(7) Liaison with other MOLG Departments on project budgets, on lending loan agreement, procurement procedures, approvals and disbursements

(8) Liaison with donors and NGOs on loan agreements and technical assistance

(9) Co-ordinate training and career development for staff within the section.

The current Head of Water and Sanitation Section is the Co-ordinator of the Nakuru Sewage Works Rehabilitation and Expansion Project and represents the MOLG in the IWG.

By-laws and regulations made by local authorities have to be studied and commented upon by the UDD before approval by the MOLG. Enforcement of the Bylaws and regulation is the responsibility of the respective local authority.

K2.5.3 Nakuru Municipal Council (NMC)

(1) Overall organization

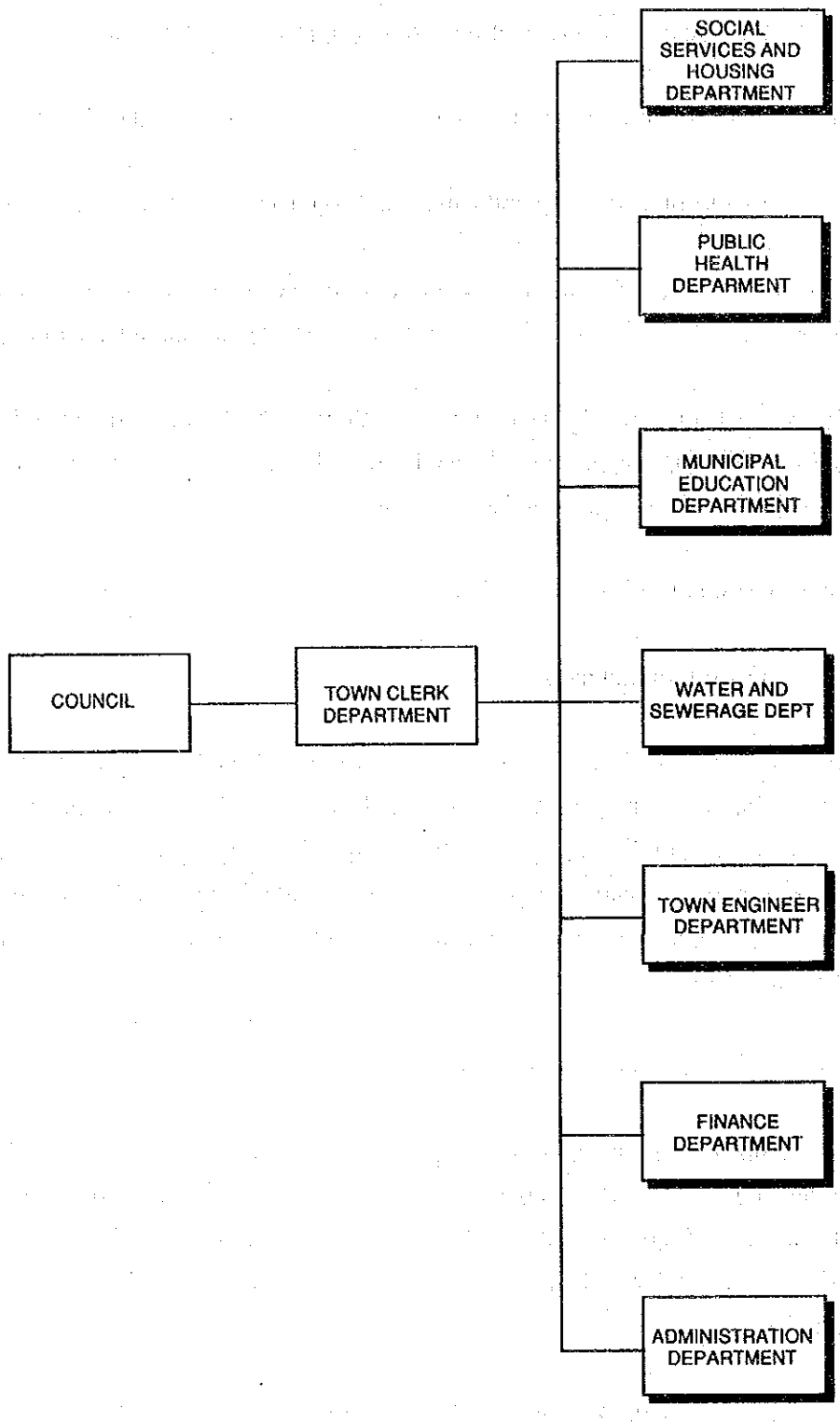
Nakuru Municipality is administered by the NMC composed of 19 elected Councillors and 6 nominated Councillors headed by His Worship the Mayor. Fig. K-4 shows the overall organization chart of the Council. There are seven departments out of which the Water and Sewerage Department (WSD) and the Health Department (HD) are directly involved in sewerage and sanitation services and are of great interest in this Study.

(2) Existing organization of the WSD

The management and administration of the water supply and sewerage affairs are under the WSD. Previously the affairs were within the Municipal Engineers Department of the Council. The NMC decided to establish the WSD vide the Council Minutes of 1992 which were given the Local Government Ministerial approval the same year.

The new organization as proposed to the Council is shown in Fig. K-5 which shows the number of staff required, the salary scales and the officers who are correctly in-post. The proposed staff are 220 in total of which 42 are proposed for the sewerage sector. Table K-1 shows the existing staff at each position in the sewerage sector of the WSD.

