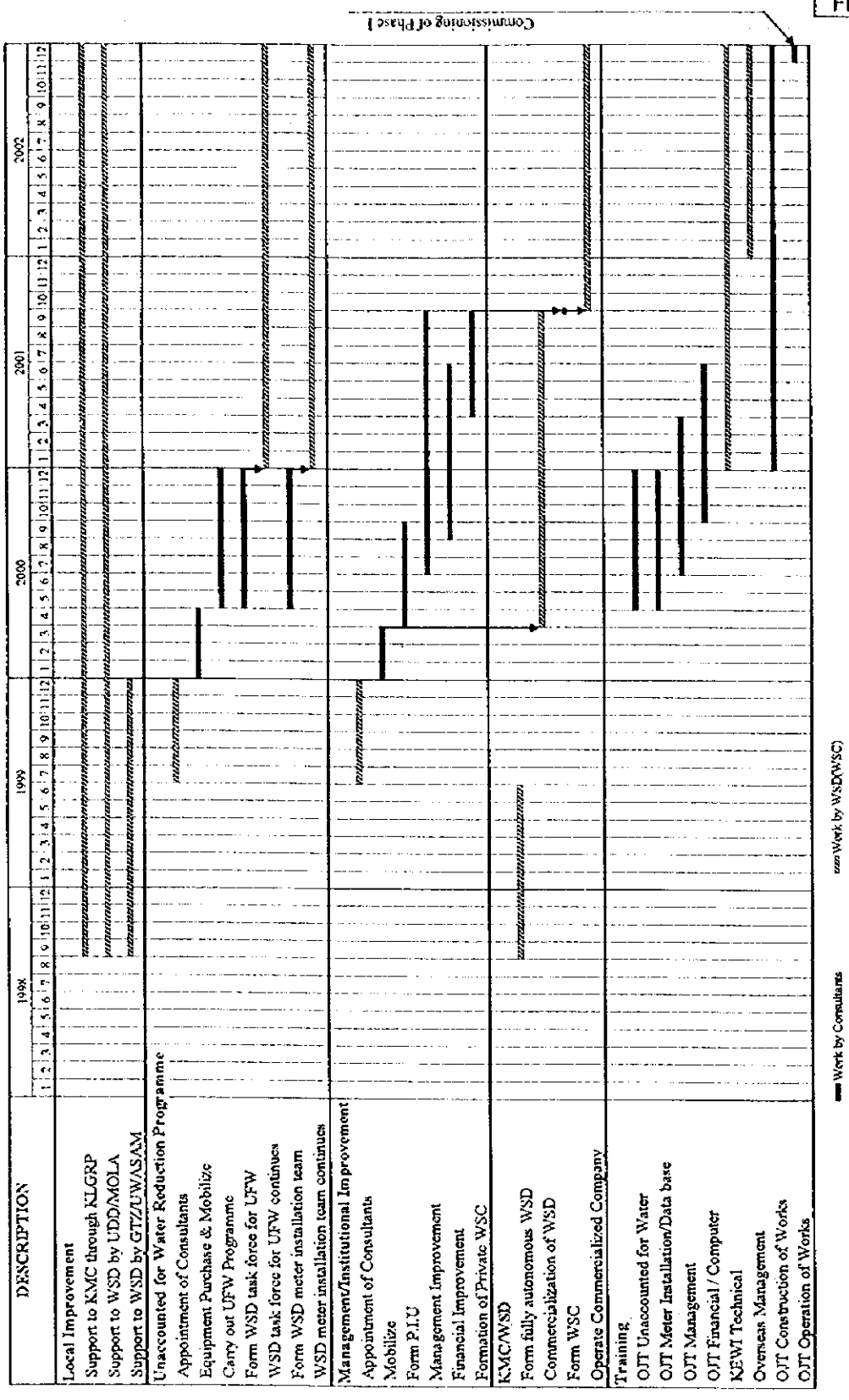


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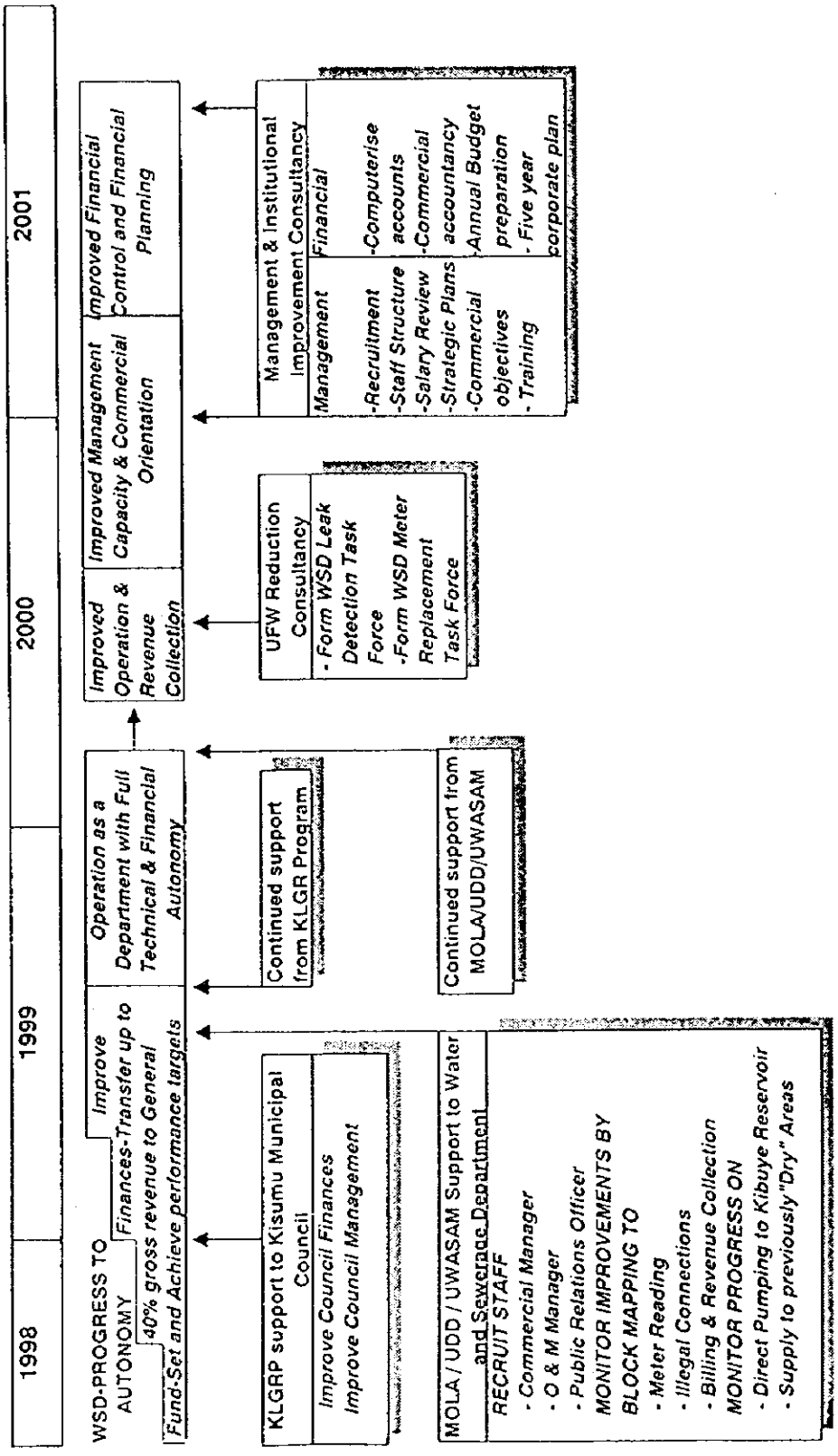
Figure 7-5



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CHAPTER 8

PROJECT COSTS AND FINANCIAL ANALYSIS

8. PROJECT COSTS AND FINANCIAL ANALYSIS

8.1 REVENUE GENERATED BY THE W&S DEPARTMENT

The water department in Kisumu generates substantial revenues. This consists of both actual income and cash generated by running arrears. This revenue is used for general council operations while the department's own bills for water treatment chemicals, electricity, and staff may go unpaid for extended periods.

This revenue potential of the W/S operations will continue in the future. The central government encourages the local authorities to operate the water departments on a self-sustaining basis. Its policy on water pricing is stated in the Sessional Paper No. 2 of 1997 " The pricing of water will be such that the rates take into account the ability to pay by the water users in different parts of the country. Rates in rural areas will cover the costs of operation and maintenance where feasible. On the other hand, prices in industrial locations will cover both the maintenance and capital investment costs on a long-term recovery basis".

The Council uses the privilege of being licensed water undertaker to charge very high tariffs to generate revenue. Major items in Municipal Council expenditures are general administration, health and education. The Municipality provides an array of other services as well. The revenue base is very weak and can not finance the services it attempts to provide. As a result, the Council is in constant crisis regarding arrears for salary payments, unpaid bills for power, telephone, and dues to suppliers.

8.1.1 Billing and Revenues of Water and Sewerage Department

The revenue generated by the W/S department has three components. The department charges the consumers for the amount of water consumed based on the current tariffs. There is also a separate schedule of charges for sewerage. Both are given in Table 8-1. The actual sewerage tariff, however, is not applied but the consumers who have sewerage connections pay an additional amount of 75% of the water bill as sewerage charge. This is levied only on the subscribers who have sewerage connections. A minor item is included in the water charge as meter rent (10 shillings per month).

The information on the amount of raw and treated water produced by the W/S department, and the amount actually billed to consumers is not reliable at all. The meters are either out of order

or produce unreliable readings. The amount of treated water actually produced and supplied to the distribution system is therefore an approximate guess and should be treated with caution.

At present, the Council is estimated to supply an average of 18,000 m^3 of treated water per day- or 540,000 m^3 per month. The physical losses are estimated to be 30%. This implies revenue generating water sales of 378,000 m^3 per month. The amount actually billed was 223,300 m^3 per month during the last four months of 1997 (Table 8-2). The average figures are similar for the whole of 1997, though these figures are less reliable than the more recent ones.

The revenue billed per month over the last four months of 1997 is given below. The corresponding physical quantities are given in Table 8-2.

Water and sewerage charges per month: K. Shillings

	Water	Sewerage	Total
Industry and commerce	4,748,400	2,803,725	7,552,125
Households	2,655,950	750,385	3,406,335
Institutions	328,775	199,750	528,635
Total	7,733,125	3,753,860	11,486,985

The actual monthly collections vary from 8 to 9 million Shillings per month –or 70% of the amount billed. The usual justification given by the Council officials is that the government institutions do not pay their bills. This explanation is not meaningful, because the total amount billed to institutions is small: only 5% of the total amount billed. Their failure to pay their bills can not explain the low collection even if all institutions not paid their bill.

Table 8-1 Water Tariffs in Kisumu (Shs/m3)

	Domestic		Governmental & Gov. Institutions		Industrial and Commercial	
	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98
Minimum	160	180	340	400	380	400
11 - 20 m3	19	20	21	22	23	24
21 - 40 m3	23	23	23	25	27	28
41 - 60 m3	26	26	28	30	31	32
Over 60 m3	32	33	35	37	39	40
Raw Water					14	15

Sewer charges in Shs/m3

	Domestic		Government & Gov. Institutions		Industrial and Commercial	
	1996/97	1997/98	1996/97	1997/98	1996/97	1997/98
Minimum	120	140	11	13	12	14
11 - 20 m3	12	14	14	15	15	17
21 - 40 m3	14	16	15	18	17	19
41 - 60 m3	16	18	18	20	20	22
Over 60 m3	20	23	22	25	24	28

Source: Kenya Gazette, August 16, 1996.

Table 8-2 Monthly Volume of Water Billed in 1997

(Thousand cubic meters)

	Industrial and Commercial	Domestic	Institutions	Total
March	78.6	108.1	6.4	193.1
April	78.6	104.4	6.9	189.9
May	138.2	100.7	9.6	248.5
June	138.2	100.7	9.6	248.5
July	149.6	107.1	10.4	267.1
August	126.6	90.8	8.8	226.2
September	143.9	104.4	10.0	258.3
October	114.9	80.3	11.7	206.9
November	111.0	90.0	11.3	211.3
December	115.9	92.4	7.5	215.8
Average (March - December)	119.5	97.9	9.2	226.0
Average (Sept - December) 1	121.4	91.8	10.1	223.3

Source:The W/S Department

1 Information on this period is provided by the new computer center.
It is believed to be more representative of actual billing.
The estimate for previous months may include computing errors.

The total revenue collection is only slightly more than the charge on industry/commerce. The big difference in the amount actually consumed and billed appears to be in the category "ordinary". This includes households and water kiosks. The Study Team estimates that this group accounts for 60% of quantity consumed. Its share in actual quantity billed is less 40%. The share of this group in revenue billed was even less than 30%.

The share of residential consumption is below our estimates and what may be expected based on comparisons with other cities. Several factors would explain this discrepancy. There probably is substantial water consumption in kiosks, which is not recorded. There also appears to be a tendency to divert water from residential users to industry. This seems to have happened in the second half of 1997: the industry and institutions have maintained their consumption while the reduction in supply has all been born by the households. Both the actual reductions in consumption and theft explain the much lower share of households in consumption than is expected. The share of households in water billed would have been even lower without fictitious billing. Many households who receive no water get billed for the minimum quantity. This inflates the apparent consumption of households.

The overall amount billed to industry seems to be reasonable. It is consistent with the independent estimates of the Study Team, which places industrial consumption at 4,000 m^3 per day. Few large users who can be easily monitored consume most of this. The amount actually billed is stable at 120,000 cubic meters per month.

Only 42% of the water supplied are actually billed. The large share of non-revenue water is due to physical losses estimated at 30%, illegal connections, tampered or faulty meters, and meters not read for revenue purposes.

8.1.2 Operating Surplus and Transfers from W&S Department

The Council generates water revenues of 8 to 9 million Shillings per month. The direct production costs are around five million Shillings per month. This leaves the Council with revenue of 3 million per month for transfer to the General Account. The actual transfer is larger, because the Council runs arrears on the water account (by not paying bills to the power company and suppliers of chemicals). The additional funds thus generated are also transferred to the general account of the Council.

High tariffs are the major factor that enables the Council to generate revenue at the existing low levels of efficiency. The council is able to charge these due to the severe water shortage in the town. Despite the rapid growth in population, the supply capacity has remained unchanged

since 1988. There are indications that this capacity may even be declining- particularly during the second half of 1997.

