6.6 PUBLIC PARTICIPATION AND EDUCATION

6.6.1 Measures for Public Participation

Public participation is essential in the following stages of implementation

- Common taps

  By involving the users, mainly women, in the selection of locations for common taps and their operation, awareness of community on the importance of common taps could be improved and vandalism could be avoided. Sustained use of common taps and maintenance of its surroundings etc. can also be improved by taking into account of the needs and wishes of the users. Existing contacts through community elder's meetings (Mzee's Barazzas) can be used as communication channel with the community. This exercise need to be done before detailed designs are carried out, through the proposed customer relations section of the Water and Sewerage Department.

- rural water supplies

  Since, communities will be entrusted to operate and maintain the rural water supplies, their involvement is required in planning, design and construction as well. In the field surveys, communication with community organisations (Church, water committee etc.) was already made with existing community organisations and should be continued by the KMC especially through Water and Sewerage Department.

  Location of facilities and the type of facilities to be built should be discussed and agreed with the respective community before decisions are made. Description including sketches of alternative facilities and their explanation shall be made in simple language.

6.6.2 Measures for Public Information and Education

Objectives of the public information and education are as follows:

- to overcome the negative image of water and sewerage services
- to create awareness on the importance of water environment related to water supply and sewerage
- to request cooperation of consumers to report leaks and to conserve water
- to educate industries especially small-scale industries (Jua-Kalis) on the use of sewers
- to create awareness that sewers are not to be used as dustbin

(1) Overcome Negative Image of Water and Sewerage Services

Poor water and sewerage service has resulted in negative image of the Water and Sewerage Department and KMC. Though, the judgement of users on water and sewerage services will be ultimate, they shall also be informed on the efforts that will be taken by KMC and the major issues related to water and sewerage services in the meantime. Recognition of the efforts taken by KMC and related issues by the users is essential to obtain and sustain cooperation of the users for water and sewerage operation. Issues related to location and number of common taps, irregular or no meter reading and unclear schedule of charges (table of water charge is not shown in water bill) are some examples for which positive measures need to be taken.

For rural areas within the municipality, KMC should act as a medium of sharing experiences and examples of successful communities in rural water supply operation.

(2) Create Awareness on the Importance of Water Environment Related to Water and Sewerage

Education is a long-term process. Awareness on the importance of water and sewerage operation need to be created especially on the younger generation. As a first-step, study tour to water and sewage works is proposed for middle-school children once a year. These can be in addition to the current visits to facilities such as Kisumu Airport, Kisumu Harbour, Kenya Breweries, KICOMI etc. During the visits to water and sewerage facilities, children can be briefed on the following:

- role of water and sewerage
- description of facilities
- sanitary and environmental habits (correct use of water supply and sewerage facilities at home and elsewhere)
- necessity of water environment protection

In the water and sewage treatment works, meeting rooms with displays should be provided for the above purpose. Discussion with Chief Education Officer of KMC were made and the officials were positive about this proposal.

Information and education of adults should be made through the following:

- encouraging facility visits by community groups (similar to that for children)
- briefing of communities on water supply and sewerage at the community health centres operated by KMC

(3) Request Consumers to Report Leaks and to Conserve Water

Publicity of the negative effect of wasting drinking water should be pursued. One item is to request the consumers to report leaks to W&S Dept when leaks are found. The other is to encourage consumers to conserve water through water conservation-type fittings such as cistern flush, shower heads, taps etc. and by promptly repairing leaking appurtenances within their premises.

(4) Education of Industries especially Small-scale Industries (Jua-Kalis) on the Use of Sewers

Serious problem is encountered with discharge of spent oils and greases into the sewers especially through manholes by automobile garages and workshops. This problem should be approached in two ways, one through education and the other through enforcement. Education is important since most of the facilities are small-scale. Alternative ways of disposal i.e. use as fuel etc. should be explored through discussion with personnel in these facilities.

(5) Create Awareness that Sewers are not to be Used as Dustbin

This item is an extension of item (3) above for all aspects of sewer use. Blocking of sewers in several locations is evident and one of the causes is disposal of waste matters other than liquid wastes into the sewers. Information on correct use of sewers should be disseminated to the public through every possible medium as possible.

6.7 PRELIMINARY COST ESTIMATION

6.7.1 Basis of Cost Estimation

Construction costs are estimated based on the future development plan of water supply and sewerage system which are described in the previous Sections 6.1 and 6.2. These costs are estimated for each phase, Phase I and Phase II.

Unit costs used in this cost estimate were collected from government offices, local consultants and manufacturers. These information were also cross checked against costs used in recent similar projects.

Base year for the cost estimate is 1997 and all costs are shown in US$. It should be noted that construction cost does not include;

- Value Added Tax,
- Physical Contingency,
- Price Contingency,
- Administration costs related to project implementation,
- Land acquisition costs.

6.7.2 Construction Cost

(1) Water Supply Facilities

Construction costs for water supply facilities are estimated separately for municipal water supply system and for rural water supply system.

Estimated construction costs for proposed municipal water supply facilities are shown on Table 6-16 for each phase of development.

Costs required for the rural water supply system in Kanagwegi and Chiga area are estimated based on "Option 2" which is discussed in Section 6.1.5 and total required amount is estimated at US$346,000 (Ksh 19,400,000).

Other than the construction costs, a total cost of US$ 1,600,000 will be required for procurement of water meters, UFW reduction works, and management/institutional improvements.

(2) Municipal Sewerage System

Construction costs for sewerage system are summarised in Table 6-17.

(3) Summary of Construction Costs

Construction costs for water supply system and for sewerage system are summarised on Table 6-18.