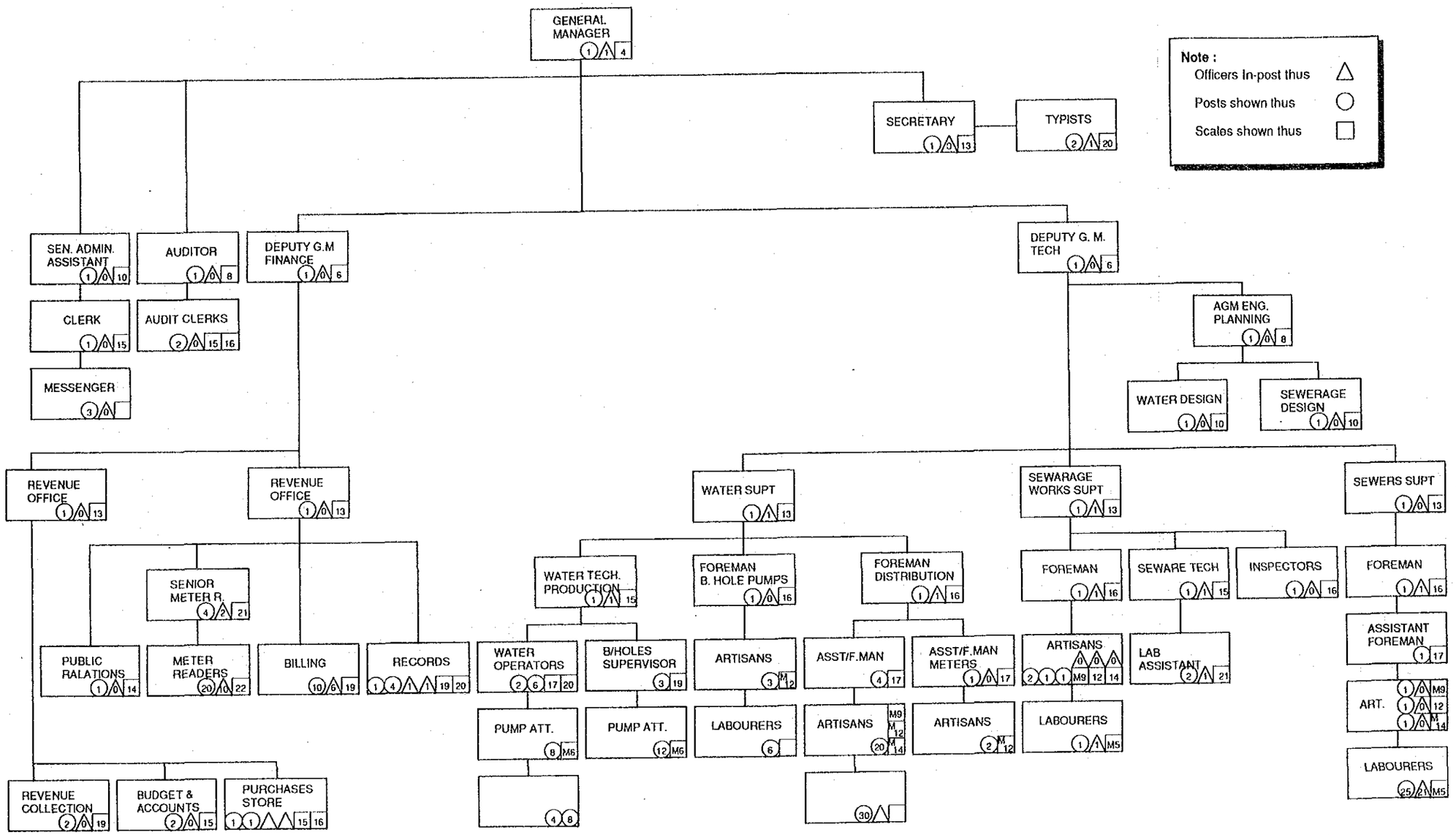
Fig. K-4



Source : Nakuru Municipality

THE REPUBLIC OF KENYA MINISTRY OF LOCAL GOVERNMENT	THE STUDY ON THE NAKURU SEWAGE WORKS REHABILITATION AND EXPANSION PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE OGRANIZATION CHART FOR MUNICIPAL COUNCIL OF NAKURU

Fig K-5



Souce : Nakuru Municipality

THE REPUBLIC OF KENYA MINISTRY OF LOCAL GOVERNMENT	THE STUDY ON THE NAKURU SEWAGE WORKS REHABILTION AND EXPANSION PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE EXISTING OGRANIZATION CHART OF WATER AND SEWAGE DEPT. OF MUNICIPAL COUNCIL OF NAKURU

Table K-1 Staffing Schedule of Sewerage Sector of WSD

	Position	Staffing			Proposed for 1993/94 Fiscal Year
		Proposed	Posted	Vacant	
A.	General Manager	1	1	0	-
B.	Deputy General Manager	1	0	1	-
C.	Sewage Works Section				
	C.1 Sewage Works Superintendent	1	1	0	-
	C.2 Sewage Foreman	1	1	0	-
	C.3 Artisan	4	0	4	-
	C.4 Laborers	1	19	0	-
	C.5 Sewage Technician	1	1	0	-
	C.6 Laboratory Assistant	2	1	1	1
	C.7 Inspector	1	0	1	1
D.	Sewer Section				
	D.1 Sewer Superintendent	1	1	0	-
	D.2 Sewer Foreman	1	1	0	-
	D.3 Asst. Sewer Foreman	1	1	0	-
	D.4 Artisan	3	0	3	-
	D.5 Laborers	25	21	4	2
	Total (excluding General and Deputy Managers)	42	47	13	4

(Data source : WSD)

Qualification of the key staff of the sewerage services are shown in Table K-2.

Table K-2 Qualification of Existing Staff in Sewerage Service Sector

Staff	Qualification
1. General Manager	- B. Sc Civil Engineering, 1978 - Post Graduate Diploma in Water and Public Health Engineering, 1983 - Post Graduate Diploma in Water Pollution Control Management, 1984 - Master of Science in Water and Waste Water Engineering, Loughbourough University of Technilochy, U.K.
2. Sewage Works Superintendent	- "O"level (graduate of secondary school), Division III - High National Diploma in Water Engineering Kenya Polytechnic. - Sewerage Inspector Certificate, Kenya Water Institute
3. Sewage Technician	- "O" level - Water Inspector Certificate, Kenya Water Institute
4. Sewage Foreman	- "O" level, Division IV - Sewerage Operator Grade III, Kenya Water Institute
5. Laboratory Assistant	- "O" level - Sewerage Operator Grade III, Kenya Water Institute
6. Sewer Foreman	- "O" level, Division III - Sewerage Inspector Certificate

(Data source : WSD, NMC)

All the key staff hold the Sewerage Inspector Certificate or the Sewage Operator Grade issued by the Kenya Water Institute (KEWI) of the MOLRRWD. According to the WSD, the proposed number of staff has been assessed on the basis of the present level of the sewerage services and therefore the WSD needs to be strengthened in line with the proposed expansion of the Njoro Sewage Treatment Works by the NWCPC and the Project under the current study. In order to achieve the stringent sewage effluent standards for discharge into Lake Nakuru, enactment and enforcement of the proposed Trade Effluent By-laws are necessary in order to reduce the pollution load into the sewers.

It is recommended that a Trade Effluent Control Unit (TECU) be established within the WSD. The proposed organization and functions of the TECU is presented in Chapter K6 of this Report. The establishment of TECU calls for additional staff and improved laboratory facilities available for wastewater analysis. The IWG should play its supervisory role to ensure that TECU has adequate facilities and resources necessary for trade effluent control and the enforcement of the Trade Effluent By-laws.

(3) The functions of the WSD

The stipulated functions of the WSD are :

(a) To procure safe and reliable potable water for the residents of Nakuru Municipality

(b) To plan, design, operate and maintain efficiently water distribution system that is also reliable in terms of quantity and quality

(c) To operate and maintain efficiently the Nakuru municipal sewerage system

(d) To operate and maintain the sewage treatment works so as to conform with the acceptable effluent standards as laid down by the Minister in charge of water affairs

(e) To operate a self financing enterprise that will allow sufficient financial reserve for development and proper preventive maintenance of water supply and sewerage services.

(f) To implement an efficient billing and revenue collection system for water and sewerage services.

(g) To maintain a sound accounting system for all operations within the WSD.

The WSD is now operational bit within human and financial resources. It works in close collaboration with the Health Department, the MOLRRWD and the NWCPC and is representated in the District Development Committee for the Nakuru District through the Office of the Town Clerk. The Town Clerk is the Chief Executive of the NMC and the Office handles all external matters related to the various Government Ministries, NGOs and State Corporations.

(4) Departmental Facilities of the WSD

According to the General Manager of the WSD the following facilities are available for the Department.

(a) Offices :

The WSD has the following offices :

(i) Office of the General Manager (two offices - one for GM and the other for the GMs Secretary)

(ii) General office for the Billing Section

(iii) Office for the Water Superintendent

(iv) One temporary office for the Administration Section

(v) One General Office shared by the Sewer Foreman, Assistant Sewer Foreman and the Sewer Technician.

(vi) The Sewage Works Manager and the Assistant Sewage Works Manager are based at the Town Sewage Works.

(vii) The Water Technician is housed at the Meroroni Water Treatment Works. This office serves also as the water laboratory and is also shared with the Senior Water Operator.

(viii) The Senior Water Operator at the Malewa Water Treatment Works has an Office - cum - Laboratory.

The WSD has a severe shortage of Offices. An Office Block should be made available for the WSD to accommodate all the staff. The proposed number of offices is presented in Section K6.3.7.