The Council could double the water income with a reasonable level of efficiency. With physical losses of 30%, it should be billing the consumers for 378,000 m^3 per month. This will double the amount currently billed. The actual collection as a share of the amount billed could also be improved. These improvements will allow the Council to get some income from the W/S department while leaving the bulk of revenue for maintaining the system

The expansion project can not be viable unless the unaccounted for water is substantially reduced, the water revenue accrues to the water and sewerage department, and controls are in place to contain costs. Expansion can not be justified without assurances that these measures will be adopted.

The proposed investments are highly profitable provided that the management problems are satisfactorily solved. This would require a commitment from the Council as well as the government of Kenya. One issue is the financial autonomy of the project. This is discussed below. The economic efficiency of the project will also have to be insured. This will include a drastic reduction in non-revenue water, maintaining the tariffs at the existing levels in real terms, and improving the ratio of revenue collected to the amount billed.

The only avenue for maintaining a financially viable water/sewerage operation is to insulate that service from the rest of the Council. Such a financially autonomous operation can be highly profitable at the existing tariff levels. This requires that no income from the extended capacity under the proposed project will be available to the Council. The Council has agreed to enact by laws that will insure this.

8.2 WATER TARIFFS AND AFFORDABILITY

8.2.1 Tariff Structure

Water tariffs presently charged in Kisumu and those proposed by the team are presented in Table 8-3. The present tariffs are very similar to those in effect since 1994: the change from then to the present tariffs is less than 5% for most users and tariff blocks.

The direction of the change in the tariffs since 1994 is consistent with our recommendations. A major deviation we are recommending is to reduce the minimum charges while the Council actually increased these from Shs.160 to 180 per m^3 in 1996.

Drastic changes in the tariff levels and structure are not essential at this time. The tariffs charged in Kisumu are substantially higher than those in Nairobi, and the structure is more varied. In Nairobi, tariffs are not differentiated between categories of users. In Kisumu, Industry and commercial establishments pay more as shown below.

	Water charges per cubic meter (Shs)		
	Nairobi	Kisumu	
		Domestic	Industry
Up to 10 cubic meters per month*	12	180*	400*
10 to 30 cubic meters	18	20	24
31 to 60 cubic meters	27.5	23	28
Over 60 cubic meters	34.5	33	40

Note * : Lump Sum charge for consumption of less than 10 m^3/month

In Nairobi, the sewerage charge is 53% of the water charge for the lowest bracket and declines to 29.7% for the largest users. In Kisumu, the rate is uniform at 75%.

Furthermore, the W/S department in Kisumu charges even higher rate than the relatively high tariffs. The actual effective tariff charged to the domestic consumers for water in Kisumu was Shs.29 per cubic meter in 1988. This is impossible with the existing tariffs and indicates considerable overcharging.

Table 8-3 Tariff Levels, Dispersion, and Proposed tariffs

Comparison With Selected Cities
(Base Charge = 100.0)

Water Tariffs in Selected Cities: Domestic Use

Block	Colombo	Tokyo	Nairobi	Kisumu
1-10	100.0	_ 1)	100.0	100.0
11-20	173.3	100.0	150.0	125.0
21-30	640.0	134.6	150.0	143.7
31-40	1,253.3	165.4	229.0	162.5
41-50	1,600.0	_	229.0	162.5
50M3	3,333.3	230.1	287.0	206.2

Present and Proposed Tariffs: Shillings per cubic meter

Monthly Consumption	Domestic		Government & Institutions		Commerce and Industry	
(M 3)	Existing	Proposed	Existing	Proposed	Existing	Proposed
-10 (minimum charge)	180	100	400	250	400	300
11-20	20	20	22	30	24	40
21-30	23	23	25	40	28	50
31-40	23	30	25	50	28	50
41-60	26	40	30	50	32	50
Over 60	33	50	37	50	40	50
Raw water	_	_	_	_	15	30

Sewerage charge: 75% of water billed for connections that have sewerage service.

1) Water up to 10 M3/month is free. The last block is thus not as a ration of the lowest, but the next block.

The study team has independently estimated the distribution of consumers between tariff blocks in 1997. This information is combined with the existing tariffs to estimate what the effective tariff would be if consumers were billed properly. Our estimate of the effective tariff for 1997 based on existing tariffs is 22.64 Shillings per cubic meter for water consumed by the domestic users (Table 8-4). This average includes a meter rent of 10 Shillings per month for each of the current subscribers. There would appear to be 40% overcharging when this is compared with what the Council is billing at the moment.

The present tariff blocks are also not sufficiently disaggregated to provide a basis for charging low tariffs to users who consume less water. The existing tariffs in Kisumu differentiate five blocks. The lowest block is monthly consumption of up to 10 cubic meters. The tariff block progression and the charges are given below for the domestic consumers: Further information for other users is given in Table 8-3.

	Water charges: shillings per cubic meter	
Tariff Blocks	Up to June 1997	Present
Minimum monthly charge	160	180
11-20 cubic meters per month	19	20
21-40	23	23
41-60	26	26
Over 60	32	33

The minimum block of 10 cubic meters per month corresponds to 55 lcd with an average household size of six people. This is below the standard set in the Design Manual of Kenya for low income households with individual connections (60 lcd/day). The present minimum charge for people at that level of consumption is too high. Several options can be adopted to reduce the minimum charge.

Table 8-4 Existing Tariff Blocks and Average Effective Tariff for Domestic Consumers in 1998

Domestic

classified by water amount (m^3/m.)	Ks/m^3/m.	Population		Connection		Consumption		Revenue	
		No.	%	No.	%	m^3/m	%	Ks/month	%
~10,Min. charge **	180	62,400	22.22	3,837	17.44	28,776	10.98	690,636	10.84
11~20	20	53,500	19.05	3,290	14.95	37,831	14.43	773,215	12.13
21~30	23	23,800	8.47	1,463	6.65	36,586	13.96	724,393	11.37
31~40	23	17,800	6.34	1,094	4.97	38,307	14.61	793,506	12.45
41~60	26	12,700	4.52	781		39,045		679,384	10.66
over 60	33	8,696	3.10	535		32,100		1,473,799	23.13
Sub-T		178,896	63.70	11,000		212,645	81.12	5,134,932	80.58
Common taps ***	25	101,944	36.30			49,501	18.88	1,237,525	19.42
Total		280,840	100.00	22,000	100.00	262,146	100.00	6,372,457	100.00

Average effective tariff for residential users at present: Shs.22.64/cubic meter

The minimum consumption could be free for households. The Council may wish to switch to actual consumption (instead of a block charge as at present). Finally, the fixed charge could be reduced. We are recommending a reduction in fixed charges. Even the reduced minimum charge is difficult to justify under the existing conditions in Kisumu.

Normally, a fixed minimum charge is economically efficient. Meters have to be read and bills sent to each subscriber. This entails fixed costs which should be born by the subscribers regardless of whether they use any water or not. In Kisumu, around half of the subscribers have used no water not by choice but because no water has been supplied in the taps for years. Yet, bills are sent out for the minimum charge every month. This is not justifiable.

The design manual of Kenya specifies the target consumption level for middle income households with individual connections at 120 lcd. With a household size of 6 people, this would imply monthly consumption of 22 cubic meters per family. Consumption beyond that may be considered excessive and could be charged at relatively higher rates. The present tariff is not disaggregated enough to allow this. The Study Team recommends that the consumption block 21-40 should be broken into two with different tariffs.

As a general principle, the concern with equity would suggest further increases in the tariff differentiation for different type of users and those who consume different amounts within the same user group. This cross subsidization protects the low-income families and allows increases in revenue.

The increase in tariff charges as consumption goes up is less in Kisumu than other cities. This comparison is presented in Table 8-3. In all cases, the difference between low and high blocks is much bigger than it is in Kisumu. This change will improve affordability for the low-income households while generating additional revenue.

Another change would increase the price differential between households and the commercial/ industrial users. Interviews with large water users, including Kenya Breweries, show that they are willing to pay double the tariffs they are currently paying. One reason for this ready acceptance of tariff increases appears to be costs.

Large users who have undertaken feasibility studies of supplying their own water have found that the costs under these schemes would be double what the W/S department is presently charging. Two causes of high costs faced by private suppliers are the high interest rates and the very large scale economies enjoyed by the department in water provision. Some of the

industrial/commercial users may develop their own sources after their tariffs are increased if this increase is not accompanied with an improvement in service reliability and water quality.

There seem to be no need to change the level or the system of charging for the sewerage service. Charging 75% of the water revenue for sewerage seem to be very reasonable. This is comparable to the charges in other towns in Kenya and in other countries. Though the sewerage charge is low in Nairobi, most other towns in Kenya charge a similar amount for sewerage as they charge for water.

8.2.2 Affordability

Affordability is a function of incomes, the acceptable share of water/ sewerage services in total expenditures, tariffs, and the target consumption levels. The ceiling on the proportion of income that may be spent for water/sewerage services is usually taken to be 5%.

On the consumption end, the expenditures for these services are a function of level of consumption, tariffs and household size. The available data on income levels, water consumption by income groups, and household size is utilized to assess the affordability.

The need to keep the price of W/S services affordable, in turn, effects the financial viability of the proposed project. Issues of affordability seem to have a small impact on the viability of the proposed project. This derives from two factors. First, low-income domestic users account for a small portion of the total revenue. The present water/sewerage system basically serves the middle and upper income households and non-residential users. Reducing the tariff for households consuming less than 10 m^3/month will have little effect on the total revenue. Second, the key equity issue for the lowest income households is not the price of water but access to piped water. These issues are further discussed below.

(1) Share of Households in Water Revenue

Table 8-2 presents a breakdown of water consumption by end users in 1997. More than half of water supplied is consumed by industry and commercial enterprises. The share of revenue originating from the household was small: 31% in 1997. These relative shares are projected to change in favor of residential users after the implementation of this project but households will continue to provide less than half of the W/S department revenue even after this project is fully implemented.

(2) Water Tariffs and the price charged by vendors

The price charged by street vendors for water was 1.5 Shillings for a 20 liter can for water drawn from shallow wells. The quality of this water is generally very poor. Tap water delivered to homes is 6 Shillings per can. This price goes up to 10 Shillings in hot/dry season. The price thus varies from Shs. 75 to 500 per cubic meter depending on the source, mode of delivery, and time of the year.

The tap water costs around 20 Shs per cubic meter. The minimum charge for those consuming up to 10 cubic meters is 180 Shillings. Households who consume between 11 to 20 m^3 per month pay 20 Shillings per cubic meter. This goes up to 23 Shillings for households that consume 21 to 40 m^3/month. The low income households who buy their water from vendors thus pay 3 to 10 more times than those who have access to piped water. The key issue is thus access to tap water rather than the price.

(3) Water consumption by income groups

There is little information on household incomes and consumption by income groups. Rigorous statistical analysis are not possible with the available data. Some inferences can be drawn from the available information.

In Kenya, the poverty surveys 1997 undertaken by the government define the "very poor" as households whose monthly income is less than 1200 Shillings. These families can not afford housing and food is purchased irregularly. The low income households are defined as those with an income of around 2000 shillings per month. The statistical office in Kisumu estimate that the mean household income in Kisumu is around Shs.5000/month. The high income households are considered to be those with an income of over Shs.10,000 per month. The first column of the table below shows how much these families can pay if they spent 5% of their income on W/S services.

This data on how much the households can afford to pay is compared with the actual estimated costs. The estimate of actual payments require information on amount consumed by income groups This data is derived from a survey of 309 households in central Kisumu undertaken by the Study Team (See Vol 2 Table 4-1). This survey found that the highest water consumers in Kisumu consumed 192 lcd. The following 52 percent consumed 118 lcd. The lowest income 12% of the families consumed 32 lcd. Given a household size of six persons, these translate into water consumption of 34.6; 21.2; and 5.8 cubic meters per month for high, medium, and low income families.

The differences in the levels of consumption given above are too large. The differences will narrow if the recommendations on proper meter reading and proposed tariffs are adopted. Therefore, the Study Team has assumed that the low income households will consume less than 10 m^3/month per family and will pay the minimum charge; middle income households consume 15 m^3; and high income families 30 m^3 per month. Those in the first group do not have sewerage connections; 40% of those in the second and 80% of those in the third group pay for sewerage. In addition to the water and sewerage charges, families are required to pay a meter rent. At present this rent is 10 Shillings per month. (It is recommended that this fee should be increased to 20 Shillings per month in the future). The calculations based on these assumptions are given on the second column of the table below.

Monthly family Income	Ability to pay (Shillings/month)	Estimated Actual Payment
2000	100	180
5000	250	390
10000	500	1,104

The money that the families can afford exceed the amounts that may be reasonably expected by a large margin. This is true in the case of relatively high income as well as the low income families. One reason for this is the relatively high tariffs in Kisumu.

Tariffs in Kisumu are in fact comparable to the absolute payments observed in Europe and Latin America where consumers pay 30 to 60 cents per cubic meter. These tariffs, combined with extremely low incomes in Kenya do not allow for reasonable levels of consumption. Under these conditions, people tend to spend proportionately more on these services and the levels of consumption are reduced. Some reduction in tariffs should be possible when the full capacity is in place and W/S department is managed efficiently, but these are disregarded in analysis of the financial viability of the proposed project. There are, however, two components of the new project which are designed to keep W/S services affordable for the low income families. This is the reduction in the proposed tariffs for the minimum charge and expansion in coverage of kiosks.

The low income people who buy water from vendors consume around 20 lcd. This is the equivalent of 3.6 cubic meters per month per household. These will be supplied from common taps. The operator will pay the municipality the average domestic tariff of around 25 Shillings per cubic meter. He will retail this water at about double the price he pays to the Council. The

implied retail price is Shillings 50 per cubic meter or one Shilling per a can of 20 liters. This is less than half of what people are paying at present.

With the present levels of consumption, people who buy their water from kiosks will pay around 100 Shillings per month. This is affordable for the low-income households. For revenue purposes, these sales are not separately identified, because the sales are at the average residential prices. There, however, will be no sewerage revenue from these sales and this is taken into account in the estimated ratio of sewerage to water revenue.

For the future, the Master Plan projections call for average per capita consumption of 60 lcd. This is the equivalent of 10.8 cubic meters per family per month. On the average, this will cost 3.6% of the median family income with the present tariff on water without sewerage charge.

The Study team proposes that the minimum charge is reduced to 100 shillings per month for the households who consume less than 10 cubic meters per month. This will allow most low-income households to afford the minimum required levels of consumption. Two additional modifications in the tariff structure are recommended. These are to increase the number of tariff blocks by splitting the 21-40 m^3/month block into two, and increasing the relative charges for non-domestic users. These cross subsidies will make it possible to further reduce the cost of water for the low-income households without adversely affecting the financial viability of the Project.