Table 6-18 Estimated Costs for Master Plan on Municipal Water Supply System

	Proposed Facilities			Remarks	Cost 1000US$
I	Intake Facilities				*6,652*
	I-a	Kibos River (Kajulu)	Rehabilt.	3,000 m3/d	70
	I-b	Lake Victoria	Rehabilt.	27,000 m3/d	1,162
	I-c	Kibos/Awach River	Phase I	42,500 m3/d (85,000 m3/d)	1,820
	I-d	Lake Victoria	Phase II	42,500 m3/d	3,600
II	Raw Water Pump Station				*2,784*
	II-a	Lake Intake	Rehabilt.	105l/s x 27.5m x 55kW x 4units*	560
	II-b	Lake Intake	Phase II	145l/s x 80m x 185kW x 5units*	2,224
III	Raw Water Transmission Pipeline				*10,192*
	III-a	Kajulu I. - Kajulu W.W	Rehabilt.	including Treatment Works	-
	III-b	Lake I. - Lake W.W	Rehabilt.	450 SP x 1.2 km	99
	III-c	Kibos/Awach I - Kibuye W.W	Phase I	900,700,400 SP x 18.8 km	7,444
	III-d	Lake I. - Kibuye W.W	Phase II	700 SP x 6.4 km	2,649
IV	Treatment Works				*25,058*
	IV-a	Kajulu Water Treatment Works	Rehabilt.	2,800 m3/day (reh./exp.)	552
	IV-b	Kibuye Water Treatment Works	Phase I	40,000 m3/day	10,741
	IV-c	Kibuye Water Treatment Works	Phase II	40,000 m3/day	10,741
	IV-d	Lake Water Treatment Works	Rehabilt.	25,000 m3/day (reh./exp.)	3,024
V	Treated Water Pump Station				*2,372*
	V-a	at Lake Water Treatment Works	Rehabilt.	145l/s x 80m x 185kW x 3units*	893
	V-b	at Kibuye Reservoir Reh.	Rehabilt.	30l/s x 27.5m x 15kW x 4units*	305
	V-c	to Kogony	Phase I	60l/s x 80m x 90kW x 2units*	391
	V-d		Phase II	60l/s x 80m x 90kW x 1unit	196
	V-e	to Kanyakwar	Phase I	60l/s x 80m x 90kW x 2units*	391
	V-f		Phase II	60l/s x 80m x 90kW x 1unit	196
VI	Treated Water Transmission Pipeline				*3,194*
	VI-a	Kajulu W.W. - Kajulu Reservoir	Rehabilt.	200 SP x 3.6 km	153
	VI-b	Lake W.W - Kibuye Reservoir	Rehabilt.	550 SP x 5.2 km	1,064
	VI-c	Kibuye Reservoir - Kogony Reservoir	Phase I	400 SP x 6.2 km	1,259
	VI-d	Kibuye Reservoir - Kanyakwar Reservoir	Phase I	350 SP x 4.2 km	718
VII	Reservoirs				*3,418*
	VII-a	Kajulu Reservoir	Rehabilt.	700m3	70
	VII-b	Kibuye Reservoir	Phase I	27,000m3	1,190
	VII-c		Phase II	19,000m3	840
	VII-d	Kogony Reservoir	Phase I	3,500m3	300
	VII-e		Phase II	4,000m3	350
	VII-f	Kanyakwar Reservoir	Phase I	5,000m3	388
	VII-g		Phase II	3,000m3	280
VIII	Trunk Mains (Pipe diameter 150mm and larger)				*10,954*
	VIII-a		Phase I	Total Length = 49.4 km	8,914
	VIII-b		Phase II	Total Length = 27.5 km	2,040
IX	Service Mains (Pipe diameter smaller than 150 mm)				*8,641*
	IX-a		Phase I	Total Length = 330 km	5,022
	IX-b		Phase II	Total Length = 232 km	3,619
				Total	**73,265**
				Rehabilitation	7,952
				Phase I	38,578
				Phase II	26,735

*: including 1 standby pump
Rehabilt. : Rehabilitation

W.W: Water Treatment Works

Yen (x 1,000)	*Total*	*9,158,125*
	Rehabilt.	*994,000*
1 US$ = 125	*Phase I*	*4,822,250*
	Phase II	*3,341,875*

Table 6-19 Estimated Costs for Master Plan on Municipal Sewerage System

Proposed Facilities		Remarks	Cost x 1,000 US$
I Sewers			
1 Trunk Sewers			*27,838*
Central WTD			
	Phase I, Expansion	Dia. = 250 to 400 mm, L=2.6 km	205
	Phase II	Dia. = 300 to 700 mm, L=2.9 km	479
Eastern WTD			
	Phase I, Rehabilitation	Dia. = 375 mm, L=0.42 km	60
	Phase I	Dia. =125 to 1,100 mm, L=22.6 k	3,737
Western WTD			
	Phase II	Dia. =250 to 1,000 mm, L=23.2 k	4,602
2 Branch Sewers			
2.1 Sewers for Conventional Sewerage (Street Sewers)			
Central WTD			
	Phase I, Expansion	Dia. = 200 mm, L=4.2 km	167
Eastern WTD			
	Phase I, Expansion	Dia. = 200 mm, L=122.5 km	4,902
	Phase II	Dia. = 200 mm, L=72.9 km	2,917
Western WTD			
	Phase II	Dia. = 200 mm, L=233.9 km	9,356
2.2 Sewers for Shallow Sewer System (Communal Sewers) (supply of pipe materials only)			
	Phase I, Expansion	Dia. = 100 mm, L=91.0 km	455
	Phase II	Dia. = 100 mm, L=191.6 km	958
II Pump Stations			*1,880*
Central WTD			
Sunset Hotel P.S.	Phase I, Rehabilitation	1.26 m^3/min, H=40 m	110
Kendu Lane P.S.	Phase I, Rehabilitation	1.20 m^3/min, H=13 m	59
Mumias Road P.S.	Phase I, Rehabilitation	1.62 m^3/min, H=10 m	61
Eastern WTD			
Labour College P.S.	Phase I, Expansion	0.72 m^3/min, H=9 m	42
Nyalenda STW P.S.	Phase I, Expansion	35.30 m^3/min, H=2 m	858
Western WTD			
Kombedu P.S.	Phase II	17.89 m^3/min, H=30 m	750
III Sewage Treatment Works			*7,517*
Conventional STW (Central WTD)			
	Phase I, Rehabilitation	mainly, replacement of	864
	Phase I, Expansion	from 6,800 to 14,600 m^3/day	1,330
Nyalenda STW (Eastern WTD)			
	Phase I, Rehabilitation	mainly, desludging for facultative	234
	Phase I, Expansion	from11,000 to 18,000 m^3/day	1,150
	Phase II	to 30,500 m^3/day	1,039
Otongolo STW (Western WTD)			
	Phase II	29,300 m^3/day including discharge pipe (dia.=1,000 mm, L=0.6 km)	2,900
IV Total Direct Construction Cost			**37,235**
		Rehabilitation	1,388
		Phase I	12,846
		Phase II	23,001

Yen (x1,000)	Total	4,654,375
	Rehabilitation	173,500
1 US$ = 125	Phase I	1,605,750
	Phase II	2,875,125

Table 6-20 Summary of Construction Costs

Unit : Thousand US$

Facility	Phase I			Phase II	Total
	Rehabili-tation	Expan-sion	Total		
Water Supply Facilities					
Municipal Water Supply	7,952	38,578	46,530	26,735	73,265
Rural Water Supply	-	346	346	-	346
Water Meter, UFW Reduction, Manage./Insti. Improvement	-	1,600	1,600	-	1,600
Sub-total Water Supply	*7,952*	*40,524*	*48,476*	*26,735*	*75,211*
Sewerage					
Sewers/Pump Stations	290	10,366	10,656	19,062	29,718
Sewage Treatment Works	1,098	2,480	3,578	3,939	7,517
Sub-total Sewerage	*1,388*	*12,846*	*14,234*	*23,001*	*37,235*
Total	**9,340**	**53,370**	**62,710**	**49,736**	**112,446**

6.8 PROJECT IMPLEMENTATION AND PRIORITY PROJECT

Kisumu needs urgent improvements on both water supply and sewerage. The prevailing water crisis and water-related diseases in the town are described elsewhere in this report and newspaper cuttings demonstrating these problems are compiled in Appendix S.

The objective of the Priority Project is thus to address these problems at the earliest timing possible. Realistically speaking, however, this cannot be achieved overnight.