(b) Laboratories

The WSD has inadequate laboratory facilities both for water and wastewater analysis. At the Meroroni Water Treatment Works, there is a small laboratory which has capacity for Residual Chlorine and Jar Test determination only. The accuracy of the results from the laboratory leaves lot to be desired. At the Njoro STW there is a small laboratory with equipment shown in Table K-3.

Table K-3 Instruments in Laboratory at Njoro STW

No.	Particulars	Manufacturer	Model	Sri No.	Conditions	Remarks
1.	Manometric incubator	BS B5-Gerat	RA 138A	9268201	Good	for six (6) bottles
2.	pH meter	WTW(*1)	pH91	38480277	Good	
3.	Oxygen meter	Syland (*2)	Simpiair-L	800690	No good	(*3)
4.	Oxygen meter	YSI (*4)	54ARC	10178	No good	(*3)
5.	pH meter	Orion (*5)	399A	80753	No good	(*3)
6.	Turbidition meter	NIL	NIL	NIL	Good	
7.	Incutrab/2	HACH (*6)	2597A	3151	Good	
8.	Incubimeter	HACH (*6)	2173A	NIL	No good	
9.	Filter set	NIL	NIL	NIL	Good	
10.	Spectro photo meter	HACH (*6)	DR/2 2582-00	887	No good	(*7)
11.	Deionizer	Elgastat	B.114	557	Good	
12.	Refrigerator	NIL	NIL	NIL	Good	Approx. 200 ltr
13.	Others	NIL	NIL	NIL	Good	

(Data source: Study Team and WSD)

(Legend)
NIL No specific figure shown on instrument

(Notes)
(*1) Wiss Techn-werkstatten, D812 Weilhelm, Germany
(*2) Syland Scientific GMBH, Tiergarten str, Humbold str 2 D-6148, Heppenheim, Germany
(*3) Not functioning due to breakdown of probe
(*4) Yellow Spring Instruments Co., Inc, Yellow Spring, Ohio, USA
(*5) Orion Research Inc. Cambridge, Mass, USA
(*6) Hach Chemical Co., PO Box 907, Ames, Iowa, USA
(*7) No stock of agents
(*8) Quantity of all instruments is one set. Quantity for item No. 13 is one lot

The parameters determined at laboratory are : -

- Biochemical Oxygen Demand (BOD)
- Dissolved Oxygen (DO)
- Settlable Solids (SS)
- pH

(c) Workshop in Town STW

A small number of electrical tools and other tools for repairing the facilities at Njoro and Town STWs are provided at the Town STW as shown in Table K-4.

Table K-4 Instruments in Workshop at Town STW

No.	Particulars	Manufacturer	Model	Srl No.	Conditions	Remarks
1.	Bench drilling machine	Black & Decker	EK	NIL	Good	13mmD
2.	Bench vice	NIL	5"	NIL	Good	
3.	Angle grinder	NIL	NIL	NIL	No Good(*1)	180mmD
4.	Double head bench grinder	NIL	7"	NIL	Good	7"D
5.	AC welder	Electra beckum	140W6	C88375	Good	46V, 30-140A

(Data source: Study Team and WSD)

(Legend)
NIL No specific figure shown on instrument

(Notes)
(*1) Carbon brushes exhausted
(*2) Quantity of equipment is one set

(d) Transport

The WSD has the following vehicles :

(i) Two (2) used Peugeot 504 in serviceable condition
(ii) One lorry for unlocking sewers. The vehicle is old and experiences frequent breakdowns.

There is therefore a serious shortage of vehicles within the WSD which affects the effectiveness of the operation and maintenance functions of the WSD. The meter servicing, repairs, attendance to leakages and sewer breakdowns are hardest hit by the shortage.

(e) Mobile Radio

The WSD has a mobile radio system that is currently out of order and needs repair.

(f) Financial Resources

The Department is allocated financial resources through the Council budgetary system which is controlled by the Municipal Treasurer. The Accounting system is the normal council accounting system through the Municipal Treasurer. The WSD is to establish a Departmental Accounting Section under the control of the General Manager. The budgetary allocation for the 1993/94 fiscal year for the WSD is shown in Table K-5.

Table K-5 Annual Expenditures for Water, Sewerage and Health Services

Year	Overall of NMC (Kshs.10^6)	Water Supply		Sewerage		Health	
		Amount (KShs 10^6)	Share (%)	Amount (KShs10^6)	Share (%)	Amount (KShs 10^6)	Share (%)
1988/89	73.20	13.35	18.2	2.93	4.0	13.40	18.3
1989/90	85.80	14.01	16.3	3.34	3.9	21.18	24.7
1990/90	103.64	17.18	16.6	5.06	4.9	22.80	22.0
1991/92	121.94	18.65	15.3	4.26	3.5	22.11	18.1
1992/93	121.70	20.81	17.1	4.94	4.1	29.82	24.5
1993/94	181.96	45.22	24.9	5.93	3.3	34.08	18.7

(Data source : NMC)

Note : Probable value for 1992/93 and budget for 1993/94.

As shown in Table K-5 only 3.3 % of the entire NMC budget for the fiscal year 1993/94 is allocated to the sewerage sector which is inadequate. Detailed annual expenditures in the sewerage sector are shown in Table K-6.

The 1993/94 fiscal year budget amounts to KShs 296,333. The amount may be categorizes, thus :

	KShs
Salaries and Wages	2,453,900
Operation and Maintenance	1,391,660
Loan Charges	1,281,060
Computer Charges	800,040

Table K-6 Annual Expenditures of Sewerage Sector

(Unit : Kenya Pound)

Items	1991/92			1992/93			1993/94		
	Sewage Treatment Works	Sewer Maintenance	Total	Sewage Treatment Works	Sewer Maintenance	Total	Sewage Treatment Works	Sewer Maintenance	Total
Salaries and wages	48,588	62,423	111,011	48,270	63,336	111,606	55,243	61,452	116,695
Superannuation fund	1,236	660	1,896	1,483	717	2,200	1,886	707	2,593
Provident fund	900	2,201	3,101	1,172	2,012	3,184	1,200	2,055	3,255
Subsistence allowance	99	0	99	1,000	0	1,000	1,000	0	1,000
Uniforms	984	894	1,878	2,750	1,500	4,250	3,000	2,000	5,000
Maintenance of building	0	0	0	2,000	0	2,000	3,000	0	3,000
Electricity	5,708	0	5,708	5,000	0	5,000	6,000	0	6,000
Water and conservancy	465	0	465	465	0	465	465	0	465
Repairs and maintenance	0	1,944	1,944	0	4,500	4,500	0	6,000	6,000
Rates and insurance	1,348	0	1,348	1,348	0	1,348	1,348	0	1,348
Laboratory Equipment	228	0	228	1,500	0	1,500	2,000	0	2,000
Transport	10	1,780	1,790	350	6,000	6,350	250	8,000	8,250
Maintenance of plant	1,492	0	1,492	5,000	0	5,000	5,000	0	5,000
Maintenance of lagoons	0	0	0	4,750	0	4,750	3,200	0	3,200
Maintenance of septic tank	0	0	0	0	500	500	0	0	0
Telephone	1,029	0	1,029	280	0	280	500	0	500
Hoses	0	1,216	1,216	0	7,000	7,000	0	7,000	7,000
Equipment, drain rods	0	0	0	0	800	800	0	3,350	3,350
Askari Force	3,290	0	3,290	3,598	0	3,598	4,634	0	4,634
Cleaning material	78	0	78	100	0	100	100	0	100
Loan Charges	64,053	0	64,053	64,053	0	64,053	64,053	0	64,053
Safety equipment	0	0	0	0	0	0	1,000	0	1,000
Maintenence of sub pumps at Mwariki	0	0	0	0	0	0	3,750	0	3,750
Sewer Extension	1,222	0	1,222	0	0	0	0	0	0
Maintenance of sludge drying bed	0	0	0	3,750	0	3,750	3,750	0	3,750
Manhole cover	0	0	0	0	0	0	0	4,388	4,388
Computer services	0	10,966	10,966	0	13,685	13,685	0	40,002	40,002
Total	130,730	82,084	212,814	146,869	100,050	246,919	161,379	134,954	296,333

Note : Probable value for 1992/93 and budget for 1993/94
Data source : NMC

The annual budget corresponds to only KShs. 30 per inhabitant and the direct operation and maintenance share only 23.5 % of the total sewerage budget. It was not possible to WSD to expand sewers in recent years due to financial constraints. Autonomy in financial in WSD will improve the situation.