This study has assumed that the real prices of W/S services will remain unchanged over the projection period. Even under the most pessimistic projections, the real per capita income is likely to increase. This will improve affordability for all families.

8.3 PROJECT COSTS AND REVENUES

8.3.1 Project Costs

(1) Fixed Investment Costs

The Project will expand the capacity of water supply and sewerage system in Kisumu from the present 18,000 to 67,800 m^3 a day of raw water equivalent. All investments associated with this level of supply are included in the project. The incremental capacity is conceived in two components. The first component is based on the rehabilitation of the existing capacity and will increase the total capacity by 9,800 from the present 18,000 cubic meters per day of treated

water equivalent to 27,800. The other component is a new unit of 40,000 cubic meters. The total incremental capacity is thus 49,800 cubic meters per day. The investments in water supply capacity are accompanied by the expansion of the sewerage system and strengthening management/ institutional capability.

There are two different ways for defining the project for financial analysis. One way is to define the project to include the existing capacity and to base the analysis on the total capacity of 67,8000 cubic meters. In this case, we need to include the value of the existing assets in project costs. This poses problems of asset valuation. This is done either "as new" or by discounting the actual value of existing assets. Both of these methodologies are not very reliable.

In this report, we have viewed the new project as separate from the existing capacity. All analyses are based on incremental costs and benefits. The revenue from the existing capacity is taken into account in the analysis of the financial capability of the Municipal Council, but is not included in the income for the new project.

Detailed information on components included in this project and their costs are given in Table 8-5. This information is summarized in Tables 8-6 and 8-7 for alternative financing schemes. In the first case, all investments are loan financed. In the other case a part is grant financed: there is some possibility that the rehabilitation component of the project will be financed by a grant. The components that would need to be credit financed in this case are presented in Table 8-7.

All costs are stated in constant 1997 prices. All fixed capital cost estimates are based on those of direct construction costs and CIF prices in the case of imported machinery. These are adjusted for price escalations, contingencies and costs of consulting services.

The project feasibility analyses are based on constant 1997 prices. This is a convention that avoids the need for projecting nominal prices. These prices are very volatile in developing economies. Use of constant base year prices implies that the nominal price changes will be same for costs and the tariffs: increasing the two at the same rate will not change the project profitability. A situation where the W/S department may not be able to raise the tariffs at the same rate as inflation is simulated in the sensitivity analysis by reducing the revenue relative to costs.

Table 8-5 Project Cost Component and Disbursement Schedule

Contract Package No.	Description of Works	Basic Cost at 1997 Price - Excluding VAT					Year 1999		Year 2000			Year 2001			Year 2002			Year 2003			Total
		Total (US$)	Foreign (%)	Local (%)	Foreign (US$)	Local (US$)	Foreign (US$)	Local (US$)	Foreign (US$)	Local (US$)	Total (US$)	Foreign (US$)	Local (US$)	Total (US$)	Foreign (US$)	Local (US$)	Total (US$)	Foreign (US$)	Local (US$)	Total (US$)	(US$)
A. REHABILITATION COMPONENTS																					
A.1 Water Supply Improvements																					
Supply and Installation of Equipment																					
RW-S1	Supply and Installation of Equipment for Rehabilitation of Kajulo and Lake WTWs	4,029,000	80%	20%	3,223,200	805,800	0	0	644,640	161,160	805,800	1,933,920	483,480	2,417,400	644,640	161,160	805,800	0	0	0	4,029,000
									20%	20%		60%	60%		20%	20%					
Civil Works																					
RW-C1	Rehabilitation of Kajulo Water Intake and WTW including construction of Kajulo Distribution Reservoir (700 m3) and Treated Water Transmission Main (SP 200mm, L=3.6 km) from Kajulo WTW to Kajulo Distribution Reservoir	273,000	10%	90%	27,300	245,700	0	0	5,460	49,140	54,600	10,920	98,280	109,200	10,920	98,280	109,200	0	0	0	273,000
									20%	20%		40%	40%		40%	40%					
RW-C2	Rehabilitation of Lake Water Intake and Lake WTW including Construction of Raw Water Transmission Main (SP 450mm, L=1.2 km) from Lake Water Intake to Lake WTW and Treated Water Transmission Main (SP 550mm, L=5.2 km) from Lake WTW to Kibuye Distribution Reservoir	3,650,000	10%	90%	365,000	3,285,000	0	0	73,000	657,000	730,000	146,000	1,314,000	1,460,000	146,000	1,314,000	1,460,000	0	0	0	3,650,000
									20%	20%		40%	40%		40%	40%					
A.2 Sewerage Improvements																					
Supply and Installation of Equipment																					
RS-S1	Supply and Installation of Equipment for Rehabilitation of Existing Conventional STW, Nyalenda STW and Three Pump Stations, namely Sunset Hotel, Kendu Lane and Mundas Road Pump Stations	454,047	80%	20%	363,238	90,809	0	0	72,648	18,162	90,809	217,943	54,486	272,428	72,648	18,162	90,809	0	0	0	454,047
									20%	20%		60%	60%		20%	20%					
Civil Works																					
RS-C1	Rehabilitation of Existing Conventional STW and Nyalenda STW including Rehabilitation of Existing Trunk Sewers (CP 375mm, L=0.42 km) in Eastern WTD	933,953	10%	90%	93,395	840,559	0	0	18,679	168,112	186,791	37,358	336,223	373,581	37,358	336,223	373,581	0	0	0	933,953
									20%	20%		40%	40%		40%	40%					
	Rehabilitation Components - Total Basic Cost for Items A.1 & A.2	9,340,000			4,072,133	5,267,86	0	0	814,427	1,053,573	1,868,000	2,346,141	2,286,469	4,632,609	911,566	1,927,825	2,839,391	0	0	0	9,340,000
	Price Contingency						0	0	49,849	165,070	215,919	193,397	492,748	686,146	94,876	532,622	627,498	0	0	0	1,529,564
	Physical Contingency 10%						0	0	86,428	121,964	208,392	253,954	277,922	531,876	100,644	246,045	346,689	0	0	0	1,086,956
	Administration Costs 2%						0	0	19,014	26,832	45,846	55,870	61,143	117,013	22,142	54,130	76,272	0	0	0	239,130
B. EXPANSION COMPONENTS																					
B.1 Water Supply Improvements																					
Supply and Installation of Equipment																					
EW-S1	Supply and Installation of Equipment for Construction of New Kibuye WTW	6,076,000	80%	20%	4,860,800	1,215,200	0	0	972,160	243,040	1,215,200	2,916,480	729,120	3,645,600	972,160	243,040	1,215,200	0	0	0	6,076,000
									20%	20%		60%	60%		20%	20%					
Civil Works																					
EW-C1	Construction of New Water Intakes on Awach and Kibos Rivers	1,680,000	10%	90%	168,000	1,512,000	0	0	33,600	302,400	336,000	67,200	604,800	672,000	67,200	604,800	672,000	0	0	0	1,680,000
									20%	20%		40%	40%		40%	40%					
EW-C2	Installation of Raw Water Transmission Mains (400 to 900 mm, L=18.8 km) from New Awach and Kibos Water Intakes to Kibuye WTW, including construction of a junction well	7,443,500	50%	50%	3,721,750	3,721,750	0	0	744,350	744,350	1,488,700	1,488,700	1,488,700	2,977,400	1,488,700	1,488,700	2,977,400	0	0	0	7,443,500
									20%	20%		40%	40%		40%	40%					
EW-C3	Construction of New Kibuye WTW (40,000 m3/day)	5,491,000	20%	80%	1,098,200	4,392,800	0	0	219,640	878,560	1,098,200	439,280	1,757,120	2,196,400	439,280	1,757,120	2,196,400	0	0	0	5,491,000
									20%	20%		40%	40%		40%	40%					
EW-C4	Construction of New Distribution Reservoir at Kibuye (27,000 m3)	1,440,600	20%	80%	288,120	1,152,480	0	0	57,624	230,496	288,120	115,248	460,992	576,240	115,248	460,992	576,240	0	0	0	1,440,600
									20%	20%		40%	40%		40%	40%					
EW-C5	Construction of Kanyakwar Distribution Reservoir (5,000 m3) and Installation of Treated Water Transmission Main (SP 350mm, L=4.2 km) from Kibuye Distribution Reservoir to Kanyakwar Distribution Reservoir	1,022,200	40%	60%	408,880	613,320	0	0	81,776	122,664	204,440	163,552	245,328	408,880	163,552	245,328	408,880	0	0	0	1,022,200
									20%	20%		40%	40%		40%	40%					
EW-C6	Construction of Kogony Distribution Reservoir (3,500 m3) and Installation of Treated Water Transmission Main (SP 400mm, L=6.2 km) from Kibuye Distribution Reservoir to Kogony Distribution Reservoir	1,488,600	40%	60%	595,440	893,160	0	0	119,088	178,632	297,720	238,176	357,264	595,440	238,176	357,264	595,440	0	0	0	1,488,600
									20%	20%		40%	40%		40%	40%					
EW-C7	Installation of Trunk Distribution Mains (PVC & SP 160 to 800 mm, L=49 km)	8,913,625	50%	50%	4,456,813	4,456,813	0	0	891,363	891,363	1,782,725	1,782,725	1,782,725	3,565,450	1,782,725	1,782,725	3,565,450	0	0	0	8,913,625
									20%	20%		40%	40%		40%	40%					
EW-C8	Installation of Secondary Distribution Mains (PVC 63 to 110 mm, L=330 km) including construction of 223 communal taps	5,022,000	50%	50%	2,511,000	2,511,000	0	0	502,200	502,200	1,004,400	753,300	753,300	1,506,600	753,300	753,300	1,506,600	502,200	502,200	1,004,400	5,022,000
									20%	20%		30%	30%		30%	30%		20%	20%		
B.2 UFW Reduction Programme and Management, Institutional Improvements																					
UF-S1	Supply of Water Meters and Leakage Detection, Repair Equipment for Reduction of Unaccounted-for Water and Water Meters for House Connections	1,400,000	90%	10%	1,260,000	140,000	0	0	252,000	28,000	280,000	756,000	84,000	840,000	252,000	28,000	280,000	0	0	0	1,400,000
									20%	20%		60%	60%		20%	20%					
MI-S1	Supply of Computers and other required equipment for Management, Institutional Improvement	200,000	90%	10%	180,000	20,000	0	0	36,000	4,000	40,000	108,000	12,000	120,000	36,000	4,000	40,000	0	0	0	200,000
									20%	20%		60%	60%		20%	20%					
B.3 Sewerage Improvements																					
Supply and Installation of Equipment																					
ES-S1	Supply and Installation of Equipment for Expansion of Conventional STW and Nyalenda STW and Construction of New Labour College Pump Station	956,898	90%	10%	861,208	95,690	0	0	172,242	19,138	191,380	516,725	57,414	574,139	172,242	19,138	191,380	0	0	0	956,898
									20%	20%		60%	60%		20%	20%					
Civil Works																					
ES-C1	Installation of Trunk Sewers in Eastern WTD (uPVC & CP 125 to 1,000mm, L=16.3 km)	3,942,000	40%	60%	1,576,800	2,365,200	0	0	315,360	473,040	788,400	630,720	946,080	1,576,800	630,720	946,080	1,576,800	0	0	0	3,942,000
									20%	20%		40%	40%		40%	40%					
ES-C2	Installation of Branch Sewers in Eastern WTD (uPVC 200mm, L=123 km)	5,524,000	40%	60%	2,209,600	3,314,400	0	0	441,920	662,880	1,104,800	883,840	1,325,760	2,209,600	883,840	1,325,760	2,209,600	0	0	0	5,524,000
									20%	20%		40%	40%		40%	40%					
ES-C3	Expansion of Conventional STW and Nyalenda STW and Construction of Labour College Pump Station	2,423,102	10%	90%	242,310	2,180,792	0	0	48,462	436,158	484,620	96,924	872,317	969,241	96,924	872,317	969,241	0	0	0	2,423,102
									20%	20%		40%	40%		40%	40%					
	Expansion Components - Total Basic Cost for Items B.1, B.2 and B.3	53,023,525			24,438,921	28,584,604	0	0	4,887,784	5,716,921	10,604,705	10,956,870	11,476,930	22,433,790	8,092,067	10,888,564	18,980,630	502,200	502,200	1,004,400	53,023,525
	Price Contingency						0	0	299,173	901,130	1,200,301	903,198	2,473,348	3,376,546	842,229	3,008,309	3,850,538	63,359	170,796	234,155	8,661,540
	Physical Contingency 10%						0	0	518,696	661,805	1,180,501	1,186,007	1,395,027	2,581,034	893,430	1,389,687	2,283,117	56,556	67,300	123,855	6,168,507
	Administration Costs 2%						0	0	114,113	145,597	259,710	260,922	306,906	567,827	196,555	305,731	502,286	12,442	14,806	27,248	1,357,071
	Total for Items B																				
	Total for Items A and B																				
C. Consultancy Services																					
CS-1	Consultancy Services for Detailed Design and Construction Supervision of Items A and B Above, Except for Item B-2	6,000,000	80%	20%	4,800,000	1,200,000	0	0	1,440,000	360,000	1,800,000	1,440,000	360,000	1,800,000	1,440,000	360,000	1,800,000	480,000	120,000	600,000	6,000,000
									30%	30%		30%	30%		30%	30%		10%	10%		
CS-2	Consultancy Services for UFW Reduction Programme	544,000	80%	20%	435,200	108,800	0	0	130,560	32,640	163,200	130,560	32,640	163,200	130,560	32,640	163,200	43,520	10,880	54,400	544,000
									30%	30%		30%	30%		30%	30%		10%	10%		
CS-3	Consultancy Services for Management, Institutional Improvement	1,300,000	80%	20%	1,040,000	260,000	0	0	312,000	78,000	390,000	312,000	78,000	390,000	312,000	78,000	390,000	104,000	26,000	130,000	1,300,000
									30%	30%		30%	30%		30%	30%		10%	10%		
	Consultancy Services - Basic Cost for Item C	7,844,000			6,275,200	1,568,800	0	0	1,882,560	470,640	2,353,200	1,882,560	470,640	2,353,200	1,882,560	470,640	2,353,200	627,520	156,880	784,400	7,844,000
	Price Contingency						0	0	115,228	74,185	189,412	155,183	101,426	256,609	195,938	130,029	325,968	79,169	53,354	132,524	904,513
	Physical Contingency 10%						0	0	199,779	54,482	254,261	203,774	57,207	260,981	207,850	60,067	267,917	70,669	21,023	91,692	874,851
	Administration Costs 2%						0	0	43,951	11,986	55,937	44,830	12,583	57,416	45,727	13,215	58,942	15,547	4,625	20,172	192,467
	Total for Item C																				
Total Project Cost (US$)																					
Total Project Cost (JPY x 1,000,000)		8,776			4,348	4,428	0	0	1,129	1,176	2,305	2,305	2,422	4,733	1,686	2,378	4,064	178	124	302	11,403