The Project is assumed that a large portion of the cost will be financed by a loan from an international lending agency. This financing arrangement can be initiated only from the beginning of 1999 at the earliest and most probably takes one year before an agreement can be reached between the Kenyan government and the loan agency. This will be followed by the selection of consultants for detailed designs, which normally takes one year or so. Detailed designs will also take 10 months or so. Generally, water supply contracts which involve construction of a new water treatment works and water distribution mains require two years to complete.

All these lead to the conclusion that the physical construction of the Priority Project can be

completed only at the end of 2002 at the earliest.

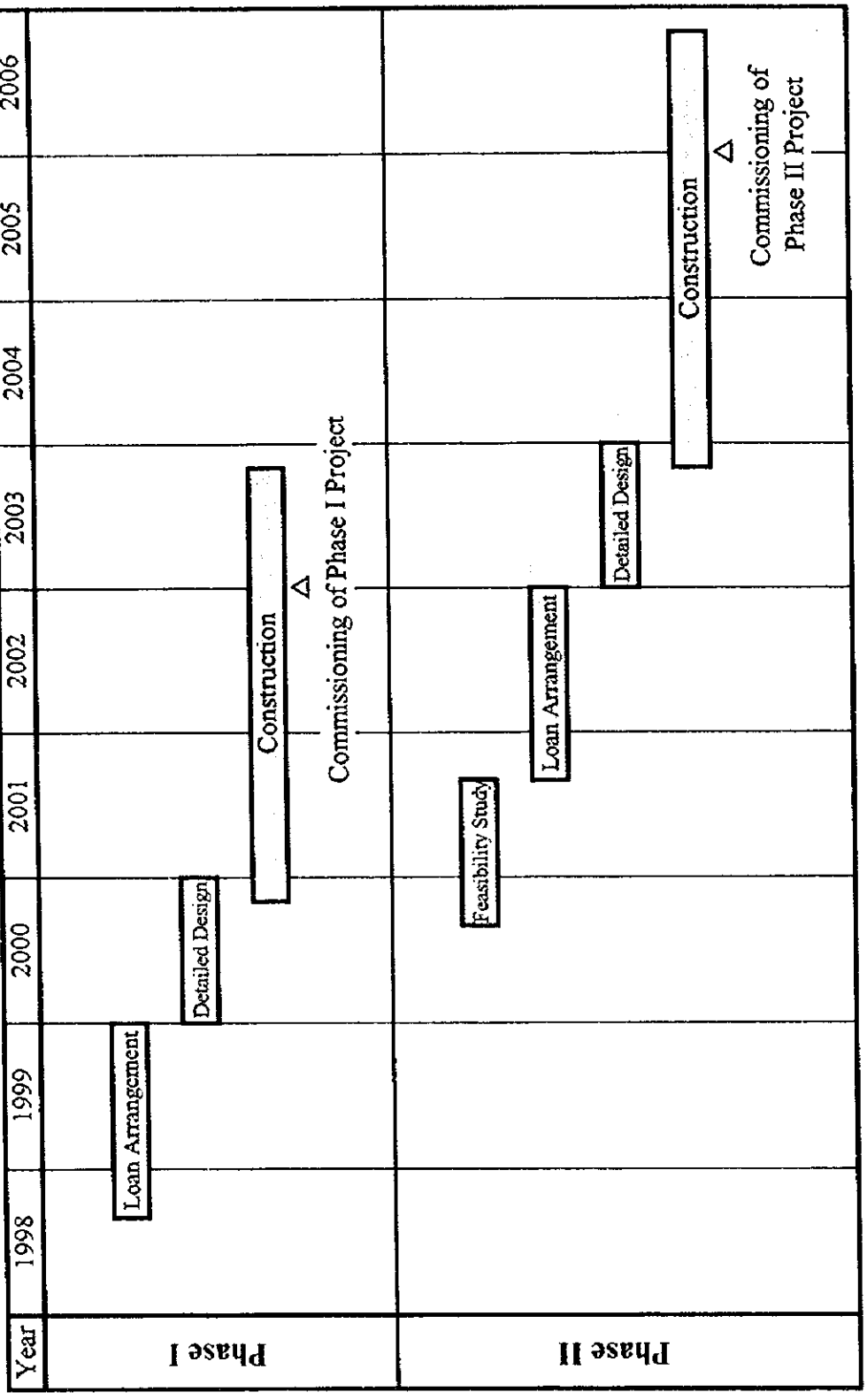
Upon completion, the water supply capacity created by the Priority Project must be able to meet the water demands projected over a period of few years to come. This is necessary to leave a reasonable amount of time for implementation of the succeeding improvements.

This Study thus recommends that the Priority Project be planned for its target year 2005, and that it should form the first phase of development, i.e., Phase I, integrating all the rehabilitation and expansion works which will be necessary for the municipal water supply system to meet the projected water demand in 2005 and for the municipal sewerage system to manage 60 % of the projected volume of wastewater in the same year.

This Study tentatively proposes that all the remaining works which will be necessary for the municipal water supply system to meet the projected water demand in 2015 and for the municipal sewerage system to manage 83 % of the projected volume of wastewater in the same year be integrated and form the second phase of development, i.e., Phase II. This issue however should be revisited and revised if necessary during the feasibility study of Phase II Project, in that review and reassessment will be made on the basic planning framework such as water demands, water sources and institutional/management capacity.

Figure 6-21 shows an overall implementation schedule of the proposed Master Plan.

Figure 6 - 22



THE REPUBLIC OF KENYA THE MINISTRY OF LOCAL AUTHORITIES KISUMU MUNICIPAL COUNCIL	THE STUDY ON KISUMU WATER SUPPLY AND SEWERAGE SYSTEM JAPAN INTERNATIONAL COOPERATION	TITLE : Overall Implementation Schedule of Master Plan

6.9 EVALUATION

The proposed project will be financially viable under normal operating conditions. There is a large suppressed demand for water. Water and sewerage tariffs are fairly high. There is thus strong demand at relatively high prices for tap water. Most of the revenue is generated from non-domestic users and households who consume large volumes of water. Substantial revenue can thus be generated while supplying the poor families at relatively low prices.

The poor who do not presently have access to tap water pay three to ten times the municipal tariff for water of doubtful quality. Expanded water supply will thus help poor people pay less for water than they do now. Because of the small share of poor households in total revenue, providing these households with water at relatively low prices does not have a large impact on project revenues.

All costs and revenues are expressed in constant 1998 prices. It is assumed that the increase in costs overtime will be reflected in tariff adjustments. Substantial price and physical contingencies are, however, included in the estimated costs. It is believed that these are sufficient to cover adverse developments during the investment phase of this project.

The operating costs of water supply and sewerage services are modest relative to the expected revenue. The proposed project is viable on commercial grounds with the level of management that is attainable in Kisumu. The expected financial IRR of the total project, covering all investments to the end of the Master Plan period, is 3.6%.