(5) The Public Health Department (PHD)

The functions of the PHD are derived mainly from the Public Health Act (Cap 242) and the Local Government Act (Cap. 265). Other relevant laws are the Pharmacy and Poisons Act (Cap 244), Medical Practitioners and Dentists Act (Cap 253) and By-laws that have been made by the Council regarding Public Health.

The functions of the PHD are stipulated as follows :

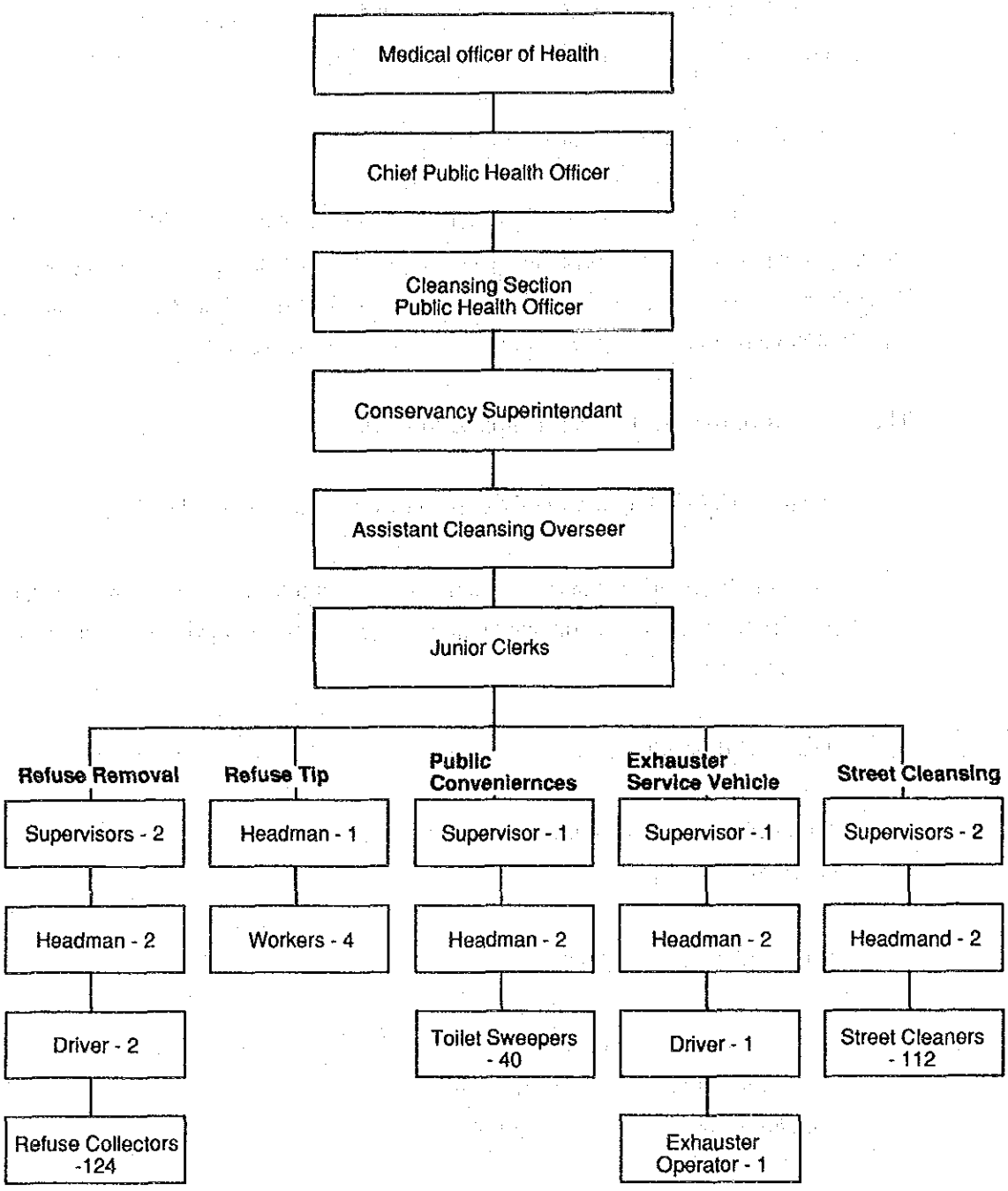
- Medical Care - diagnosis and treatment of diseases within the Clinics
- Disease Preventive Services - control of communicable diseases, cleaning services, food inspection water quality, pollution control and inspection of public places.
- Health Promotion Services - mainly through public health education
- Other Services - ambulances, hearse burials in cemeteries and mortuary services.

(a) Cleansing Services

The cleansing services provided by the PHD is essential for pollution reduction. The organization of the Cleansing Section is shown in Fig. K-6 and the present staffing in Table K-7.

The annual expenditure was for the PHD is presented in Table K-5.

Fig. K-6



THE REPUBLIC OF KENYA MINISTRY OF LOCAL GOVERNMENT	THE STUDY ON THE NAKURU SEWAGE WORKS REHABILITATION AND EXPANSION PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE EXISTING ORGANIZATION FOR CLEANSING SERVICE SECTION

Table K-7 Present Staffing of Cleansing Services Section of PHD

	Position	Nos. of Staff
A.	Medical Officer of Health	1
B.	Chief Public Health Officer	1
C.	Cleansing Service Section	
	C.1 Public Health Officer	1
	C.2 Conservancy Superintendent	1
	C.3 Asst., Cleansing Overseer	1
	C.4 Junior Clerk	1
D.	Refuse Removal Sub-section	
	D.1 Supervisor	2
	D.2 Drivers	4
	D.3 Refuse Collector	124
E.	Refuse Tip Sub-section	
	E.1 Headman	1
	E.2 Worker	4
F.	Public Convenience Sub-section	
	F.1 Supervisor	1
	F.2 Headman	2
	F.3 Toilet Sweeper	40
G.	Exhauster Service Sub-section	
	G.1 Supervisor	1
	G.2 Headman	2
	G.3 Driver	1
	G.4 Exhauster Operator	1
H.	Street Cleansing Sub-section	
	H.1 Supervisor	2
	H.2 Headman	2
	H.3 Street Cleaner	112
	Total for C through H	305

(Data source : PHD, NMC)

(b) Garbage Disposal Management

For the purpose of garbage collection the Nakuru Municipality is divided into ten (10) districts, each housing a team of twelve (12) workers including a head man. Each district is then subdivided into small sections or subdivisions to facilitate regular refuse collection. The refuse collection is carried out twice a week in each district.