1US$ 125 JPY

Table 8-5 Project Cost Component and Disbursement Schedule

Contract Package No.	Description of Works	Base Cost at 1997 Price - Excluding VAT: Total (US$)	Foreign (%)	Local (%)	Foreign (US$)	Local (US$)	Year 1999 Foreign (US$)	Year 1999 Local (US$)	Year 2000 Foreign (US$)	Year 2000 Local (US$)	Year 2000 Total (US$)	Year 2001 Foreign (US$)	Year 2001 Local (US$)	Year 2001 Total (US$)	Year 2002 Foreign (US$)	Year 2002 Local (US$)	Year 2002 Total (US$)	Year 2003 Foreign (US$)	Year 2003 Local (US$)	Year 2003 Total (US$)	Total (US$)
A. REHABILITATION COMPONENTS																					
A1 Water Supply Improvements																					
Supply and Installation of Equipment																					
RW-S1	Supply and Installation of Equipment for Rehabilitation of Kajulu and Lake WTWs	4,029,000	80%	20%	3,223,200	805,800	0	0	644,640	161,160	805,800	1,933,920	483,480	2,417,400	644,640	161,160	805,800				4,029,000
									20%	20%		60%	60%		20%	20%					
Civil Works																					
RW-C1	Rehabilitation of Kajulu Water Intake and WTW including construction of Kajulu Distribution Reservoir (700 m3) and Treated Water Transmission Main (SP 200mm, L=3.6 km) from Kajulu WTW to Kajulu Distribution Reservoir	273,000	10%	90%	27,300	245,700	0	0	5,460	49,140	54,600	10,920	98,280	109,200	10,920	98,280	109,200				273,000
									20%	20%		40%	40%		40%	40%					
RW-C2	Rehabilitation of Lake Water Intake and Lake WTW including Construction of Raw Water Transmission Main (SP 450mm, L=1.2 km) from Lake Water Intake to Lake WTW and Treated Water Transmission Main (SP 550mm, L=5.2 km) from Lake WTW to Kibuye Distribution Reservoir	3,650,000	10%	90%	365,000	3,285,000	0	0	73,000	657,000	730,000	146,000	1,314,000	1,460,000	146,000	1,314,000	1,460,000				3,650,000
									20%	20%		40%	40%		40%	40%					
Sub-total for Item A1		**7,952,000**			**3,615,500**	**4,336,500**	**0**	**0**	**723,100**	**867,300**	**1,590,400**	**2,090,540**	**1,895,760**	**3,986,300**	**801,560**	**1,573,440**	**2,375,000**	**0**	**0**	**0**	**7,952,000**
A2 Sewerage Improvements																					
Supply and Installation of Equipment																					
RS-S1	Supply and Installation of Equipment for Rehabilitation of Existing Conventional STW, Nyalenda STW and Three Pump Stations, namely Sunset Hotel, Kendu Lane and Mumias Road Pump Stations	454,047	80%	20%	363,238	90,809	0	0	72,648	18,162	90,809	217,943	54,486	272,428	72,648	18,162	90,809	0	0	0	454,047
									20%	20%		60%	60%		20%	20%					
Civil Works																					
RS-C1	Rehabilitation of Existing Conventional STW and Nyalenda STW including Rehabilitation of Existing Trunk Sewers (CP 375mm, L=0.42 km) in Eastern WDD	933,953	10%	90%	93,395	840,558	0	0	18,679	168,112	186,791	37,358	336,223	373,581	37,358	336,223	373,581	0			933,953
									20%	20%		40%	40%		40%	40%					
Sub-total for Item A2		**1,388,000**			**456,633**	**931,367**	**0**	**0**	**91,327**	**186,273**	**277,600**	**255,301**	**390,709**	**646,009**	**110,006**	**354,385**	**464,391**	**0**	**0**	**0**	**1,388,000**
	Rehabilitation Components - Total Base Cost for Items A1 & A2	9,340,000			4,072,133	5,267,867	0	0	814,427	1,053,573	1,868,000	2,346,141	2,286,469	4,632,609	911,566	1,927,825	2,839,391	0	0	0	9,340,000
	Price Contingency						0	0	49,849	166,070	215,919	193,397	492,748	686,146	94,876	532,622	627,498	0	0	0	1,529,564
	Physical Contingency 10%						0	0	86,428	121,964	208,392	253,954	277,922	531,876	100,644	246,045	346,689	0	0	0	1,086,956
	Administration Costs 2%						0	0	19,014	26,832	45,846	55,870	61,143	117,013	22,142	54,130	76,272	0	0	0	239,131
Total for Item A		[illegible]					**0**	**0**	**959,718**	**1,368,439**	**2,328,157**	**2,849,363**	**3,118,281**	**5,967,643**	**1,129,228**	**2,760,622**	**3,889,850**	**0**	**0**	**0**	**12,195,651**
B. EXPANSION COMPONENTS																					
B1 Water Supply Improvements																					
Supply and Installation of Equipment																					
EW-S1	Supply and Installation of Equipment for Construction of New Kibuye WTW	6,076,000	80%	20%	4,860,800	1,215,200	0	0	972,160	243,040	1,215,200	2,916,480	729,120	3,645,600	972,160	243,040	1,215,200				6,076,000
									20%	20%		60%	60%		20%	20%					
Civil Works																					
EW-C1	Construction of New Water Intakes on Awach and Kibos Rivers	1,680,000	10%	90%	168,000	1,512,000	0	0	33,600	302,400	336,000	67,200	604,800	672,000	67,200	604,800	672,000	0			1,680,000
									20%	20%		40%	40%		40%	40%					
EW-C2	Installation of Raw Water Transmission Mains (400 to 900 mm, L=18.8 km) from New Awach and Kibos Water Intakes to Kibuye WTW, including construction of a junction well	7,443,500	50%	50%	3,721,750	3,721,750	0	0	744,350	744,350	1,488,700	1,488,700	1,488,700	2,977,400	1,488,700	1,488,700	2,977,400	0			7,443,500
									20%	20%		40%	40%		40%	40%					
EW-C3	Construction of New Kibuye WTW (40,000 m3/day)	5,491,000	20%	80%	1,098,200	4,392,800	0	0	219,640	878,560	1,098,200	439,280	1,757,120	2,196,400	439,280	1,757,120	2,196,400	0			5,491,000
									20%	20%		40%	40%		40%	40%					
EW-C4	Construction of New Distribution Reservoir at Kibuye (27,000 m3)	1,440,600	20%	80%	288,120	1,152,480	0	0	57,624	230,496	288,120	115,248	460,992	576,240	115,248	460,992	576,240	0			1,440,600
									20%	20%		40%	40%		40%	40%					
EW-C5	Construction of Kanyakwar Distribution Reservoir (5,000 m3) and Installation of Treated Water Transmission Main (SP 350mm, L=4.2 km) from Kibuye Distribution Reservoir to Kanyakwar Distribution Reservoir	1,022,200	40%	60%	408,880	613,320	0	0	81,776	122,664	204,440	163,552	245,328	408,880	163,552	245,328	408,880	0			1,022,200
									20%	20%		40%	40%		40%	40%					
EW-C6	Construction of Kogony Distribution Reservoir (3,500 m3) and Installation of Treated Water Transmission Main (SP 400mm, L=6.2 km) from Kibuye Distribution Reservoir to Kogony Distribution Reservoir	1,488,600	40%	60%	595,440	893,160	0	0	119,088	178,632	297,720	238,176	357,264	595,440	238,176	357,264	595,440	0			1,488,600
									20%	20%		40%	40%		40%	40%					
EW-C7	Installation of Trunk Distribution Mains (PVC & SP 160 to 800 mm, L=49 km)	8,913,625	50%	50%	4,456,813	4,456,813	0	0	891,363	891,363	1,782,725	1,782,725	1,782,725	3,565,450	1,782,725	1,782,725	3,565,450				8,913,625
									20%	20%		40%	40%		40%	40%					
EW-C8	Installation of Secondary Distribution Mains (PVC 63 to 110 mm, L=330 km) including construction of 223 communal taps	5,022,000	50%	50%	2,511,000	2,511,000	0	0	502,200	502,200	1,004,400	753,300	753,300	1,506,600	753,300	753,300	1,506,600	502,200	502,200	1,004,400	5,022,000
									20%	20%		30%	30%		30%	30%		20%	20%		
Sub-total for Item B1		**38,577,525**			**18,109,003**	**20,468,525**	**0**	**0**	**3,621,801**	**4,093,705**	**7,715,506**	**7,964,661**	**8,179,349**	**16,144,010**	**6,020,341**	**7,693,269**	**13,713,610**	**502,200**	**502,200**	**1,004,400**	**38,577,525**
B2 UFW Reduction Programme and Management/Institutional Improvements																					
UE-S1	Supply of Water Meters and Leakage Detection/Repair Equipment for Reduction of Unaccounted For Water and Water Meters for House Connections	1,400,000	90%	10%	1,260,000	140,000	0	0	252,000	28,000	280,000	756,000	84,000	840,000	252,000	28,000	280,000				1,400,000
									20%	20%		60%	60%		20%	20%					
MI-S1	Supply of Computers and other required equipment for Management/Institutional Improvement	200,000	90%	10%	180,000	20,000	0	0	36,000	4,000	40,000	108,000	12,000	120,000	36,000	4,000	40,000				200,000
									20%	20%		60%	60%		20%	20%					
Sub-total for Item B2		**1,600,000**			**1,440,000**	**160,000**	**0**	**0**	**288,000**	**32,000**	**320,000**	**864,000**	**96,000**	**960,000**	**288,000**	**32,000**	**320,000**	**0**	**0**	**0**	**1,600,000**
B3 Sewerage Improvements																					
Supply and Installation of Equipment																					
ES-S1	Supply and Installation of Equipment for Expansion of Conventional STW and Nyalenda STW and Construction of New Labour College Pump Station	956,898	90%	10%	861,208	95,690	0	0	172,242	19,138	191,380	516,725	57,414	574,139	172,242	19,138	191,380				956,898
									20%	20%		60%	60%		20%	20%					
Civil Works																					
ES-C1	Installation of Trunk Sewers in Eastern WDD (uPVC & CP 125 to 1,000mm, L=26.5 km)	3,942,000	40%	60%	1,576,800	2,365,200	0	0	315,360	473,040	788,400	630,720	946,080	1,576,800	630,720	946,080	1,576,800				3,942,000
									20%	20%		40%	40%		40%	40%					
ES-C2	Installation of Branch Sewers in Eastern WDD (uPVC 200mm, L=123 km)	5,524,000	40%	60%	2,209,600	3,314,400	0	0	441,920	662,880	1,104,800	883,840	1,325,760	2,209,600	883,840	1,325,760	2,209,600				5,524,000
									20%	20%		40%	40%		40%	40%					
ES-C3	Expansion of Conventional STW and Nyalenda STW and Construction of Labour College Pump Station	2,423,102	10%	90%	242,310	2,180,792	0	0	48,462	436,158	484,620	96,924	872,317	969,241	96,924	872,317	969,241				2,423,102
									20%	20%		40%	40%		40%	40%					
Sub-total for Item B3		**12,846,000**			**4,889,918**	**7,956,082**	**0**	**0**	**977,984**	**1,591,215**	**2,569,200**	**2,128,209**	**3,201,571**	**5,329,780**	**1,783,726**	**3,163,295**	**4,947,020**	**0**	**0**	**0**	**12,846,000**
	Expansion Components - Total Base Cost for Items B1, B2 and B3	53,023,525			24,438,921	28,584,604	0	0	4,887,784	5,716,921	10,604,705	10,956,870	11,476,920	22,433,790	8,092,067	10,888,564	18,980,630	502,200	502,200	1,004,400	53,023,525
	Price Contingency						0	0	299,171	901,330	1,200,501	903,198	2,473,348	3,376,546	842,229	3,048,309	3,890,538	63,339	170,796	234,135	[illegible]
	Physical Contingency 10%						0	0	518,696	661,805	1,180,501	1,186,007	1,395,027	2,581,034	893,430	1,389,687	2,283,117	56,554	67,300	123,854	[illegible]
	Administration Costs 2%						0	0	114,113	145,597	259,710	260,922	306,906	567,827	196,555	305,731	502,286	12,442	14,806	27,248	1,357,071
Total for Item B		[illegible]					**0**	**0**	**5,819,764**	**7,425,453**	**13,245,217**	**13,306,997**	**15,652,200**	**28,959,197**	**10,024,280**	**15,592,292**	**25,616,571**	**634,557**	**755,102**	**1,389,658**	**69,210,643**
	Total for Items A and B	**62,363,525**			**28,511,054**	**33,852,471**	**0**	**0**	**6,789,482**	**8,793,892**	**15,583,374**	**16,156,359**	**18,770,482**	**34,926,840**	**11,153,508**	**18,352,914**	**29,506,421**	**634,557**	**755,102**	**1,389,658**	**81,406,294**
C. Consultancy Services																					
CS-1	Consultancy Services for Detailed Design and Construction Supervision of Items A and B Above, Except for Item B2	6,000,000	80%	20%	4,800,000	1,200,000	0	0	1,440,000	360,000	1,800,000	1,440,000	360,000	1,800,000	1,440,000	360,000	1,800,000	480,000	120,000	600,000	6,000,000
									30%	30%		30%	30%		30%	30%		10%	10%		
CS-2	Consultancy Services for UFW Reduction Programme	544,000	80%	20%	435,200	108,800	0	0	130,560	32,640	163,200	130,560	32,640	163,200	130,560	32,640	163,200	43,520	10,880	54,400	544,000
									30%	30%		30%	30%		30%	30%		10%	10%		
CS-3	Consultancy Services for Management/Institutional Improvement	1,300,000	80%	20%	1,040,000	260,000	0	0	312,000	78,000	390,000	312,000	78,000	390,000	312,000	78,000	390,000	104,000	26,000	130,000	1,300,000
									30%	30%		30%	30%		30%	30%		10%	10%		
	Consultancy Services - Base Cost for Item C	7,844,000			6,275,200	1,568,800	0	0	1,882,560	470,640	2,353,200	1,882,560	470,640	2,353,200	1,882,560	470,640	2,353,200	627,520	156,880	784,400	7,844,000
	Price Contingency						0	0	115,224	74,185	189,412	155,183	101,426	256,609	195,938	130,029	325,968	79,164	53,354	132,524	[illegible]
	Physical Contingency 10%						0	0	199,779	54,482	254,261	203,774	57,207	260,981	207,850	60,067	267,917	70,669	21,023	91,692	874,851
	Administration Costs 2%						0	0	43,951	11,986	55,937	44,830	12,585	57,416	45,727	13,215	58,942	15,547	4,625	20,172	192,467
	Total for Item C	**7,844,000**			**6,275,200**	**1,568,800**	**0**	**0**	**2,241,518**	**611,293**	**2,852,811**	**2,286,348**	**641,858**	**2,928,206**	**2,332,075**	**673,951**	**3,006,026**	**792,906**	**235,883**	**1,028,788**	**9,815,831**
Total Project Cost (US$)		**70,207,525**			**34,786,254**	**35,421,271**	**0**	**0**	**9,031,000**	**9,405,185**	**18,436,185**	**18,442,707**	**19,412,340**	**37,855,046**	**13,485,583**	**19,026,864**	**32,512,447**	**1,427,462**	**990,984**	**2,418,447**	**91,222,125**
Total Project Cost (JPY × 1,000,000) (US$ = [illegible] JPY)		8,776			4,348	4,428	0	0	1,129	1,176	2,305	2,305	2,427	4,732	1,686	2,378	4,064	178	124	302	11,403