The estimated IRR is sensitive to three factors. These are the tariffs, construction schedule and costs, and changes in future demand. The first question is whether the municipality will be able to sell the water it plans to supply at the existing average tariffs. There is general consensus that the present demand is around 40,000 m^3/ day compared to the supply of 18,000 m^3/day. The risk that the planned capacity will remain idle seems to be small for the Phase I. Developments in Phase II will depend on general economic conditions and development of Kisumu city.

Both the Municipal Council and the Central government are committed to maintaining the water and sewerage services as financially viable operations. It is expected that this commitment will be reflected in future tariff adjustments. These tariff adjustments should reflect the changes in inflation fully.

6.9.1 Investments during the Master Plan

(1) Expected Revenue

The project's revenue has three components. These are a) water charges; b) the charge for sewerage services which is 75% of the water bill for subscribers who have access to sewerage services and, c) meter rent. The water tariff is differentiated for three types of consumers: domestic, industrial and commercial users and institutions. The Study Team has recommended that the common taps, which are presently treated as households, should be identified as a separate group. The proposed tariffs for these four groups are very similar to the existing tariffs (Volume 3, Chapter 8) and they are one of the bases of revenue estimation.

The sewerage charge is based on the water bill. It would be 75% of the water bill if all subscribers were connected to the system. It is less due to the limited coverage of sewerage service. For revenue purposes, the required information is the proportion of water consumed by those with sewerage connections and not the proportion of subscribers. One proxy for this variable is the ratio of water and sewerage income at present. These ratios will change as the coverage of sewerage service improves over time. The estimates are based on an average, which has not been changed over the Master Plan period. It is assumed that half of water consumed by households is in units that are connected to sewerage network. This is 75% for industrial/ commercial users, and 50% for the institutions.

The effective tariff over the Master Plan period will also change, due to the increase in per capita consumption, even with the same tariffs, as a higher proportion of consumption shifts into the brackets which are charged a higher tariff. This is incorporated into household consumption by assuming water tariff of Shs. 22/cubic meter instead of the estimated actual effective tariff of 19.25 in 1998. Together with the sewerage charge, this results in an average water and sewerage charge of Shs.30.25 per cubic meter. The revenue estimates for households uses Shs. 30 per cubic meter.

The effective tariff for both industry/ commerce, and institutions is very close to the maximum tariff due to the dominance of a few users in total consumption. These large users are charged the highest tariff. The highest tariff block is, therefore, used for estimating revenue from these two groups of users. Together with the assumptions on the consumption with sewerage connections, these result in effective water and sewerage charges of Shs. 78.1/ cubic meters for industry and Shs. 68.75 for institutions.

The amount of water sold to each group of consumers is given in Table 6-19. The average effective tariff applied to households represents the average of individual connections and common taps. The meter rent from the existing 11,000 meters is included in the estimated domestic tariff. The number of meters is projected to increase to 56,573 at the end of Master Plan period. The rent from the new meters is separately calculated and added to the total revenue.

The Project begins to generate revenue in year 2003. The revenue until then is due to existing capacity. The difference between this and the future revenue is income of the Project. This is indicated as the incremental income in Table 6-20.

(2) Operating 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. The amount of each of these costs over the Master Plan period is given in Table 6-20. The changes in operating costs are sensitive to the assumptions on the source of water and expected operation plans.

The capacity created in the lake will be fully utilised until the Kibos/Awach system comes on stream. The demand is below the supply capacity beginning in year 2003. The capacity will be fully utilised on the rivers during this interim period with partial utilisation of the capacity on the lake. This saves power and reduces water treatment chemical costs. The incremental staff costs are derived from detailed operation plans and staff requirements. The same gross per employee costs as incurred now are assumed for the additional staff required.

The amount of water treatment chemicals used depends on the quality of water from each source. The study team collected detailed information on water quality of alternative sources. The treatment costs were calculated on the basis of this water quality analysis. Two separate dosages are recommended for treating the lake water and the river water. In general, lake water is more costly to treat as shown below. Detailed information on recommended amounts for the two sources and prices is given in Appendix L.

Electricity is the next major cost item. 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 consumption for a unit producing 20,000 m^3/day of clean water from Lake Victoria for a pump head of 27 meters raw water and 80 meters clean water will be 3.4 million kwh per annum. The actual cost per kwh of electricity was K.Shs. 5.55 for the bills in mid-1997.

Table 6-21 **Water Sales and Production during the Master Plan Period (m3/day)**

	Net Consumption per day				Accounted for Water Ratio	Gross water Supplied
	Domestic	Industrial/ Commercial	Institutional	Total		
1997	7,497	4,347	756	12,600	0.700	18,000
1998	7,497	4,347	756	12,600	0.700	18,000
1999	7,497	4,347	756	12,600	0.700	18,000
2000	7,497	4,347	756	12,600	0.700	18,000
2001	7,497	4,347	756	12,600	0.700	18,000
2002	7,497	4,347	756	12,600	0.700	18,000
2003	12,387	7,100	1,344	20,831	0.700	29,759
2004	17,368	9,918	1,942	29,228	0.704	41,517
2005	22,393	12,747	2,580	37,720	0.708	53,277
2006	27,498	15,621	3,252	46,371	0.713	65,036
2007	28,795	16,315	3,503	48,613	0.717	67,801
2008	29,104	16,480	3,615	49,199	0.721	68,237
2009	30,666	17,340	3,950	51,956	0.725	71,663
2010	32,311	18,250	4,280	54,841	0.729	75,228
2011	34,044	19,230	4,650	57,924	0.733	79,023
2012	35,867	20,260	5,040	61,167	0.738	82,882
2013	37,790	21,360	5,470	64,620	0.742	87,089
2014	39,816	22,520	5,930	68,266	0.746	91,509
2015	41,952	23,800	6,500	72,252	0.750	96,336

Table 6-22 **Project Revenues and Operating Costs During the Master Plan Period**

	Total Revenue						Total Costs				
	Domestic (1,000 Ksh)	Indus./Com (1,000 Ksh)	Institutional (1,000 Ksh)	Total (1,000 Ksh)	Total (US$)	Incremental (US$)	Chemical (US$)	Electrical (US$)	Staff (US$)	Maintenance (US$)	Total Cost (US$)
1997	82,092	123,918	18,971	224,981	3,750		358	527	362	249	1,496
1998	82,092	123,918	18,971	224,981	3,750						
1999	82,092	123,918	18,971	224,981	3,750						
2000	82,092	123,918	18,971	224,981	3,750						
2001	82,092	123,918	18,971	224,981	3,750						
2002	82,092	123,918	18,971	224,981	3,750						
2003	135,638	202,396	33,726	371,760	6,196	2,446	591	527	362	296	1,776
2004	190,180	282,727	48,732	521,639	8,694	4,944	825	571	420	363	2,179
2005	245,203	363,372	64,742	673,318	11,222	7,472	1,058	616	521	439	2,634
2006	301,103	445,300	81,605	828,008	13,800	10,050	1,292	676	521	498	2,987
2007	315,305	465,084	87,903	868,292	14,472	10,722	1,347	706	521	515	3,088
2008	318,689	469,787	90,714	879,190	14,653	10,903	1,355	706	523	517	3,101
2009	335,793	494,303	99,120	929,216	15,487	11,737	1,423	740	613	555	3,332
2010	353,805	520,244	107,401	981,450	16,358	12,608	1,494	776	613	577	3,460
2011	372,782	548,180	116,686	1,037,648	17,294	13,544	1,570	814	613	599	3,596
2012	392,744	577,542	126,473	1,096,758	18,279	14,530	1,646	852	613	622	3,734
2013	413,801	608,899	137,263	1,159,962	19,333	15,583	1,730	895	613	647	3,885
2014	435,985	641,966	148,806	1,226,758	20,446	16,696	1,818	939	641	679	4,077
2015	459,374	678,455	163,109	1,300,938	21,682	17,933	1,914	987	641	708	4,250