Table K-8 Type, Model and Condition of Vehicles for Refuse Disposal

Registration No.	Year of Manufacture	Engine Type	Engine Capacity	Carrying Capacity	Type of Body	Condition
KLO 981	1968	Diesel	5700 cc	8790 lbs.	Rear loader comapctor	Undergoing repair
Z5205	1962	-	-	4750 lbs.	Side loader	Not good
KLG 157	1972	Diesel	5700 cc	10565 lbs.	Side loader compactor	Undergoing repair
KLU 516	1976	Diesel	5600 cc	4588 lbs.	Side loader compactor	Good condition
KSD 790	1978	Diesel	6224 cc	6200 kg	Side loader compactor	Good condition
KSG 043	1980	Diesel	6224 cc	6000 kg	Side loader compactor	Undergoing repair
KQY 676	1976	Diesel	5420 cc	6775 lbs.	Tanker	Not in working condition
KWE 053	1989	-	3908 cc	1150 lbs.	Minimatic, compacting system	Unserviceable
KWE 055	1989	-	3908 cc	1220 lbs.	Same as above	Undergoing repair
KWE 056	1989	-	3908 cc	1220 lbs.	Same as above	Undergoing repair
KWE 058	1989	-	3908 cc	1220 lbs.	Same as above	Good condition
KWE 060	1989	-	3908 cc	1260 lbs.	Same as above	Good condition
KWE 059	1989	-	5870 cc	13798 lbs.	Container lifting	Good condition
KWD 061	1989	-	5560 cc	13798 lbs.	Same as above	Good condition
KWE 05?	1989	-	5870 cc	11548 lbs.	Exhauster	Good condition
KWE 052	199?	-	8102 cc	-	Land crawler	Undergoing repair

Data source : PHD, NMC

The eating establishments, hospitals and boarding schools are attended to more often than twice a week. Two refuse collection vehicles are available on Saturday for refuse collection. Table K-8 shows the type and condition of vehicles for refuse disposal.

At present the solid waste is disposed with earth fill in a small valley located in the northeast of the Nakuru Municipality. A land crowler is used to facilitate the controlled tipping disposal of refuse. Table K-9 presents the number of dustbins and volume of refuse collected in the recent years.

Table K-9 Number of Dustbins and Volume of Refuse Collected

Year	Number of Dustbins	Domestic Refuse (ton)	Industrial Waste (ton)
1987	10,275	7,461	6,018
1988	10,513	7,178	9,493
1989	10,807	15,150	4,683
1990	11,045	23,040	3,792
1991	11,283	23,040	4,818
1992	11,286	23,040	4,956

(Data source : PHP, NMC)

It is recommended that solid waste from industries should be separated from domestic refuse. Solid waste containing heavy metals and hazardous chemical should be disposed in lined landfill to reduce groundwater pollution. This location has been in use since 1973 and it is estimated that it will take about ten (10) years before the valley is covered. However no monitoring is being practiced as to quantity and quality of leachate from the disposal area. There may be possibility of ground water contamination from infiltration of pollutants from the refuse dumping site. Surface runoff may also have adverse effect on Lake Nakuru as it may contain pollutants from industrial and commercial establishments.

K2.6 Ministry of Land Reclamation Regional and Water Development (MOLRRWD)

The MOLRRWD was formed in January 1993 after a merger of the former Ministries of Water Development Regional Development, Reclamation and Development of Arid, Semi-Arid and Waste Lands. The functions of the MOLRRWD that are relevant to this Study are :

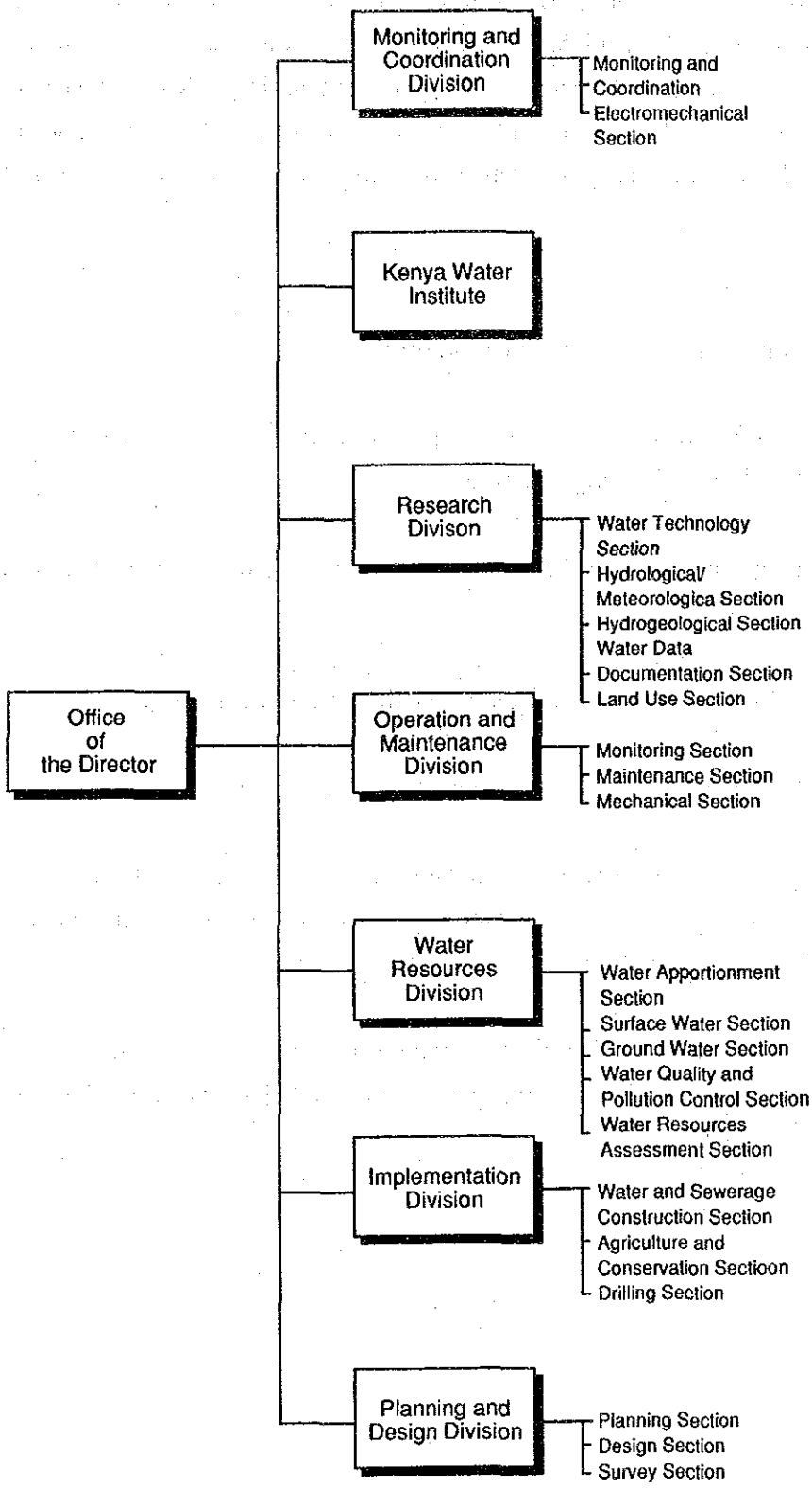
- Water development and supplies
- Control of water catchment
- Water quality and pollution control

The MOLRRWD has the overall responsibility for planning, conserving and operating water supplies throughout the country with a view to providing safe and clean water to all households. The Ministry administers the Water Act (Cap 372) through the Water Apportionment Board (WAB) of which the Director of Water Development is the Technical Advisor. The organization of the MOLRRWD is shown in Fig. K-7.