Table 8-6 Investment Costs in $ - Base Case

	2000	2001	2002	2003	2012/2022	Total
Direct Investment Cost						
Rehabilitation Component						
I. Water Supply Improvement	1,590,400	3,986,600	2,375,000	0	4,029,000	7,952,000
I.1. Procurement	805,800	2,417,400	805,800	0	4,029,000	4,029,000
I.2 Civil Works	784,600	1,569,200	1,569,200	0	0	3,923,000
II. Sewerage Improvement	277,600	646,009	464,391	0	454,047	1,388,000
II.1 Procurement	90,809	272,428	90,809	0	454,047	454,047
II.2 Civil Works	186,791	373,581	373,581	0	0	933,953
Sub-Total of Rehabilitation Component	**1,868,000**	**4,632,609**	**2,839,391**	**0**	**4,483,047**	**9,340,000**
Expansion Component						
III. Water Supply Improvement	7,715,505	16,144,010	13,713,610	1,004,400	6,076,000	38,577,525
III.1 Procurement	1,215,200	3,645,600	1,215,200	0	6,076,000	6,076,000
III.2 Civil Works	6,500,305	12,498,410	12,498,410	1,004,400	0	32,501,525
IV. Sewerage Improvement	2,569,200	5,329,780	4,947,020	0	956,898	12,846,000
IV.1 Procurement	191,380	574,139	191,380	0	956,898	956,898
IV.2 Civil Works	2,377,820	4,755,641	4,755,641	0	0	11,889,102
V. UFW/Management/Institution	320,000	960,000	320,000	0	0	1,600,000
V.1 UFW Reduction	280,000	840,000	280,000	0	0	1,400,000
V.2 Manage/Institution	40,000	120,000	40,000	0	0	200,000
Sub-Total of Expansion Component	**10,604,705**	**22,433,790**	**18,980,630**	**1,004,400**	**7,032,898**	**53,023,525**
Rehabilitation + Expansion	**12,472,705**	**27,066,399**	**21,820,021**	**1,004,400**	**11,515,945**	**62,363,525**
VI. Consultancy Services	2,353,200	2,353,200	2,353,200	784,400	0	7,844,000
VI.1 D/D, S/V	1,800,000	1,800,000	1,800,000	600,000	0	6,000,000
VI.2 UFW Reduction	163,200	163,200	163,200	54,400	0	544,000
VI.3 Managment/Institn.	390,000	390,000	390,000	130,000	0	1,300,000
Total of Direct Investment Cost	**14,825,905**	**29,419,599**	**24,173,221**	**1,788,800**	**11,515,945**	**70,207,525**
Other Costs	3,610,280	8,435,447	8,339,226	629,647	0	21,014,600
VII Price Contingency	1,605,632	4,319,301	4,804,005	366,678	0	11,095,617
VII Physical Contingency	1,643,154	3,373,890	2,897,723	215,548	0	8,130,314
IX. Administration Cost	361,494	742,256	637,499	47,421	0	1,788,669
Grand Total	**18,436,185**	**37,855,046**	**32,512,447**	**2,418,447**	**11,515,945**	**91,222,125**

Note: The investment cost in 2012/2022 is for replacement of the procurement installed every ten (10) years
The replacement investment is excluded from "Total Cost".

The estimates of financing requirements need to be made in nominal prices of the year when this financing will be needed. This can be done separately when assumptions on future exchange rates and domestic inflation are made. The cost of imported components is projected to increase by 2% per annum in hard currency. The domestic cost components will increase by the rate of domestic inflation and a component which corresponds to the appreciation in the exchange rate. We have assumed that the domestic inflation and the exchange rate adjustments will be the same. The domestic cost components will increase at the rate of 3% per annum above the rate of inflation. Combined with the hard currency inflation of 2%, the increase in the prices of domestic cost components in hard currency will thus be 5% per annum. These are believed to be fairly cautious estimates that allow for possible cost increases.

Direct investment costs of the project are estimated to be $70.2 million when there is no grant financing available- Base Case (Table 8-6). These investments basically occur over a period of three years in 2000 to 2002. The equipment component of investments will be replaced 10 years after installation. This is indicated by repeating the equipment investments in the year 2012 in Table 8-6.

In the Base Case, external funding will be needed for the investments indicated for the period up the full operation of the supply capacity. Thereafter, auxiliary investments related to the capacity created under this project will be financed by internally generated funds. The equipment replacement costs in year 2012 will be financed from these funds.

The direct investment costs will decline to $60.9 million if the rehabilitation component can be grant financed (Table 8-7). The investment phasing remains unchanged for the loan financed component under this alternative- Case I.

(2) Operating and Maintenance Costs

Three major cost items in that group account for over 80% of total costs. These are: a) electricity for pumping raw and treated water; b) chemicals for water treatment; and c) staff. In the case of power, the incremental costs are incurred for pumping the additional water from the lake. There is also substantial power consumption when the Kogony and Kanyakvar reservoirs are in operation. All of the power consumed in the sewerage treatment plants and for pumping is included in the costs of incremental component.

a. Water Treatment Chemicals

The cost of water treatment chemicals depends on the source of raw water, dosage, unit prices of chemicals and operation plans. The study team collected detailed information on water quality of alternative sources. Two separate dosages are recommended for treating the lake water and the river water. The following dosages are recommended for the water from the two sources:

Unit Price	Alum Input (0.58 US$/kg)	Soda Ash Input (0.29 US$/kg)	chlorine Input (291.0 US$/kg)	Total Cost (US$)
Lake Water 1,000 m^3	60 kg	0	6 kg	1780.8
River Water 1,000 m^3	30 kg	6 kg	3 kg	892.1

The recommended dosage is for the physical product for Alum but for the net content in the case of Chlorine. This is taken into account in calculating the costs of chemicals. For chlorine, the net price is based on the 35% Tropical Chloride of Lime. In Kisumu, the water department actually uses HTH. This costs three times more, on a net basis, than the alternative. (Product price of 517 Kshs/kg for HTH which corresponds to a net price of 795 Kshs/kg. This is 291 Kshs/kg for TLC).

Operation plans effect chemical costs. It costs less to treat river water and water from these sources is used whenever excess capacity is projected. Even when there is excess capacity, the lake water works are kept in operation at a capacity of 10,000 m^3/day. This will maintain that capacity for emergencies and eventual full utilization when demand increases.

Appropriate dozing is also important for cost control. The water department in Kisumu does not exploit these opportunities. In Kajulu, the actual alum use was more than double the recommended amount at 73.6 mg/lt. in 1996. The amount of soda ash used (21.5 mg./lt.) was four times the recommended dosage. Chlorine use was similarly excessive.

The actual practice was unstable in the lake water works. Alum use appears steady and at the recommended dosage. Chlorine use varies from time to time possibly reflecting shifts to substitutes that were not reported. Substantial amounts of soda ash seem to be used though none is recommended. We have based our estimates of costs of treatment chemicals on the recommended dosage and actual prices paid.

The annual cost of treatment chemicals is calculated on the basis of recommended dosage and the amount supplied as shown below.

	Alum Input	Soda Ash Input	Chlorine Input	Annual Cost (US$)
Lake Water (26,400 m^3/d)	1,584 kg/d	0	158 kg/d	615,740
River Water (41,400 m^3/d)	1,242 kg/d	248 kg/d	124 kg/d	508,787
Total				1,124,528

The gross amount of water treated is derived from the net consumption given in Table 8-8 and the projected levels of physical losses. These physical losses are estimated to be 30% in 1997. They remain at that level until the year 2003. Thereafter it declines: to 27.1% in 2010 and to 25% in 2025.

The incremental cost at full development is estimated 616,698 US$/annum based on chemical cost for 5,400 m^3/day of Lake Water and 39,900 m^3/day of River Water.

b. Power Consumption

Unlike the general impression, power is not the single most important component of operating costs. The cost of treatment chemicals is twice as large. Furthermore, power consumption can be substantially reduced by appropriate design to minimize the pump head. Estimates show that the power consumption will be reduced in proportion to the reduction in pump head.

The amount of electricity that will be consumed after rehabilitation is calculated in relation to the pump head, and efficiency of pumps and motors.

The actual cost of electricity charged to the water department was KShs. 5.55/ kWh for the bills in mid-1997. The charge varies depending on the reactive power factor, changes in foreign exchange rate, and fuel costs. We have assumed that the cost of power will remain unchanged in real terms over the financial evaluation period.

As in chemicals, in power the actual consumption was different from our estimates. The amount of power consumed at the intake pumps seems not to be correlated with that of the clean water pumps and the monthly variations in power consumption are not related to the amount of water pumped. There are serious problems either in power or water meters.

Power consumption in Phase I consists of three components: a) raw water from the lake and pumping the treated water to Kibuye reservoir; b) water pumped to Kanyakwar and Kogony reservoirs beginning in year 2003; and finally c) power consumption by the sewerage system.

After completion of the Project, the power consumption is expected to increase to 8,056,000 kWh per annum when 67,800 m^3 per day of water is supplied to Kisumu, as shown below.

	Discharge L/.sec	Head (m)	Electric Energy (kWh/year)
Lake Intake			
Phase I (Reha.) 27,000 m^3/d	105	27.5	1,394,000
Lake Water Treatment Works			
Phase I (Reha.) 25,000 m^3/d	145	80.0	2,938,000
Kinbuye Reservoir			
Phase I (Reha.) 7,600 m^3/d	30	27.5	344,000
for Kanyakwar R. 10,337 m^3/d	60	70	1,316,000
for Kogony R. 9,946 m^3/d	60	80.0	1,266,000
Sewerage System			798,000
		Total:	8,056,000

The incremental cost consists of following costs

- Pumping for the additional water from Lake
  - at Lake Intake (5,800 m^3/d) 299,000 kWh/year
  - at Lake Water Treatment works (5,400 m^3/d) 635,000 kWh/year
- Pumping for Delivery
  - at Kibuye Reservoir for Kanyakwar Reservoir 1,316,000 kWh/year
  - at Kibuye Reservoir for Kogony Reservoir 1,266,000 kWh/year
- Sewerage System 798,000 kWh/year

Total 4,314,000 kWh/year

The incremental consumption thus would be 4,314,000 kWh at full development. This would cost $399,045 with the present tariff of 5.55 Shillings per kWh and the exchange rate of $= 60 shillings. This is the amount indicated at the last column of Table 8-10 for the electricity costs. The costs for the period prior to full capacity utilization is calculated proportionate to the cost at full development.

c. Staff Costs

There were 208 employees of the water/sewerage department as of March 1998. The budgeted gross salary cost of these employees, including allowances and taxes, was K.Shs.15,468,480 for the fiscal year 1997/98. The total cost per employee is thus Shs.74,367/annum (1,239 US$/annum).

A detailed staffing plan has been prepared in the light of the proposed institutional system. According to this plan, the number of employees will increase from 208 in 1998 to 344 in 2005 and 377 in 2015. Staff cost estimates are based on the per employee costs and this staffing plan as shown below.

	Number of Staff	Staff Cost (US$/annum)	Incremental Number of Staff	Incremental Staff Cost (US$/annum)
1998	208	257,712	-	-
2005	344	426,216	136	168,504
2015	377	467,103	169	209,391

d. Other Operating Costs

The three major items are estimated to be 80% of operating costs. Other items include telecommunication, office rent, stationary etc.

e. Maintenance Costs

Project costs (Table 8-5) are specified separately for equipment and civil works. There is no need to replace the civil works for the duration of the life of the project- estimated to be 30 years. It is assumed that equipment will be replaced every 10 and an annual maintenance costs are equal to 1 % of "Total of Direct Investment Costs".

8.3.2 Revenues

The income is estimated from water consumption given in Table 8-8 and revenue parameters, which include charges for water, sewerage and the meter rent.

a. Revenue from Domestic Use

The water charge is based on the proposed tariffs and projected consumption by tariff blocks. The data for the calculation of the effective tariff for residential users is given in Table 8-4. First, consumption in each tariff block is calculated. This is converted into revenue estimates by multiplying with progressive tariffs and adding the meter charge. The total revenue derived from residential sales is divided by the quantity consumed to arrive at the "average effective tariff" for water and meter rent. This is given as Shs. 22.64/ m^3 at the end of Table 8-4 with the present tariffs. Replacing the present tariffs with the proposed tariffs, given in Table 8-3, and increasing the meter rent to the present charge of Shs to 20 shillings/month results in 20.9 Shillings/ cubic meter for the water charge- including the meter rent. The calculation table is shown in Table 8-7.

The sewerage charge needs to be added to that figure to arrive at the total income to be billed by the W/S department. Sewerage charge is 75% of the water bill. It would be 15.67 Shillings/ cubic meter if all consumers were connected to the sewerage system and therefore paid the sewerage charge. This is not the case. Some people who receive tap water do not have sewerage connections and their water does not include a sewerage charge.

For revenue estimation, the relevant parameter is not the proportion of consumers who has sewerage, but the proportion of water consumed by users with access to sewerage. The two can be substantially different.

Information, presented in section 8.1.1, of this report suggest that sewerage revenue was 28.3% of the water revenue in 1977 for households. The implied consumption in households with sewerage connection is 37.67 %. This probably is an underestimate of the present situation. The sewerage coverage will also be expanded under the proposed project. It is therefore, estimated that, as an average for the planning period, 60% of water will be consumed by households with sewerage. The total revenue of the W/S department for water supplied will be 30.3 Shillings per cubic meter of water metered (20.9*0.6*0.75 + 20.9=30.3).