Power consumption consists of three components. These are: a) raw water intake from the lake and pumping the treated water to Kibuye reservoir; b) water pumped to Kanyakvar and Kogony reservoirs beginning in year 2003; and finally power consumption in the sewerage system. Each of these are calculated separately based on detailed parameters given in Appendix L. .

The last major item for which detailed analysis are made is 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. A detailed staffing plan has been prepared in the light of the proposed institutional system. Staff cost estimates are based on the per employee costs and this staffing plan. The staff size is built up to this level parallel to the increase in supply capacity. This build up reflects both the increase in the capacity as well as the number of intake points and treatment works envisioned.

The three major items are estimated to be 80% of operating costs. Other items include telecommunication, office rent, stationary etc. These are assumed to 20% of the calculated operating costs.

(3) Investment Costs

The present water supply capacity in Kisumu is estimated to be 18,000 cubic meters per day. This will be increased to 107,800 cubic meters over the Master Plan period. The first is a rehabilitation component that increases this capacity to 27,800. This is followed by two units of 40,000 each. The rehabilitation and the first 40,000 unit is included in Phase I and the last unit in Phase II. The investment costs for each of these and the timing of these investments is shown in Table 6-21. These costs cover all components of the water supply and sewerage system.

The total costs for the Master Plan are estimated at $164 million. The priority projects covering Phase I are projected to require 56% of this amount. The actual loan requirements are slightly different as discussed in Section 6.10.

The projected net cash flow during the Master Plan period is given in Table 6-22. The project is expected to generate a gross revenue of $17.9 million at full development. It is projected to incur operating costs of $ 4.2 million at that time. This leaves a large cash surplus which can be used to service a possible loan to finance the project.

Table 6-23 **Investment Schedule for Master Plan (x1,000 US$ in 1997 prices)**

				1999	2000	2001	2002	2003	2004	2005	2006	
Construction Period												
Phase I												
Phase II												Total
Direct Construction Cost	Total	Phase I	Phase II									
Water Supply System	75,211	48,476	26,735	0	14,543	19,390	14,543	8,021	10,694	8,021	0	75,211
Sewerage System	37,235	14,234	23,001	0	4,270	5,694	4,270	6,900	9,200	6,900	0	37,235
Sub-Total	*112,446*	*62,710*	*49,736*	*0*	*18,813*	*25,084*	*18,813*	*14,921*	*19,894*	*14,921*	*0*	*112,446*
Consultancy Services	Total	Phase I	Phase II									
Consultancy Services	14,065	7,844	6,221	0	2,353	3,138	2,353	1,866	2,488	1,866	0	14,065
Sub-Total	*14,065*	*7,844*	*6,221*	*0*	*2,353*	*3,138*	*2,353*	*1,866*	*2,488*	*1,866*	*0*	*14,065*
Contingencies	Total	Phase I	Phase II									
Price Contingency	19,896	11,096	8,800	0	3,329	4,438	3,329	2,640	3,520	2,640	0	19,896
Physical Contingency	14,578	8,130	6,448	0	2,439	3,252	2,439	1,934	2,579	1,934	0	14,578
Administration Cost	3,208	1,789	1,419	0	537	716	537	426	568	426	0	3,208
Sub-Total	*37,682*	*21,015*	*16,667*	*0*	*6,305*	*8,406*	*6,305*	*5,000*	*6,667*	*5,000*	*0*	*37,682*
Grand Total	**164,193**	**91,569**	**72,624**	**0**	**27,471**	**36,628**	**27,471**	**21,787**	**29,050**	**21,787**	**0**	**164,193**

Table 6-24 Projected Cash Flow During the Master Plan Period (x1,000 US$ in 1997 prices)

	Incremental Income	Incremental Cost	Fixed Investments	Net cash flow
1997				
1998				
1999				
2000			27,471	-27,471
2001			36,628	-36,628
2002			27,471	-27,471
2003	2,446	1,776	21,787	-21,117
2004	4,944	2,179	29,050	-26,284
2005	7,472	2,634	21,787	-16,949
2006	10,050	2,987		7,064
2007	10,722	3,088		7,633
2008	10,903	3,101		7,802
2009	11,737	3,332		8,405
2010	12,608	3,460	11,500	-2,352
2011	13,544	3,596		9,949
2012	14,530	3,734		10,796
2013	15,583	3,885		11,698
2014	16,696	4,077		12,619
2015	17,933	4,250		13,683
2016	17,933	4,250		13,683
2017	17,933	4,250		13,683
2018	17,933	4,250		13,683
2019	17,933	4,250		13,683
2020	17,933	4,250	11,500	2,183
2021	17,933	4,250		13,683
2022	17,933	4,250		13,683
2023	17,933	4,250		13,683
2024	17,933	4,250		13,683
2025	17,933	4,250		13,683
2026	17,933	4,250		13,683
2027	17,933	4,250		13,683
2028	17,933	4,250		13,683
2029	17,933	4,250		13,683
2030	17,933	4,250		13,683
2031	17,933	4,250		13,683
2032	17,933	4,250		13,683
2033	17,933	4,250		13,683
			IRR =	3.6%

The IRR in the base case is estimated to be 3.6% (Table 6-22). This is based on a schedule of fixed investments where all contingencies are actually incurred. The assumed investment schedule is also very tight and all investments required to create the capacity needed in 2015 are completed in the year 2005. The IRR will be significantly higher with alternative assumptions on investment schedule and if some of the contingencies are excluded from the base case flows.

6.9.2 Investments During Priority Projects

The analysis of the projects components proposed for implementation under the priority projects is subjected to full feasibility analysis. This includes full verification costs and revenues as well as detailed analysis of technical components. These are given in Volume 3, Chapter 8.

The IRR for the priority projects is estimated to be 6.45%. Sensitivity analysis covering a range of likely adverse impacts were undertaken. The IRR remains positive under all these conditions.

For sensitivity analysis, the impact of cost overruns is simulated by increasing the estimated cost by 20% without changing the investment schedule. Lack of tariff adjustments, in the face of domestic inflation, is simulated by estimating the w/s revenue at 80% of the base case revenue. 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 while leaving the expenditure schedule unchanged. The estimated IRR for these cases is:

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

6.9.3 Technical Evaluation

The proposed Master Plan for water supply and sewerage system improvement is evaluated in respect of its ultimate goal "Sustainable Water Supply and Sewerage Services". The following were identified in Chapter 5 as the key factors for this evaluation.