The Director of Water Development controls six divisions, the KEWI, the eight Provincial Water Engineers and 44 District Water Engineers . The Water Resources Division (WRD) carries out assessment, conservation and control of water, and registration of water right in co-operation with the WAB. The Planning and Design Division is in charge of studies, planning and design activities. The Implementation Division executes construction works of dam, pipeline, sewerage, agriculture, conservation and drilling. The Operation and Maintenance Division is responsible for operation and maintenance of works on water supply and wastewater systems including the policy making thereof. The Research Division is responsible for formulation of water research policies and activities in water resources and wastewater engineering. The Monitoring and Co-ordination Division coordinates all the other organizations under the Director and all the Engineers of Provinces and District. The KEWI is responsible for training of employees in the Ministry and local authorities.

The MOLRRWD is a member of the IWG of which the Director of Water Development is the Chairman. The Ministry maintains a small laboratory at Nakuru Provincial Water Engineers Offices for water and wastewater analysis. The capability of the laboratory is very limited and not sufficient for the detailed analysis that would be necessary for detailed wastewater analysis for monitoring purposes to check on compliance of effluent standards.

Fig. K-7



THE REPUBLIC OF KENYA MINISTRY OF LOCAL GOVERNMENT	THE STUDY ON THE NAKURU SEWAGE WORKS REHABILITATION AND EXPANSION PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE MINISTRY OF LAND RECLAMATION, REGIONAL AND WATER DEVELOPMENT (MOLRRWD) ORGANIZATION CHART WATER DEVELOPMENT DEPARTMENT

It is proposed that a well equipped laboratory be established in Nakuru under MOLRRWD with financial support from KWS. The laboratory should then be gazette in the Kenya Gazette in order to give legal credence to the result emanating from the laboratory. Such analytical results can be used in a Court of Law for prosecuting cases of pollution of any body of water. The details of the proposed laboratory are presented in Chapter K6 of this Report.

K2.7 National Water Conservation and Pipeline Corporation

The National Water Conservation and Pipeline Cooperation (NWCPC) was established in June 1988 with the following functions :

(1) Plan, manage, and procure equipment for construction of dam and water supplies,

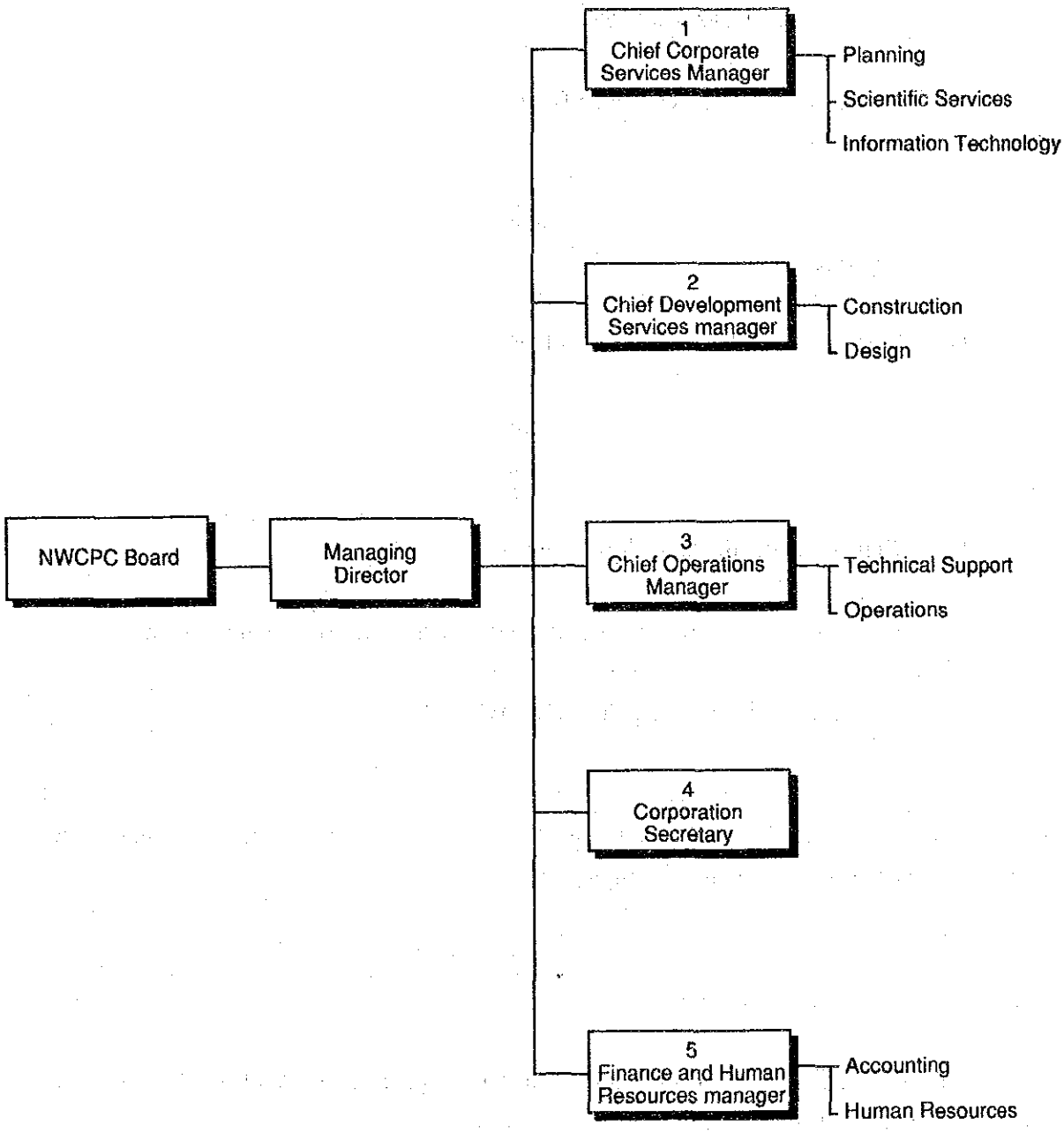
(2) Promote efficiency in the operation of existing major water projects,

(3) Ensure that water projects that are financially viable do generate revenue.

The NWCPC is responsible for the implementation, operation and maintenance of the Greater Nakuru Water Supply Project for bulk water supply for the Nakuru Municipality and is a member of the IWG discussed in Section K2.3 in this report.

The NWCPC consists of the Board, the Managing Director, five Departmental Managers and other junior staff mainly transferred from the MOLRRWD. Fig. K-8 shows the organization chart of the NWCPC.

Fig. K-8



THE REPUBLIC OF KENYA *MINISTRY OF LOCAL GOVERNMENT*	THE STUDY ON THE NAKURU SEWAGE WORKS REHABILITATION AND EXPANSION PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ORGANIZATION STRUCTURE OF THE NATIONAL WATER CONSEVATION AND PIPELINE CORPORATION

K2.8 District Water Boards

The District Water Boards were established by the Government is 1991. The objectives of establishment of the Boards was to ensure proper coordination and planning of water activities at the district level. The Boards are sub-committee of the DDC.

The functions of the District Water Board through coordination with the DDC and Ministerial agencies are :

(1) Protection, conservation and preservation of all cathment areas within the District.

(2) Partitioning, allocations and authorization of all water bodies.

(3) Water quality and pollution control activities. This will include the control and elimination of all agricultural and industrial pollutants.