The charge will be slightly less if the base for sewerage bill excludes the meter rent. In this estimate, it is included. The revenue per cubic meter of water metered is thus rounded to be 30.3 shillings per cubic meter.

b. Revenue from Industrial and Commercial Use

Similar analysis is also undertaken for industry/ commerce and institutions. For these, both the basic tariffs are higher and a higher proportion is sewered. As a result, the actual effective average charges are considerably higher. In industry, few large users dominate the total consumption. The estimated base water charge is 49.9 Shillings per cubic meter as shown in Table 8-7. It is assumed that 75% of these will be sewered. This leads to the estimated revenue of 78.0 Shillings per cubic meter of water billed. (49.9 * 0.75 * 0.75 + 49.9 = 78.0)

c. Revenue from Institutions

Analysis similar to those conducted for residential consumption is conducted for institutions. The estimated base water charge is 49.5 Shillings per cubic meter as shown in Table 8-7. This yields unit revenue of 86.6 Shillings with total sewerage coverage. (49.5 * 0.75 + 49.5 =86.6)

d. Total of Incremental Project Expenditures

The unit revenues thus estimated are multiplied with the projected consumption to calculate the revenue. The estimated revenue is converted into US $ equivalent by conversion at the rate of $1= 60 Shillings. The results are presented in Table 8.9.

All of the revenue up to the end of year 2002 is due to the existing capacity. The revenue thereafter is a combined result of the existing capacity and the capacity created through the new project. Subtracting the estimated present revenue from the projected future revenue yields the incremental revenue. This is the income of the new project. This is presented in the last four columns of Table 8-9. The incremental cost and revenue data is summarized in Table 8-10.

Table 8-7 Calculation for Unit Revenue

1. Unit Revenue Calculation for Domestic Use

classified by water amount		Population		Connection		Consumption		* Revenue	
(m3/m.)	Ks/m3/m.	No.	%	No.	%	m3/m	%	Ks/month	%
~10,Min. charge **	100	62,400	22.2	3,837	34.9	28,776	11.0	460,424	8.4
11~20	20	53,500	19.0	3,290	29.9	37,831	14.4	723,717	13.2
21~30	23	23,800	8.5	1,463	13.3	36,586	14.0	636,588	11.6
31~40	30	17,800	6.3	1,094	9.9	38,307	14.6	766,143	14.0
41~50	40	12,700	4.5	781	7.1	39,045	14.9	976,126	17.8
over 60	50	8,696	3.1	535	4.9	32,100	12.2	679,450	12.4
Sub-T		178,896	63.7	11,000	100.0	212,645	81.1	4,242,447	77.4
Common taps ***	25	101,944	36.3			49,501	18.9	1,237,525	22.6
Total		280,840	100.0	11,000	100.0	262,146	100.0	5,479,972	100.0

Ave.: Kshs/m3/m= 20.90

1) Population, Connection, Consumption Value: Present Conditon in 1998
2) Tariff: proposed tariff as shown in Table 8-3

2. Unit Revenue Clculation for Industrial and Commercial Use

Unit		Connec.		Consumption		Revenue
		No.	%	m3/m	%	Ks/month
0						
0~10	300	0	0.0	0	0.0	0
11~20	40	0	0.0	0	0.0	0
21~30	50	0	0.0	0	0.0	0
31~40	50	0	0.0	0	0.0	0
41~50	50	0	0.0	0	0.0	0
over 60	50	188	100.0	714,000	100.0	35,662,400
Total		188	100.0	714,000	100.00	35,662,400

Ave.: Kshs/m3/m= 49.9

1) Tariff: proposed tariff as shown in Table 8-3
2) Connection, Consumption: Estimated by Study Team

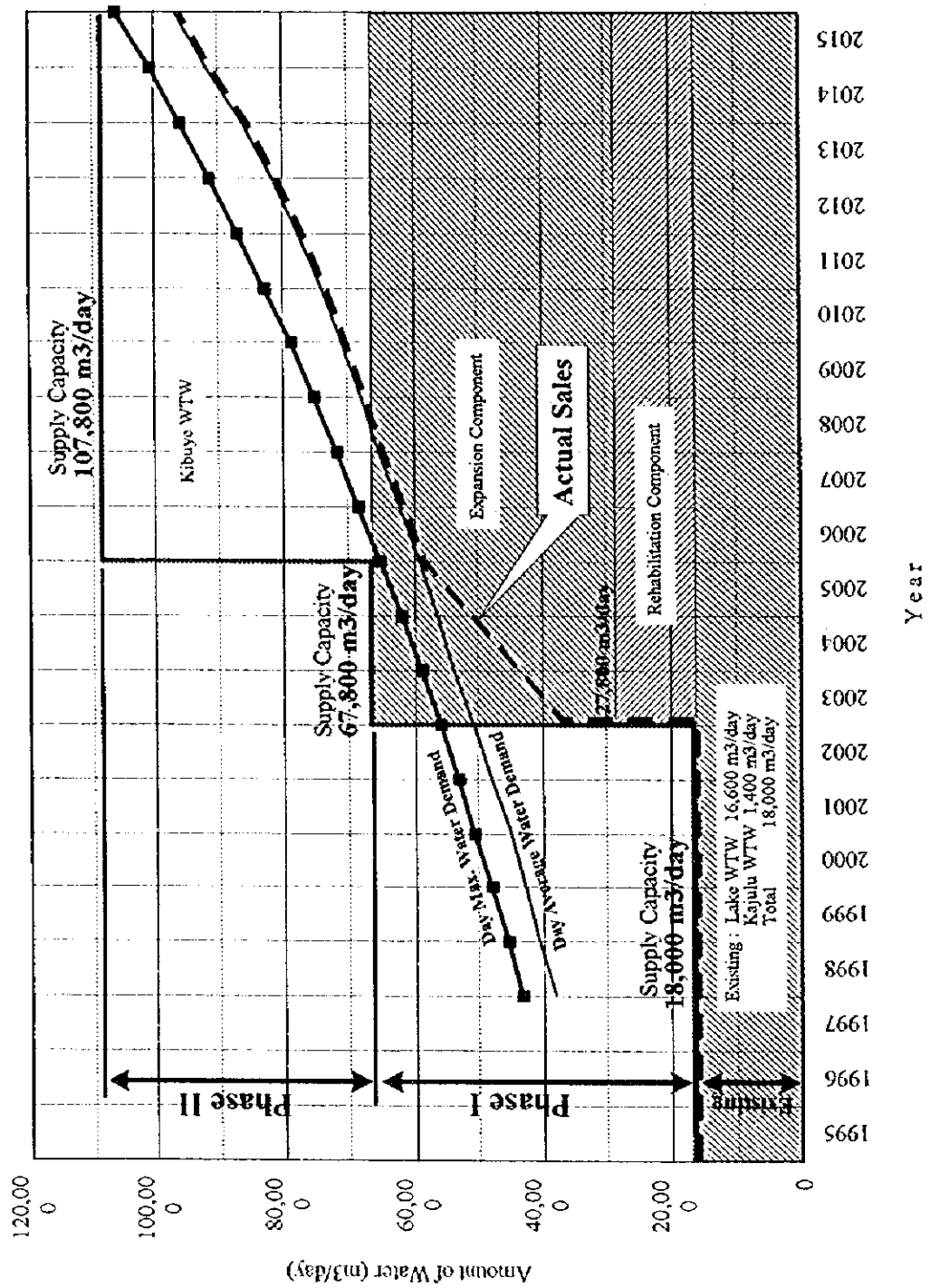
3. Unit Revenue Calculation for Institutions Use

classified by water amount (m3/m.) ~10.Min. charge **		Connec.		Consumption			Revenue	
		No.	%	m3/m Ave.	m3/m Total	%	Ks/m	%
0~10	250	153	45.2	7.5	1,147	0.6	38228	0.4
11~20	30	24	7.2	15.0	363	0.2	9,667	0.1
21~30	40	20	6.0	25.0	503	0.3	12,670	0.1
31~40	50	20	6.0	35.0	704	0.4	25,943	0.3
41~50	50	20	6.0	45.0	905	0.5	36,200	0.4
over 60	50	101	29.8	1,902.6	191,379	98.1	9,523,685	98.7
Total		338	100.0	576.9	195,000	100.0	9,646,393	100.0

Ave.: Kshs/m3/m= 49.47

1) Tariff: proposed tariff as shown in Table 8-3
2) Connection, Consumption: Estimated by Study Team

Figure 8-1



THE REPUBLIC OF KENYA THE MINISTRY OF LOCAL AUTHORITIES KISUMU MUNICIPAL COUNCIL	THE STUDY ON KISUMU WATER SUPPLY AND SEWERAGE SYSTEM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE : Production Capacity, Demand and Sales

Table 8-8 Daily Net Water Consumption (m^3/day)

Year	Dommestic	Commercial	Industrial	Public use	Total
	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
1997	7,497	1,000	3,347	756	12,600
1998	7,497	1,000	3,347	756	12,600
1999	7,497	1,000	3,347	756	12,600
2000	7,497	1,000	3,347	756	12,600
2001	7,497	1,000	3,347	756	12,600
2002	7,497	1,000	3,347	756	12,600
2003	12,387	2,000	5,100	1,344	20,831
2004	17,368	2,000	7,918	1,942	29,228
2005	22,393	2,747	10,000	2,580	37,720
2006	27,498	3,621	12,000	3,252	46,371
2007	28,795	4,315	12,000	3,503	48,613
2008	28,903	4,315	12,051	3,615	48,884
2009	29,013	4,315	12,051	3,737	49,116
2010	29,121	4,315	12,094	3,857	49,387
2011	29,209	4,315	12,171	3,990	49,685
2012	29,340	4,315	12,245	4,123	50,023
2013	29,420	4,315	12,314	4,258	50,307
2014	29,500	4,315	12,370	4,394	50,579
2015	29,525	4,315	12,435	4,575	50,850
2016	29,525	4,315	12,435	4,575	50,850
2017	29,525	4,315	12,435	4,575	50,850
2018	29,525	4,315	12,435	4,575	50,850
2019	29,525	4,315	12,435	4,575	50,850
2020	29,525	4,315	12,435	4,575	50,850
2021	29,525	4,315	12,435	4,575	50,850
2022	29,525	4,315	12,435	4,575	50,850
2023	29,525	4,315	12,435	4,575	50,850
2024	29,525	4,315	12,435	4,575	50,850
2025	29,525	4,315	12,435	4,575	50,850
2026	29,525	4,315	12,435	4,575	50,850
2027	29,525	4,315	12,435	4,575	50,850
2028	29,525	4,315	12,435	4,575	50,850
2029	29,525	4,315	12,435	4,575	50,850
2030	29,525	4,315	12,435	4,575	50,850

1) Increacement of "Daily Net Water Consumption" since 2007 is caused by implementation of Unaccounted-for Water Reduction Program

Table 8-9 Total and Incremental Water and Sewerage Revenue

Year	Total Sales (1,000 US$/Year)				Incremental Sales (1,000 US$/Year)			
	Domestic	Industry & Commercial	Institutions	Total	Domestic	Industry	Industry & Commercial	Total
1997	1,381.9	2,062.7	398.3	3,842.8				
1998	1,381.9	2,062.7	398.3	3,842.8				
1999	1,381.9	2,062.7	398.3	3,842.8				
2000	1,381.9	2,062.7	398.3	3,842.8				
2001	1,381.9	2,062.7	398.3	3,842.8				
2002	1,381.9	2,062.7	398.3	3,842.8				
2003	2,283.2	3,369.0	707.9	6,360.1	901.3	1,306.3	309.6	2,517.2
2004	3,201.4	4,706.1	1,023.3	8,930.7	1,819.5	2,643.4	625.0	5,087.8
2005	4,127.6	6,048.5	1,359.2	11,535.2	2,745.7	3,985.8	960.9	7,692.3
2006	5,068.6	7,412.2	1,713.3	14,194.0	3,686.7	5,349.5	1,315.0	10,351.1
2007	5,307.6	7,741.5	1,845.3	14,894.4	3,925.7	5,678.8	1,447.0	11,051.5
2008	5,327.5	7,765.7	1,904.3	14,997.5	3,945.6	5,703.0	1,506.0	11,154.6
2009	5,347.8	7,765.7	1,968.8	15,082.3	3,965.9	5,703.0	1,570.5	11,239.4
2010	5,367.7	7,786.1	2,032.1	15,185.9	3,985.8	5,723.4	1,633.8	11,343.0
2011	5,383.9	7,822.6	2,101.8	15,308.3	4,002.0	5,759.9	1,703.5	11,465.4
2012	5,408.1	7,857.7	2,172.1	15,437.9	4,026.2	5,795.0	1,773.8	11,595.0
2013	5,422.8	7,890.5	2,243.2	15,556.5	4,040.9	5,827.8	1,844.9	11,713.6
2014	5,437.6	7,917.0	2,314.8	15,669.5	4,055.7	5,854.3	1,916.5	11,826.6
2015	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2016	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2017	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2018	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2019	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2020	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2021	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2022	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2023	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2024	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2025	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2026	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2027	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2028	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2029	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4
2030	5,442.2	7,947.9	2,410.2	15,800.3	4,060.3	5,885.2	2,011.9	11,957.4

1) Total Sales Amount is calculated base on "Daily Net Water Comsumption" as shown in Table 8-8 and the assumed unit water prices are shown as below.

2) The assumed unit prices are calculated in Section 8.3.2.