1. Some for all rather than more for some
2. Early emergence of project effects

3. Appropriate and locally compatible level of technical expertise
4. Ease of operation and maintenance

(1) Some for All Rather Than More for Some

The Master Plan proposes that water will be supplied through not only individual house connections but also communal taps, and that the minimum water charge for those who consume less than 10 m3 per household per month be reduced from the present Ksh.180 to Ksh.100. This will increase opportunities for low income households to gain access to the municipal water supply system either indirectly through communal taps or directly through house connections.

Those who live outside the municipal water supply system are proposed to be served by rural water supply schemes, using local deep wells as the source of supply. This will provide those who currently depend on unhygienic shallow well and surface waters with access to more hygienic water on a more reliable basis.

(2) Early Emergence of Project Effects

In proposing the implementation schedule of the Master Plan, priority is given to the rehabilitation of existing water supply and sewerage facilities. All of these rehabilitation works are proposed for implementation under the first phase of development, i.e., Phase I.

Rehabilitation of existing facilities generally require a shorter time to complete than in the case of constructing new facilities. There is thus a possibility that some of the rehabilitation works proposed under Phase I may have been completed and ready for use ahead of the scheduled completion of the overall Phase I scheme.

(3) Appropriate and Locally Compatible Level of Technical Expertise

Throughout the Master Plan study, consistent efforts were made by the Study Team to ensure that any works proposed can be constructed, operated and maintained within the limit of technical skills and engineering expertise currently available in Kenya and Kisumu. As a result, the schemes proposed in the Master Plan can be constructed within the time frame envisaged, and they, once constructed, can fully be managed by local engineers and operators.

(4) Ease of Operation and Maintenance

Most of the problems which currently undermine the operation and maintenance of the existing water supply and sewerage system in Kisumu are more or less related with the breakdown of mechanical and electrical equipment, such as pumps, valves, meters, agitators, etc. Once these equipment are broken down, they are often left unattended due to the lack of funds or spareparts.

Wherever possible, gravity flow is adopted for ease of operation and maintenance and to reduce energy costs. Raw water from the Kibos and Awach rivers will be conveyed to the proposed Kibuye WTW by gravity. A major portion of treated water from the works will also gravitate to the distribution networks.

At water treatment works, use of hydraulic energy for chemical mixing and flocculation is proposed instead of using mechanical agitators and flocculators. Instead of providing an emergency power supply equipment at the water treatment works, an adequate capacity is provided for distribution reservoirs.

Steel and polyvinyl chloride pipes are proposed for use for water supply. Polyvinyl chloride and concrete pipes are proposed for sewerage. All these pipes are locally fabricated or manufactured and readily available within a relatively short time. The use of these pipe materials will therefore expedite construction works and facilitate maintenance once they are installed.

6.10 FINANCING REQUIREMENTS

Kenya is classified among the least developed of the developing countries. This makes the development projects eligible for concessional finance. In this case, up to 85% of the costs may be loan financed.

The repayment period is also favourable. These are incorporated in the financing schedule presented in Table 6-23. It is assumed that 85% of the project will be financed by a foreign loan and the rest by a local loan from the Government. The interest rate is the same as the one used for the priority projects and is 1.6%. (The details of the interest rate calculation are presented in Volume 3, Chapter 8.

The total financing requirements are slightly higher than the estimated investments due to inability of the project to service the loan during the first six years of project implementation. Interest

during that period is capitalised and the total financing requirements increase to $174 million (Table 6-23).

The project runs a cumulative net positive cash flow of close to $ 20 million in the period 2006 to 2009. Most of this, however, is needed to finance replacement investment in 2010. It is therefore suggested that the repayment of the principle starts 10 year after project implementation. The cumulative cash flow allows full loan servicing under these conditions.

6.11 RECOMMENDATIONS

The Study Team's recommendations are presented elsewhere in this report. This section therefore focuses on some of the Team's recommendations which should and can be undertaken by KMC even before the actual implementation of the proposed Master Plan initiates.

Water Supply and Sewerage

- Make necessary arrangements for appropriation of land for construction of proposed facilities
- Protection of water sources proposed for use from pollution
- Reduction of unaccounted for water, particularly illegal connections
- Establish a regulatory framework for controlling industrial effluents, including monitoring and penalisation

Institutional/Management

- Establish financial autonomy of the water and sewerage department
- Provide continuous supports to on-going reform programmes

Table 6-25 Financing of the Master Plan and Loan Servicing

	Financing Requirment	Foreign Loan	Domestic Loan	Total Loan Outstanding	Loan service		Surplus After Loan Servicing
					Interest	Principal	
1999							
2000	27,471	23,350	4,121	27,911			
2001	36,628	31,134	5,494	65,571			
2002	27,471	23,350	4,121	94,531			
2003	21,787	18,519	3,268	118,179			
2004	29,050	24,693	4,358	149,585			
2005	21,787	18,519	3,268	174,114			
2006				174,114	2,786		4,278
2007				174,114	2,786		4,848
2008				174,114	2,786		5,016
2009				174,114	2,786		5,619
2010				174,114	2,786	8,706	-13,843
2011				165,831	2,786	8,706	-1,543
2012				157,549	2,653	8,706	-563
2013				149,267	2,521	8,706	472
2014				140,985	2,388	8,706	1,525
2015				132,703	2,256	8,706	2,721
2016				124,421	2,123	8,706	2,854
2017				116,139	1,991	8,706	2,986
2018				107,857	1,858	8,706	3,119
2019				99,575	1,726	8,706	3,251
2020				91,293	1,593	8,706	-8,116
2021				83,011	1,461	8,706	3,516
2022				74,729	1,328	8,706	3,649
2023				66,447	1,196	8,706	3,781
2024				58,165	1,063	8,706	3,914
2025				49,883	931	8,706	4,046
2026				41,601	798	8,706	4,179
2027				33,319	666	8,706	4,311
2028				25,037	533	8,706	4,444
2029				16,755	401	8,706	4,577
2030					268	8,706	4,709

CHAPTER 7

INITIAL ENVIRONMENTAL EXAMINATION

7 INITIAL ENVIRONMENTAL EXAMINATION

7.1 GENERAL

Initial Environmental Examination (IEE) is conducted as a part of Study on Kisumu Water Supply and Sewerage System. The objectives of the IEE for the Study are as follows;

- To identify potential impacts of proposed Project in Master Plan
- To Prepare information for Environmental Impact Assessment to Phase 1 Project in following Feasibility Study

The IEE has been carried out following JICA Environmental Guideline. Details of IEE are described in Appendix (O).

The Project consists of Water Supply Component and Sewerage Component as mentioned in Section 6.11. The Initial Environmental Examination (IEE) is carried out on above two components respectively as shown in Table 7-1 and 7-2, because both of the components are expected to affect different impacts.