(4) Management and control of water use.

(5) Overseeing and coordinating all water related activities in the District.

(6) Assisting in the enforcement of the Water Act.

All issues discussed by the Board are channeled through the office of the District Water Engineer who is the secretary to the Board. The District Water Engineer is the technical advisor to the Board and the implementer of the Board's decisions.

K2.9 Kenya Wildlife Services (KWS)

The KWS was established in 1989 by an Amendment of the Wildlife (Conservation and Management) Act (Cap 376) of the Laws of Kenya.

Section 3A of the Act stipulated the functions of KWS, thus :

(1) formulate policies regarding the conservation, management and utilization of all types of fauna (not being domestic animals) and flora;

(2) advise the Government on establishment of National Parks, National Reserves and other protected wildlife sanctuaries;

(3) manage National Parks and National Reserves;

(4) prepare and implement management plans for National Parks and National Reserves and the display of fauna and flora in their natural state for promotion of tourism and for the benefit and education of the inhabitants of Kenya;

(5) provide wildlife conservation education and extension services to create public awareness and support for wildlife policies;

(6) sustain wildlife to meet conservation and management goals;

(7) conduct and co-ordinate research activities in the field of wildlife conservation and management;

(8) identify manpower requirements and recruit manpower at all levels for the Service for wildlife conservation and management;

(9) provide advice to the Government and local authorities and landowners on the best methods of wildlife conservation and management and be the principal instrument of the Government in pursuit of such ecological appraisals or controls outside urban areas as are necessary for human survival;

(10) administer and co-ordinate international protocols, conventions and treaties regarding wildlife in all its aspects in consultation with the Minister;

(11) solicit by public appeal or otherwise, and accept and receive subscriptions, donations, devises and bequests (whether movable or immovable property and whether absolute or conditional) for the general or special purposes of the Service or subject to any trust;

(12) render services to the farming ranching communities in Kenya necessary for the protection of agriculture and animal husbandry against destruction by wildlife.

KWS is managed by a Board of Trustees which according to Section 3B(1) of the Act consists of :

(1) a chairman appointed by the President;

(2) the Permanent Secretary in the Ministry for the time being responsible for matters relating to wildlife;

(3) the Permanent Secretary in the Ministry for the time being responsible for finance;

(4) the Permanent Secretary in the Ministry for the time being responsible for local government;

(5) the Commissioner of Police;

(6) the Director of Forests;

(7) a representative of the Permanent Secretary in the Office of the President responsible for internal security;

(8) the Director of Veterinary Services;

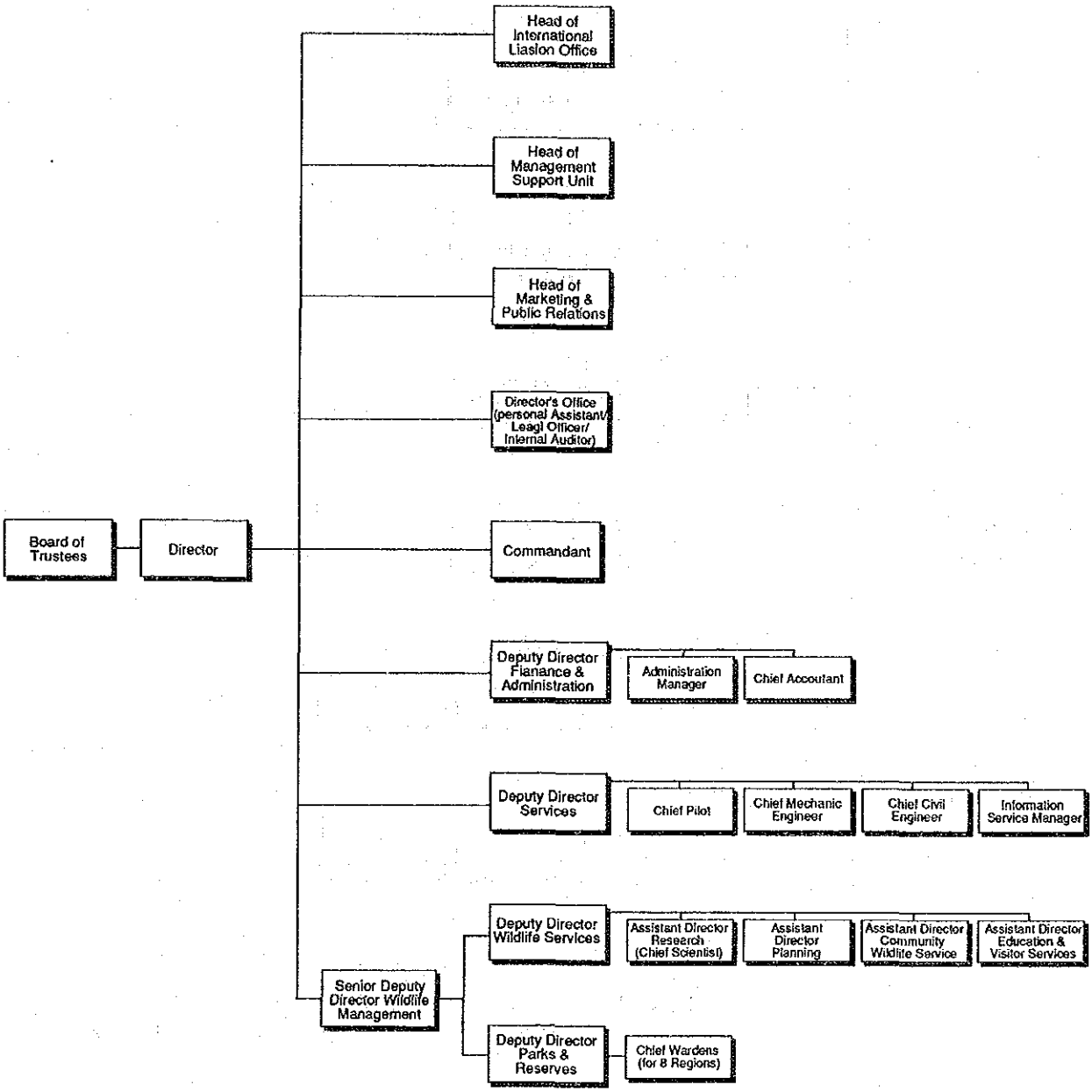
(9) not more than six other trustees to be appointed by the Minister from amongst the persons who are conversant with nature conservation in all its aspects.

The chairman and the trustees to be appointed under subsection (1) (a) and (i) shall hold office for three years and shall be eligible for reappointment. The Board shall elect a vice-chairman from among its members and meet at least four times in every year.

Fig. K-9 shows the senior management structure of KWS and Fig. K-10 organization chart of KWS Regional Office.