Domestic: 30.3 Kshs/m3, Industry and Commercial: 78.0 Kshs/m^3, Institutions: 86.6 Kshs/m^3

Table 8-10 Operating Revenue and Expenditures of the Water & Sewerage Department

(1,000 US$/year)

Year	Incremental Water and Sewerage Revenue				Incremental Project Expenditures						Operating Surplus
	Dome-stic	Ind. And Com.	Institu-tions	Total Revenue	Chemi-cals	Elec.	Staff	Other costs	Maintena nce Cost	Total Expen.	
1997											
1998											
1999											
2000											
2001											
2002											
2003	901.3	1,306.3	309.6	2,517.2	141.0	91.2	168.5	100.2	148.3	649.1	1,868.06
2004	1,819.5	2,643.4	625.0	5,087.8	284.7	184.2	168.5	159.4	442.5	1,239.3	3,848.50
2005	2,745.7	3,985.8	960.9	7,692.3	430.2	278.3	168.5	219.2	284.2	1,380.4	6,311.91
2006	3,686.7	5,349.5	1,315.0	10,351.1	578.3	374.2	172.6	281.3	702.1	2,108.4	8,242.67
2007	3,925.7	5,678.8	1,447.0	11,051.5	616.7	399.0	176.7	298.1	702.1	2,192.6	8,858.96
2008	3,945.6	5,703.0	1,506.0	11,154.6	616.7	399.0	180.8	299.1	702.1	2,197.7	8,956.96
2009	3,965.9	5,703.0	1,570.5	11,239.4	616.7	399.0	184.9	300.1	702.1	2,202.8	9,036.55
2010	3,985.8	5,723.4	1,633.8	11,343.0	616.7	399.0	189.0	301.2	702.1	2,207.9	9,135.13
2011	4,002.0	5,759.9	1,703.5	11,465.4	616.7	399.0	193.0	302.2	702.1	2,213.0	9,252.42
2012	4,026.2	5,795.0	1,773.8	11,595.0	616.7	399.0	197.1	303.2	702.1	2,218.1	9,376.84
2013	4,040.9	5,827.8	1,844.9	11,713.6	616.7	399.0	201.2	304.2	702.1	2,223.3	9,490.34
2014	4,055.7	5,854.3	1,916.5	11,826.6	616.7	399.0	205.3	305.3	702.1	2,228.4	9,598.19
2015	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2016	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2017	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2018	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2019	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2020	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2021	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2022	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2023	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2024	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2025	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2026	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2027	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2028	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2029	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88
2030	4,060.3	5,885.2	2,011.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.88

1) Values of "Incremental Water and Sewerage Revenue" come from Table 8-9.
2) Breakdown of "Incremental Project Expenditures" are shown in Section 8.3.1 (2) Operation and Maintenance Costs.
3) Annual Maintenance Cost is assumed 1 % of Direct Investment Costs of the Project

8.4 SOURCES OF FINANCE AND CREDIT COSTS

8.4.1 Financing Requirements

It is expected that the physical investments foreseen under this project will commence at the beginning of the year 2000 and will be completed by the end of 2003. The bulk is scheduled for completion by the beginning of the year 2003 when the water from the new investment will become available. Foreign resources are planned to finance 85% of the total project costs in any given year, or a total of $77.5 million as shown below.

Year	Total investment	Foreign loan	Domestic loan
2000	18,436.2	15,670.8	2,765.4
2001	37,855.0	32,176.8	5,678.2
2002	32,512.4	27,635.5	4,876.9
2003	2,418.4	2,055.6	362.8
Total	91,222.0	77,538.7	13,683.3

There are two types of financing being considered for the project. In the base case, which represents the most likely scenario, the project is all loan financed: 85% of the project by an OECF loan and 15% by a loan from the Central Government of Kenya. The total loan financing needed in this case will be $91.2 million before the financing charges.

The actual financial obligations to the external funding source will be slightly higher, because the project can not repay the interest charges during the investment period. These charges are capitalized as shown in Table 8-11. The calculations of interest charges assume that the foreign loan is made available at the beginning of the year when expenses are incurred. Repayment of both the interest and the principal is due at the end of calendar year.

In the other case, the rehabilitation component of the project will be grant financed. The expansion component will be financed in the same manner as in the Base Case. With partial grant financing, the financial IRR improves substantially. The unit costs of rehabilitation are similar to the overall project. Excluding the grant component from the costs and deducting the revenue due to the rehabilitation component will produce results that are similar to the overall project.

8.4.2 Foreign Finance

The government of Kenya has expressed its intention to apply for an OECF loan to finance the project. It is assumed that OECF will finance up to 85% of the project costs. The rest will be financed jointly by the central government and the Municipal Council of Kisumu.

In the past, even the budgetary allocations were extended as loans. The conduit for these loans was the Local Government Loan Agency. This agency is now defunct. It is conceivable that the central government contribution may also be extended as a grant. The government contribution will also be a loan and will carry the same conditions as the OECF loan.

The hard currency loan will be made to the Government of Kenya. The government will guarantee the loan repayment and will bear the exchange rate risk on the Yen denominated loan. It will make the local currency equivalent of the loan proceeds available to the project.

The on-lending will be in Shillings. The interest rate on these loans was recently increased from 6.5 to 8.5 percent per annum. Against this interest charge, the government will bear the exchange risk. The real interest rate will become negative if the domestic inflation during the loan period exceeds 8.5%. It will be real to the extent that the rate of inflation will decline below the interest rate charged by the government.

At this stage, we have not attempted projections of the domestic inflation rate. Instead we have assumed that real interest rate will be the same as that charged by the OECF. The regular OECF interest rate is 1.8% per annum for ordinary projects. The interest cost is 0.75% for environmental projects. The lower rate may apply only to the sewerage component. A weighted average interest rate of 1.6% is assumed. This is based on the share of sewerage component in the total costs and the rate that applies to each component.

The loan is assumed to have a grace period of 10 years and a repayment period of 20 years. Interest is paid during the grace period. For the construction period, it is assumed that interest will be capitalized: i.e. it is added to the cost of fixed investments and not actually paid. The project begins to generate operating surpluses in the year 2004. It will begin paying interest on the foreign currency loan at that time.

8.4.3 Domestic finance

The domestic financing requirements over the investment period will be $3.4 million per annum. This will be a central government loan to Kisumu council extended through MOLA. This loan carries the same interest and repayment terms as the foreign loan.

The volume of domestic funding required by the project is considered to be easily manageable. MOLA has just finished the major expansions in Nairobi water supply. It indicates that there are no other major projects for which the resources available to the Ministry are committed. The funding requirements of Kisumu are within the limits of financial resources available to the Ministry.

Cash flow projections show that the project will be able service both loans (Table 8-14). There will be a small surplus left after loan servicing. This surplus is relatively large initially when the repayment of the principal has not yet started. This can be used to finance some of the system expansion components that are planned for Phase II project.

8.5 PROJECT BENEFITS AND PROFITABILITY

The same convention for the present and additional components applies to costs as well. The incremental revenue due to the expansion project is presented in Table 8-10. This operating surplus is the positive cash flow generated by the project. The future revenue of the W/S is calculated on the basis of proposed tariffs, water demand and incremental supply capacity. The present and projected consumption of households, industry/commerce and institutions is given in Table 8-8. Each of these users has a different tariff.

The output of this project is allocated to the end users on the basis of demand analysis presented in Chapter 3 of this report. For purposes of revenue estimation, consumption is related to the supply capacity by using water loss ratios, which are projected to decline from 30% in 1997 to 25% in 2015.

Initially, when the demand far exceeds the supply capacity, all of the existing capacity is fully utilized. Beginning in year 2003, the supply capacity is above the total demand for a few years (Figure 8-1). The demand rather than the supply capacity determine the total amount of water that can be sold during that period. All of the excess capacity is assigned to the new investment while the existing capacity is continuously operated. This causes an underestimate in the revenue for the new project in the period 2003-2006.

One more modification is made in the revenue estimated for this period. In 2003, the total net demand is 32,774 cubic meters per day. The supply capacity that comes on stream that year exceeds this and all of the demand can be met. Yet, for revenue purposes, we have assumed sales of only 20,000 cubic meters that year. This derives from our concern that it will take some time to fully install all components of the supply system (including the distribution network and individual connections) to actually deliver the water. The estimated amount of water that may be sold is indicated by the line "actual sales" in Figure 8-1.

Initial capital investments and the replacement costs are matched with these surpluses in Table 8-10. The financial IRR derived from the data given in Table 8-11 is 6.45%. This is the financial IRR for the Base Case. All investments in this case are credit financed.

In practice, the W/S department will not operate two distinct components but a single facility. It is assumed that the income from the existing capacity will be transferred to the Council accounts. The calculation of the revenue from this capacity should take into account, and will be conditional on, improvements in technical efficiency. The Council staff is in the process of formulating these parameters.

It is suggested that the contribution to the council revenue from the existing capacity should be based on a figure net of all costs. It should also be expressed as the equivalent of revenue from sale of a certain amount of water. This will maintain the level of Council income in real terms. It may also encourage the Council to approve upward tariff adjustments, as this will increase its income as well.

8.5.1 Prices

The project financial analyses are conducted in 1997 fixed base year prices. This convention avoids the need for projections of price and tariff changes. The analyses capture a situation where the changes in domestic prices are fully reflected in the tariff adjustments. The possible increases in fixed investment costs, however, are included in the investment cost estimates.

There is a need to project the current prices for the estimates of actual cash requirements during the project implementation. Financing requirements are stated in current prices for that purpose. We have assumed that the nominal price changes will be 2% for the hard currency components of the project. Local costs are projected to increase by 3% above the rate of inflation- or by 5% per annum in hard currency. This would imply considerable appreciation in the exchange rate of Shilling. These assumptions on the nominal price changes are built into cost estimates. The

contingencies for the likely price changes are $10.9 million during the three years of project implementation.

The details of annual revenues and expenditures under these assumptions are presented in Table 8-10. As expected, the annual operating costs are a small proportion of the revenue. Because of the capital-intensive nature of the project, the project viability is essentially determined by the investment costs.

The project generates substantial operating surpluses at full development. The projections indicate that the project will start to generate operating surpluses in 2003 and reach about 9.7 million US$/annum at full capacity utilization. The loan service requirement at its peak (year 2010 in Table 8-12) is about 6.3 million US$/annum. The operating surplus at that time is about 9.7 million US$/annum. This is sufficient to service the proposed domestic and foreign loan.

8.5.2 Financial Internal Rate of Return

The measures of IRR used in this project are derived from modified financial data that is normally incorporated in economic but not financial analysis. This confusion derives from government policy on taxes. The project costs exclude all import duties and VAT. This is normally done in economic but not in financial analysis. The operating costs, on the other hand, include all taxes. The exemption from import duties and VAT applies to all externally financed projects. This does not change whether the funds are loan or grant. The fixed investment costs thus do not change between economic and financial analysis.

The estimates of IRR are based on the column "operating surplus" given in Table 8-10. The cash out-flow includes the equipment replacement indicated for the year 2012/2022 in Table 8-6. The period considered for analysis is 30 years. No scrap value is included in cash-in stream either for equipment or other fixed assets. The IRR is 6.45 % in the Base Case as shown in Table 8-11.

Table 8-11 Data for Financil IRR Calculations

(1,000 US$)

	Invest-ments	Revenue	Incremental Project Costs						Operating Surplus	Net cash
			Chemi-cals	Elec.	Staff	Other costs	Main-tenance	Total		
1998										
1999										
2000	18,436.2									(18,436.2)
2001	37,855.0									(37,855.0)
2002	32,512.4									(32,512.4)
2003	2,418.4	2,517.2	141.0	91.2	168.5	100.2	148.3	649.1	1,868.1	(550.3)
2004		5,087.8	284.7	184.2	168.5	159.4	442.5	1,239.3	3,848.5	3,848.5
2005		7,692.3	430.2	278.3	168.5	219.2	284.2	1,380.4	6,311.9	6,311.9
2006		10,351.1	578.3	374.2	172.6	281.3	702.1	2,108.4	8,242.7	8,242.7
2007		11,051.5	616.7	399.0	176.7	298.1	702.1	2,192.6	8,859.0	8,859.0
2008		11,154.6	616.7	399.0	180.8	299.1	702.1	2,197.7	8,957.0	8,957.0
2009		11,239.4	616.7	399.0	184.9	300.1	702.1	2,202.8	9,036.6	9,036.6
2010		11,343.0	616.7	399.0	189.0	301.2	702.1	2,207.9	9,135.1	9,135.1
2011		11,465.4	616.7	399.0	193.0	302.2	702.1	2,213.0	9,252.4	9,252.4
2012	11,515.9	11,595.0	616.7	399.0	197.1	303.2	702.1	2,218.1	9,376.8	(2,139.1)
2013		11,713.6	616.7	399.0	201.2	304.2	702.1	2,223.3	9,490.3	9,490.3
2014		11,826.6	616.7	399.0	205.3	305.3	702.1	2,228.4	9,598.2	9,598.2
2015		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2016		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2017		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2018		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2019		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2020		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2021		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2022	11,515.9	11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	(1,792.0)
2023		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2024		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2025		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2026		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2027		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2028		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2029		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
2030		11,957.4	616.7	399.0	209.4	306.3	702.1	2,233.5	9,723.9	9,723.9
Economic IRR										6.45%

1) Values of "Investments" come from Table 8-6
2) Values of "Revenue" and "Incremental Project Expenditures" come from Table 8-10

Table 8-12 Cash Flow and Loan Service

(in thousand 1997 current dollars)

Year	Fixed investment	Loans received.				Repayment		Operating Surplus	Net Cash
		Foreign	Domestic	Interest Capitalized	Loan Outstanding	Repayment of Principal	Interest		
1997									
1998									
1999									
2000	18,436.2	15,670.8	2,765.4	295.0	18,731.2				
2001	37,855.0	32,176.8	5,678.3	905.4	57,491.6				
2002	32,512.4	27,635.5	4,876.9	1,440.1	91,444.0				
2003	2,418.4	2,055.6	362.8	1,501.8	95,364.2			1,868.1	1,868.1
2004					95,364.2		1,525.8	3,848.5	2,322.7
2005					95,364.2		1,525.8	6,311.9	4,786.1
2006					95,364.2		1,525.8	8,242.7	6,716.8
2007					95,364.2		1,525.8	8,859.0	7,333.1
2008					95,364.2		1,525.8	8,957.0	7,431.1
2009					95,364.2		1,525.8	9,036.6	7,510.7
2010					90,596.0	4,768.2	1,525.8	9,135.1	2,841.1
2011					85,827.8	4,768.2	1,449.5	9,252.4	3,034.7
2012	11,515.9				81,059.6	4,768.2	1,373.2	9,376.8	3,235.4
2013					76,291.4	4,768.2	1,297.0	9,490.3	3,425.2
2014					71,523.2	4,768.2	1,220.7	9,598.2	3,609.3
2015					66,755.0	4,768.2	1,144.4	9,723.9	3,811.3
2016					61,986.7	4,768.2	1,068.1	9,723.9	3,887.6
2017					57,218.5	4,768.2	991.8	9,723.9	3,963.9
2018					52,450.3	4,768.2	915.5	9,723.9	4,040.2
2019					47,682.1	4,768.2	839.2	9,723.9	4,116.5
2020					42,913.9	4,768.2	762.9	9,723.9	4,192.8
2021					38,145.7	4,768.2	686.6	9,723.9	4,269.0
2022	11,515.9				33,377.5	4,768.2	610.3	9,723.9	4,345.3
2023					28,609.3	4,768.2	534.0	9,723.9	4,421.6
2024					23,841.1	4,768.2	457.7	9,723.9	4,497.9
2025					19,072.9	4,768.2	381.5	9,723.9	4,574.2
2026					14,304.6	4,768.2	305.2	9,723.9	4,650.5
2027					9,536.4	4,768.2	228.9	9,723.9	4,726.8
2028					4,768.2	4,768.2	152.6	9,723.9	4,803.1
2029					-		76.3	9,723.9	9,647.6
2030							-	9,723.9	9,723.9

1) Valu of "Operating Surplus" come from Table 8-11.