Impacts during construction period and impacts during operation period are considered also as different kinds of impacts. The evaluation of IEE are therefore proceeding as follows;

1) Impacts during Construction Stage
2) Impacts by Water Supply Component during Operation Period
3) Impacts by Sewerage Component during Operation Period

In order to identify the potential impacts, a checklist method was applied for IEE. The checklist includes 23 environmental items defined by JICA Environmental Guideline.

Results of IEE for Water Supply and Sewerage Components are shown in the following tables;

Table 7-1 IEE Check List: Water Supply Component

Item	Evaluation	Reason
1. Resettlement	C	Not clear
2. Economic Activities	D-2	Positive impacts are expected by increased water supply amount
3. Transport	D-1	Need attention during construction period
4. Separation of Community	D-2	This is not an issue in this component
5. Cultural Assets and Archaeology	D-2	No such sites
6. Water and Common Rights	C	This may be affected, because water discharge amount will be reduced in Rivers to be proposed as intake sites
7. Sanitation	D-2	Sanitation condition shall be improved by safe water supply
8. Waste	D-1	Need attention during construction
9. Dangers	D-1	Need attention during construction
10. Topography and Geology	D-2	Project include no big structure to give such impact
11. Soil Erosion	D-1	Need attention during construction period
12. Groundwater	D-2	Project would not be related to groundwater
13. Lake, Marsh and River	A	Kibos River shall be affected by the completion of the intakes
14. Coastline and Sea	D-2	No such area
15. Flora and Fauna	C	Changing the rivers discharge and sewage generation may affect Flora and Fauna in Lake Victoria and Kibos River
16. Weather	D-2	This Project does not include structures which might influence weather
17. View	D-2	This Project does not include structures which might influence view
18. Air Pollution	D-2	No adverse impact
19. Water Pollution	C	Sewage amount shall be increased due to the new water supply. Lake Victoria will be affected, if nothing to do any countermeasure
20. Soil Contamination	D-1	Nothing expected
21. Noise and Vibration	D-1	Need attention during construction
22. Ground Subsidence	D-2	Nothing expected
23. Noxious odors	D-2	Nothing expected

A : Serious Impact expected
B : Minor Impact expected
C : Uncertain (may become clear on investigation)
D-1 : Almost no Impact expected, if proper construction is carried out
D-2 : Almost no Impact expected, no need for EIA

Table 7-2 IEE Check List: Sewerage Component

Item	Evaluation	Reason
1. Resettlement	C	Not clear
2. Economic Activities	D-2	Any negative impacts are not expected
3. Transport	D-1	During construction period, needs attention
4. Separation of Community	D-2	Nothing expected
5. Cultural Assets and Archaeology	D-2	No such sites
6. Water and Common Rights	D-2	No impact expected
7. Sanitation	D-2	Sanitation condition shall be improved by proper sewage treatment
8. Waste	B	Sludge generated from Sewage Treatment Works should be managed properly
9. Dangers	D-1	Need attention during construction period
10. Topography and Geology	D-2	Project include no big structure to have such an impact
11. Soil Erosion	D-1	Need attention during construction period
12. Groundwater	C	Waste Stabilization Ponds may deteriorate ground water. Reduction of pit latrine user shall improve ground water deterioration
13. Lake, Marsh and River	D-2	Water quality in Lake Victoria shall be improved by strengthened sewage treatment capacity
14. Coastline and Sea	D-2	No such area
15. Flora and Fauna	C	Increase of effluent discharge from sewage treatment works may effect Flora and Fauna in Lake Victoria.
16. Weather	D-2	This Project does not include structures which might influence weather
17. View	D-2	This Project does not include structures which might influence view
18. Air Pollution	D-2	Nothing expected
19. Water Pollution	D-2	The main function of the Project is to treat sewage properly before discharge into Lake Victoria
20. Soil Contamination	C	Raw sewage may cause soil contamination during the treatment process
21. Noise and Vibration	D-1	Need attention during construction
22. Ground Subsidence	D-2	Nothing expected
23. Noxious odors	B	Any sewage generates odors.

A : Serious Impact expected
B : Minor Impact expected
C : Uncertain (may become clear on investigation)
D-1 : Almost no Impact expected, if proper construction is carried out
D-2 : Almost no Impact expected, no need for EIA

7.2 IMPACTS DURING THE CONSTRUCTION STAGE

Any construction works may cause impacts in/around the construction sites. However, impacts during construction stage are generally temporary and are not difficult to make countermeasures to mitigate the negative impacts. In addition, the Project does not include such big structures which will affect serious impacts in/around the construction sites. Major Construction Sites are as follows;

Water Supply Components

- Kibos Intake Works and Kajulu Water Treatment Works Site
- Awach Intake Works Site
- Lake Intake Works Site
- Lake Water Treatment Works Site
- Kibue Water Treatment Works Site

Sewage components

- Conventional Sewage Treatment Works Site
- Nyalenda Sewage Treatment Works Site

As the result of IEE, it is judged that the impacts during the construction stage may be happen more or less on "Resettlement", "Transportation", "Dangers", "Soil Erosion" and "Noise and Vibration".

7.3 IMPACTS BY WATER SUPPLY COMPONENT DURING OPERATION PERIOD

The purpose of the water supply component of the Project is to supply safe and stable potable water to Kisumu Municipality. The Project is therefore expected to have positive impacts on human and social environment, for example "Economic Activity" and "Sanitation".

However, the Project is also expected to have negative impacts on "Water and Common Rights", "Lake, Mash and River", "Flora and Fauna" and "Water Pollution". The major causes of the negative impacts are following phenomenon;

a) Reduction of River Water Discharge due to water abstraction by the Project

Proposed intakes on Kibos River and Awach/Nyangori River are expected to abstract 38,600 m^3/d and 6,900 m^3/d of water from each rivers respectively.

b) Increase of Wastewater Generation due to the New Water Supply

After completion of the proposed project, wastewater generated in Kisumu Municipality are expected to increase.

These phenomenons shall give impacts on Kibos and Awach/Nyangori River and Kisumu Bay.

(1) Water Right and Common Right

The intake sites are proposed in Kibos River, Awach/Nyangori River and Lake Victoria. Reduction of river flow in Kibos and Awach.nayngori River shall affect water right and/or common right.

Water Act stipulates as " the right to the use of every body of water is hereby declared to be vested in the Ministry, and except in accordance with such right, no person shall divert, abstract or use water from a body of water otherwise than under this act".

But actual situation of the water usage may include other user including common user without registration and illegal abstracts. At further stage, actual water usage condition in the rivers is to be reviewed. The usage condition includes registered water rights, and actual water usage even including illegal abstraction.

(2) Water Pollution

After completion of the proposed project, wastewater generation in Kisumu Municipality is expected to increase. The increase of wastewater generation may cause water pollution in Kisumu Bay (Lake Victoria), if any measures are not taken.

The two existing Sewage Treatment Works in Kisumu do not have enough treatment capacity even for present wastewater amount. Expansion and rehabilitation of the existing treatment works are required as countermeasure for mitigating the impacts of increase of wastewater generation.

(3) Lake, Marsh and River

The conditions of Kisumu Bay (Lake Victoria) and the Rivers may be changed by the above impacts, even if countermeasures are carried out.

(4) Flora and Fauna

Impacts on Flora and Fauna may be affected by the reduction of water flow in the rivers and/or the water pollution due to increase of the wastewater generation.

7.4 IMPACTS BY SEWERAGE COMPONENT DURING OPERATION

The purpose of the sewerage component of the Project is to collect wastewater generated in Kisumu Municipality and treat it properly. The sewerage components are therefore expected to improve sanitary conditions in the municipality, and also expected to mitigate the adverse impact of increase of wastewater generation.

Because of the function of sewage treatment works, sewage system should collect a lot of wastewater at the sites. Mismanagement of sewage treatment works therefore may cause serious impacts around the sites. However, proper design and proper O&M of the sewage works are expected to avoid the adverse impacts.

(1) Waste Disposal

A lot of sludge is generated in the wastewater treatment process. Due to increase of the treatment capacity, sludge generation will be also increased. Well-treated sludge could be useful for agriculture activities, but untreated sludge could be serious pollution source. Sludge treatment plan shall be proposed in further stage.

(2) Groundwater / Soil Contamination

Wastewater seeping through bottom of waste stabilization ponds in Nyalenda STW may cause contamination of groundwater and soil. Groundwater usage condition shall be investigated around the site.

(3) Flora and Fauna

Mismanagement of sewage and sludge may affect Flora and Fauna around the sites of Sewage Treatment Works. However, the Project is basically expected to improve ecosystem by proper wastewater treatment.

(4) Offensive Odor

Offensive odor is generated from wastewater, especially under anaerobic conditions. Any sewage treatment site generally causes this problem. The appropriate countermeasures will be proposed in further stage.

7.5 Conclusion of IEE

As the results of IEE, following environmental items are selected as assessment items in Environmental Impacts Assessment for the Phase 1 Project

1) Impacts caused by Construction Works during Construction Period
   - Resettlement
   - Transportation
   - Dangers
   - Soil Erosion
   - Noise and Vibration

2) Impacts caused by Water Abstraction from Rivers during Operation Period
   - Water and Common Rights
   - Lake, Mash and River
   - Flora and Fauna

3) Impacts caused by Increase of Wastewater Generation due to the new water supply
   - Water Pollution
   - Lake, Mash and River
   - Flora and Fauna

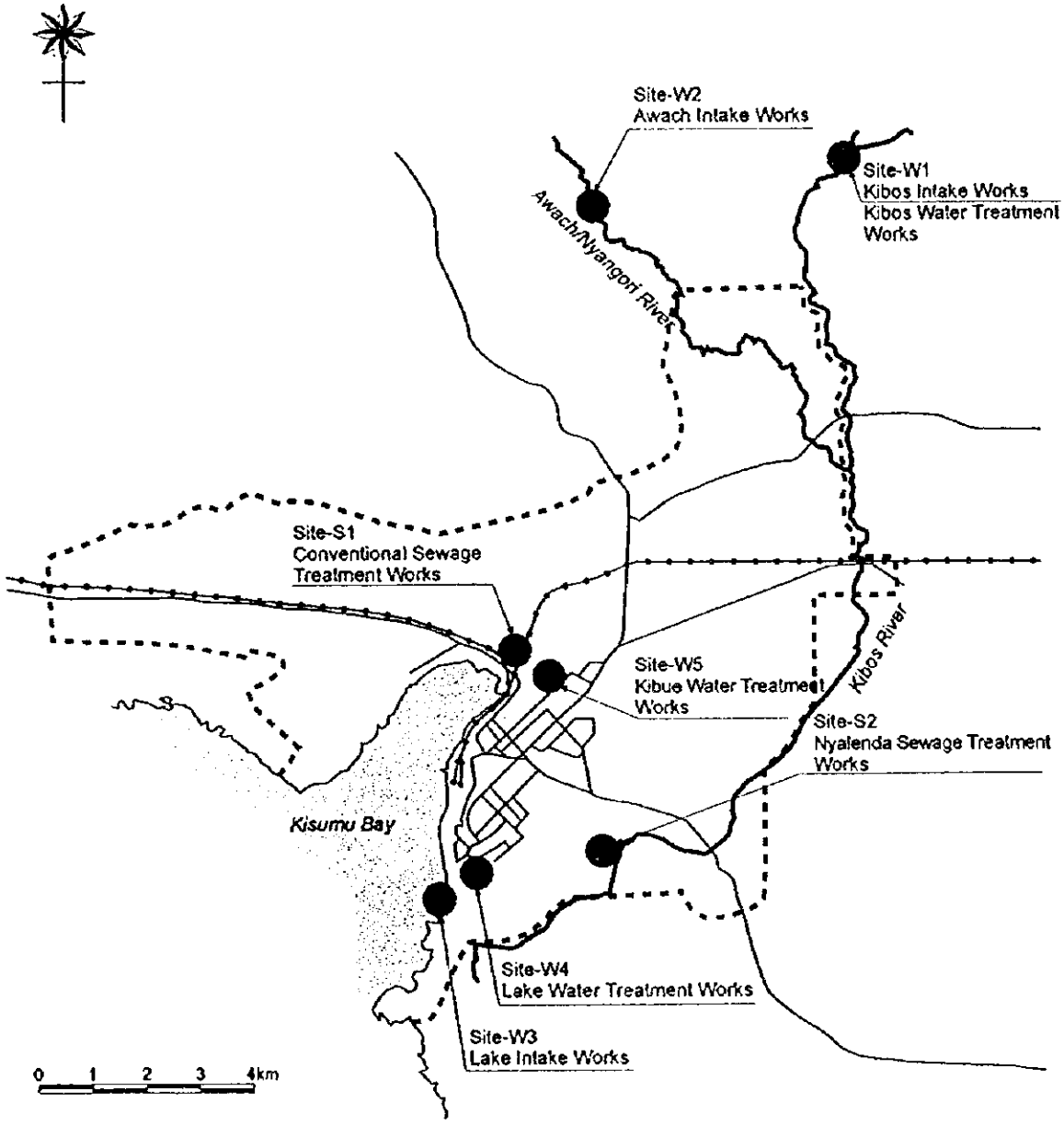
4) Impacts caused by Operation of Sewage Treatment Works
   - Waste Disposal
   - Groundwater
   - Flora and Fauna
   - Soil Contamination
   - Offensive Odor

In order to assess the above environmental items, following investigation and review works shall be carried out in EIA Study Area as shown in Figure 7-1.

1) Construction Sites Survey

2) Water Usage and River condition Survey downstream from proposed intakes in Kibos River and Awach/Nyangori River
3) Pollution Load Prediction in Kisumu Municipality
4) Review Works of Environmental Impacts Procedure proposed by Government of Kenya.
5) Review Works of Ecological Survey Reports, and Study in Kisumu Bay (Lake Victoria)

Figure 7-1



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 : EIA STUDY AREA