2) "Net Cash" is the value of "Repayment" subtracted from "Operating Surplus"

8.5.3 Economic IRR

Project economic analysis is based on the same data as the financial calculations. The difference between the two is the treatment of taxes, subsidies and shadow pricing of some inputs.

In Kenya, imported equipment financed by foreign loans or grants is exempted from all customs duties and taxes. Import taxes are therefore excluded both in financial as well as economic analysis. The other significant tax is the 16% value added tax charged to water treatment chemicals. This tax is included in financial costs but is deducted from costs given in table 8-10. The economic costs thus derived for chemicals are given in Table 8-13.

For labor, the financial costs given in Table 8-10 include net salary, taxes, and social charges. For financial analysis, 75% is added to the base salary to derive the gross costs. The payroll tax should be excluded from these charges to arrive at economic costs. This varies with salary grade. For economic analysis, we have simplified the calculation by taking half of the added charges as taxes and transfers. This corresponds to 21.4% of the staff costs given in Table 8-10. The staff costs in Table 8-13 is thus 78.6% of those used for financial analysis.

Two items could be shadow priced for economic analysis. One would be to assume that the shadow price of unskilled labor is zero: i. e. the alternative to employing these people is open unemployment. In this case, we would exclude the cost of unskilled workers from project economic analysis.

The other possibility is to shadow price the foreign exchange. If government exchange controls lead to appreciation of the foreign exchange, the cost of imported machinery is increased by an adjustment factor. Kenya has substantially liberalized its foreign exchange market and this correction is not considered to be significant. The shadow pricing of the unskilled workers and the foreign exchange is thus not done in this study.

No explicit subsidies are provided to the water/sanitation sector in Kenya. Therefore, no adjustment is needed for that purpose. Similarly, adjustments in the output prices are not needed. Prices used in both financial and economic analysis are market determined. This implies that the large users have the option to develop their own sources of supply if they choose to do so.

Table 8-13 Data for Economic IRR Calculations

(1,000 US$)

	Invest-ments	Revenue	Incremental Project Costs						Operating Surplus	Net cash
			Chemi-cals	Elec.	Staff	Other costs	Main-tenance	Total		
1998										
1999										
2000	18,436.2									(18,436.2)
2001	37,855.0									(37,855.0)
2002	32,512.4									(32,512.4)
2003	2,418.4	2,517.2	121.5	91.2	132.4	86.3	148.3	579.7	1,937.4	(481.0)
2004		5,087.8	245.5	184.2	132.4	140.5	442.5	1,145.2	3,942.7	3,942.7
2005		7,692.3	370.8	278.3	132.4	195.4	284.2	1,261.2	6,431.1	6,431.1
2006		10,351.1	498.5	374.2	135.7	252.1	702.1	1,962.5	8,388.5	8,388.5
2007		11,051.5	531.6	399.0	138.9	267.4	702.1	2,039.0	9,012.6	9,012.6
2008		11,154.6	531.6	399.0	142.1	268.2	702.1	2,043.0	9,111.6	9,111.6
2009		11,239.4	531.6	399.0	145.3	269.0	702.1	2,047.0	9,192.3	9,192.3
2010		11,343.0	531.6	399.0	148.5	269.8	702.1	2,051.0	9,292.0	9,292.0
2011		11,465.4	531.6	399.0	151.7	270.6	702.1	2,055.1	9,410.4	9,410.4
2012	11,515.9	11,595.0	531.6	399.0	154.9	271.4	702.1	2,059.1	9,535.9	(1,980.0)
2013		11,713.6	531.6	399.0	158.2	272.2	702.1	2,063.1	9,650.5	9,650.5
2014		11,826.6	531.6	399.0	161.4	273.0	702.1	2,067.1	9,759.4	9,759.4
2015		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2016		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2017		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2018		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2019		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2020		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2021		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2022	11,515.9	11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	(1,629.7)
2023		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2024		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2025		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2026		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2027		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2028		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2029		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
2030		11,957.4	531.6	399.0	164.6	273.8	702.1	2,071.1	9,886.2	9,886.2
Economic IRR										6.61%

1) "Chemical Costs" is the value of "Chemical Costs in Financial IRR Calculation" devided by 1.16, because of 16% tax.
2) "Staff Costs" is 78.6% of "Staff Costs in Financial IRR Calculation"
3) "Electric Costs" and "Maintenance Costs" are not changed

Adjustments in output prices are not needed for tax purposes either. In Kenya, value added tax is not charged for water and sanitation services. The output prices and the revenues are thus the same for both financial and economic analysis. Similarly, the water undertakers, whether they are private or publicly owned, are exempt from corporate income tax.

The costs and revenues used in economic analysis are given in Table 8-13. The economic IRR calculated from this data is 6.61%. This is very close to the financial analysis calculated for the comparable case (Base case): 6.45%. The slight improvement in the economic IRR, compared with the financial IRR, is due to reductions in operating costs. These have a small impact on the base IRR estimates.

8.5.4 Benefit/ Cost ratio

The benefit cost ratio exceeds 1.0 if the discount rate is lower than the estimated IRR. The estimated IRR, of course, makes the discounted benefits equal to the costs.

The appropriate discount rate is very high if the project is funded by internal funds in Kenya. At present inflation is around 10% while the prime lending rate varies from 24 to 26 percent. The real rate of interest (net of inflation) is 11.3% for the 24% prime rate. This is the limit on the possible discount rate to be used for the short term. This is very high and reflects the severe economic conditions prevailing at present.

On the low side, the discount rate is the rate of interest that the government of Kenya will pay to the external funding agencies. This rate can be less than 1% for environmentally motivated projects. We have calculated two B/C ratios for the base case financial analysis corresponding to two discount rates as given below. The data for these estimates is given in Table 8-14.

	Benefit/ Cost ratio
Discount rate 7%	0.96
Discount rate 2%	1.72

The costs exceed the project benefits in the first case. The excess of costs over benefits can be justified even in this case, because the project provides a basic need (water) and improves the environmental conditions with consequent positive impacts on health and other social benefits.

Table 8-14 Data for Financial Benefit / Cost Calculations

(1,000 US$)

	Base Case		Discount Rate:2%		Discount Rate:7%	
	Invest-ments	Operating Surplus	Costs	Benefits	Costs	Benefits
1998						
1999						
2000	18,436.2		18,436.2		18,436.2	
2001	37,855.0		37,112.7		35,378.5	
2002	32,512.4		31,249.9		28,397.6	
2003	2,418.4	1,937.4	2,278.9	1,825.7	1,974.1	1,581.5
2004		3,942.7		3,642.4		3,007.8
2005		6,431.1		5,824.9		4,585.3
2006		8,388.5		7,448.8		5,589.6
2007		9,012.6		7,846.0		5,612.6
2008		9,111.6		7,776.7		5,303.1
2009		9,192.3		7,691.7		5,000.0
2010		9,292.0		7,622.7		4,723.6
2011		9,410.4		7,568.4		4,470.8
2012	11,515.9	9,535.9	9,080.2	7,519.0	5,113.2	4,234.1
2013		9,650.5		7,460.1		4,004.6
2014		9,759.4		7,396.4		3,784.9
2015		9,886.2		7,345.6		3,583.2
2016		9,886.2		7,201.6		3,348.8
2017		9,886.2		7,060.4		3,129.7
2018		9,886.2		6,921.9		2,925.0
2019		9,886.2		6,786.2		2,733.6
2020		9,886.2		6,653.1		2,554.8
2021		9,886.2		6,522.7		2,387.7
2022	11,515.9	9,886.2	7,448.9	6,394.8	2,599.3	2,231.5
2023		9,886.2		6,269.4		2,085.5
2024		9,886.2		6,146.5		1,949.0
2025		9,886.2		6,026.0		1,821.5
2026		9,886.2		5,907.8		1,702.4
2027		9,886.2		5,792.0		1,591.0
2028		9,886.2		5,678.4		1,486.9
2029		9,886.2		5,567.1		1,389.6
2030		9,886.2		5,457.9		1,298.7
Total			105,606.9	181,354.1	91,898.9	88,116.8
Benefit Cost Ratio				1.72		0.96

8.5.5 Loan Requirements and the Repayment Schedule

The maximum cash deficit in this project is reached in year 2003 (Table 8-14). Thereafter, the project generates sufficient revenue to cover costs and service the required loan.

All of the project is loan financed. The loan extended in any year is assumed dispersed at the beginning of the year and carries a weighted average interest rate of 1.6% per annum. This interest is capitalized during construction to derive the total loan outstanding. (Table 8-14).

The repayment of the principal starts in the year 2010. At that time, the total loan service is about 6.3 million US$/annum. The operating surplus generated by the project at that time is about 9.7 million US$/annum. The project is thus not only able to service the loan but also generates a surplus to finance the system expansion.

8.5.6 Project Risks and Sensitivity Analysis

For externally financed projects, the most important risk is normally related to the changes in exchange rates relative to the domestic price changes. Rapid devaluation increase the loan service requirements when the project earnings are in local currency but the project has to service a foreign currency denominated loan. For this project, this risk is born by the central government.

At a technical level, there are three major risks facing the proposed project. First, the revenue increase may be less than the increase in cost and general price level because of the unwillingness or inability to adjust the tariffs. Second, the actual cost may still exceed the estimates, although substantial contingencies are included in cost estimates. Finally, the Council may not be able to sell all the water it produces within the assumed schedule.

The impact of each of these on project IRR is given below.

a. Revenues are 80 % of the Base Case

Estimating the W/S revenue at 80% of the base case revenue simulates lack of sufficient adjustments in tariffs in the face of domestic inflation. This revenue shortfall could also occur if the unaccounted for water is not reduced as projected. Constantly collecting less revenue than the amount billed and a host of other factors will have a similar impact on the project revenues.

b. Costs Exceed the estimates by 20 %

Increasing the project investment costs by 20% without changing the investment schedule simulates cost overruns. These additional costs may be due to unforeseen investment cost components, domestic inflation, and appreciation in the exchange rate. This last will increase the local currency equivalent of the foreign loan by an amount less than the requirements of inflation.

c. Sale of Full Capacity Water Delayed by Two Years

The inability of the W/S department to sell all the water it produces at the indicated prices is simulated by delaying the project income by 2 years. This would occur also if there are delays in completing key system components. These would delay revenue while the expenditure schedule is not altered in a major way.

d. Partial Grant Financing

The impact of two other special cases is also investigated. Due to the severe water shortage in Kisumu, there is some possibility that emergency actions, for components included in this project, will be taken before this project is implemented. In this case, the cost of these components will be excluded from the loan financed part. This is refereed to as the case of "partial grant financing".

	Financial IRR
Base Case	6.45%
a. Revenues are 80% of the base case	3.95%
b. Costs exceed the estimates by 20%	4.98%
c. Sale of full capacity water delayed by two years	5.18%
d. Partial grant financing	7.69%

(The Data for these estimates are given in Table 8-15)

Table 8-15 Sensitivity Analysis

	Base Case			Revenues are 80% of base case			Investment costs up by 20%			2 years Delay in project completion			Partial grant financing		
	Invest-ments	Operating Surplus	Net Cash	Invest-ments	Operating Surplus	Net Cash	Invest-ments	Operating Surplus	Net Cash	Invest-ments	Operating Surplus	Net Cash	Invest-ments	Operating Surplus	Net Cash
1998															
1999															
2000	18,436	0	(18,436)	18,436		(18,436)	22,123		(22,123)	18,436		(18,436)	16,098	0	(16,098)
2001	37,855	0	(37,855)	37,855		(37,855)	45,426		(45,426)	37,855		(37,855)	31,887	0	(31,887)
2002	32,512	0	(32,512)	32,512		(32,512)	39,015		(39,015)	32,512		(32,512)	28,623	0	(28,623)
2003	2,418	1,868	(550)	2,418	1,365	(1,054)	2,902	1,868	(1,034)	2,418		(2,418)	2,418	1,868	(550)
2004		3,848	3,848		2,831	2,831		3,848	3,848			-		3,848	3,848
2005		6,312	6,312		4,773	4,773		6,312	6,312		1,868	1,868		6,312	6,312
2006		8,243	8,243		6,172	6,172		8,243	8,243		3,848	3,848		8,243	8,243
2007		8,859	8,859		6,649	6,649		8,859	8,859		6,312	6,312		8,859	8,859
2008		8,957	8,957		6,726	6,726		8,957	8,957		8,243	8,243		8,957	8,957
2009		9,037	9,037		6,789	6,789		9,037	9,037		8,859	8,859		9,037	9,037
2010		9,135	9,135		6,867	6,867		9,135	9,135		8,957	8,957		9,135	9,135
2011		9,252	9,252		6,959	6,959		9,252	9,252		9,037	9,037		9,252	9,252
2012	11,516	9,377	(2,139)	11,516	7,058	(4,458)	11,516	9,377	(2,139)	11,516	9,135	(2,381)	11,516	9,377	(2,139)
2013		9,490	9,490		7,148	7,148		9,490	9,490		9,252	9,252		9,490	9,490
2014		9,598	9,598		7,233	7,233		9,598	9,598		9,377	9,377		9,598	9,598
2015		9,724	9,724		7,332	7,332		9,724	9,724		9,490	9,490		9,724	9,724
2016		9,724	9,724		7,332	7,332		9,724	9,724		9,598	9,598		9,724	9,724
2017		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2018		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2019		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2020		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2021		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2022	11,516	9,724	(1,792)	11,516	7,332	(4,183)	11,516	9,724	(1,792)	11,516	9,724	(1,792)	11,516	9,724	(1,792)
2023		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2024		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2025		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2026		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2027		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2028		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2029		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724		9,724	9,724
2030		9,724	9,724		7,332	7,332		9,724	9,724		9,724	9,724			
		IRR	6.45%			3.95%			4.98%			5.18%			7.69%

1) Values of "Investments" on "Base Case" come from Table 8-6
2) Values of "Investments" on "Partial grant financing" come from Table 14 in Appendix (L)
3) Values of "Operating Surplus" on Base Case come from Table 8-10
4) Values of "Operating Surplus" on "Revenues are 80 % of base case" are calculated based on Total Revenues and Total Expenditues in Table 8-10