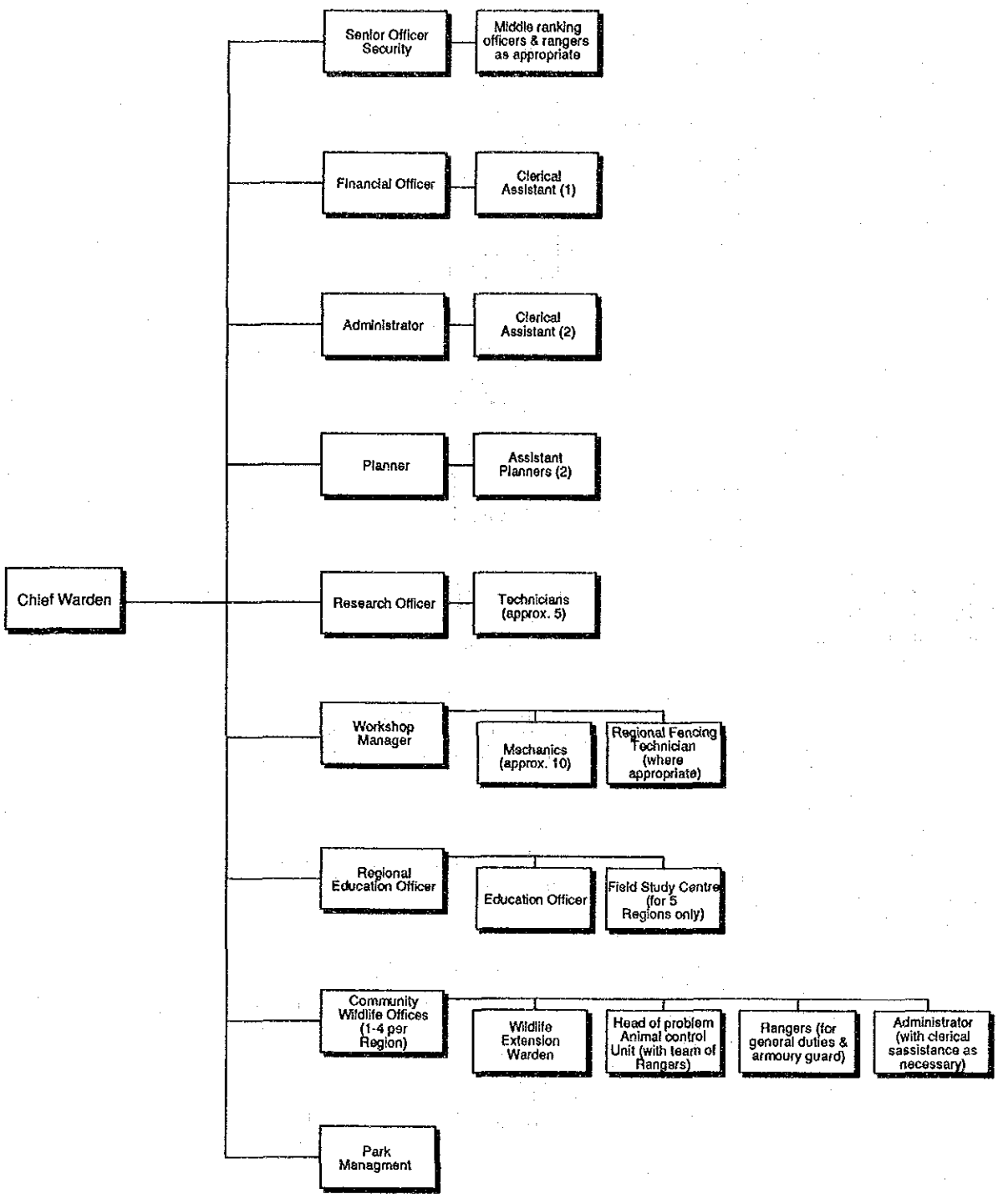
KWS has established the Lake Nakuru National Park at the centre of which is Lake Nakuru.

Fig. K-9



THE REPUBLIC OF KENYA	THE STUDY ON *THE NAKURU SEWAGE WORKS* REHABILITATION AND EXPANSION PROJECT	TITLE *MINISTRY OF TOURISIM AND WILDLIFE* KWS SENIOR MANAGEMENT STRUCTURE
MINISTRY OF LOCAL GOVERNMENT	JAPAN INTERNATIONAL COOPERATION AGENCY	

Fig. K-10



THE REPUBLIC OF KENYA MINISTRY OF LOCAL GOVERNMENT	THE STUDY ON THE NAKURU SEWAGE WORKS REHABILITATION AND EXPANSION PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE MINISTRY OF TOURISIM AND WILDLIFE KWS ORGANIZATION CHART FOR REGIONAL OFFICE

K2.10 Non-Governmental Organizations

(1) African Association for Literacy and Adult Education (AALAE)

Founded in 1984, the organization is concerned with furthering women education as far as the environment is concerned.

(2) African NGO's Environmental Network (ANEN)

The organization was founded in 1982 and its main subject areas are marine ecosystems, agriculture, freshwater, forestry, energy, women in development and environmental development.

(3) African Water Network (AWN)

This organization was established in 1989 and its interest is in issues of freshwater, dams, drinking water, water resources development and conservation.

(4) African Pesticide and Environment Management Foundation (APEMAF)

Established in 1986, APEMAF aims to monitor and manage the impact of development activities on human health. The organization has carried out several projects in compilation of regional data base; short term and post graduate training on EIA; assisting governments in preparing their NEAPs.

(5) African Wildlife Foundation (AWF)

AWF was founded in 1961 with the aim of strengthening the local conservation efforts and wildlife institution. The main activities of AWF include, protection of endangered species, maintenance of integrity in protected areas, community conservation and planning for wildlife management and training.

(6) Bellerive Foundation

This organization which was established in 1983 has various activities aimed at providing means of conserving woody biomass resources. The main interest is in natural resources conservation, wildlife conservation, afforestation and reafforestation, energy, pollution and wastemanagment.

(7) Care International (CARE)

The organization was founded in 1968 and its main interest is in community and social services, natural resources, environmental policy, environmental education, medical treatment and health care.

(8) Council for Human Ecology Kenya (CHEK)

The organization has been in existence since 1977. Its aim and objective are to improve the quality of life in rural areas both physically and spiritually. The subject areas of interest include trees, rural areas, women in development, agricultural management, sustainable development and environmental education.

(9) East African Natural History Society

The organization is interested in the conservation of natural resources and is also interested in social and cultural indicators. The society has published ornithological books featuring the birds of East Africa and the breeding seasons of birds.

(10) ELSOE - Conservation Trust

The trust was founded in 1964 with the aim of protecting the habitats and also to further conservation education in respect of the wildlife. The subject areas of wildlife conservation, environmental education, marine ecosystems, and social economic aspects of human settlements.

(11) Environment Liaison Centre International (ELCI)

The organization was founded in 1974 and is currently engaged with activities which are in the broad areas of human settlements, energy; public information, environment education, agroforestry, sustainable development, agriculture, underprivilaged people; women in development. ELCI has been involved with various activities including strengthening of capacities of southern NGO's and promoting NGO advocay rules through UN organizations such as FAO, ECOSOC and IFAD.

(12) Ford Foundation

The organization was founded as early as 1938 and is concerned with areas such as agro-forestry, natural resources, ecological balance, women in development, energy, human settlements and environmental education.

(13) International Council for Research in Agroforestry (ICRAF)

ICRAF was founded in 1974 and is concerned with subject areas such as:

- Tropical forests
- Environmental education
- Afforestation and re-afforestation
- Agroforestry
- Economic development
- Fuel wood

The aim of the organization is to increase the economic and nutritional well being of people in developing countries in farming land use. The activities of ICRAF are mainly focussed on research, training and dessemination of information.

(14) Mazingira Institute

The institute has started programmes on housing, human health, afforestation and reafforestation, human population, women in development and sustainable development.

(15) Wildlife Clubs of Kenya (WCK)

Established in 1968, the clubs are engaged in activities which will create awareness on the economic and cultural value of the natural resources. The activities of these clubs are targeted to Kenya in particular and to East Africa in general. WCK publishes reports books on wildlife and then this information is documented. The WCK has established Langata Environment Resource Centre as a library and an information centre.

(16) The Worldwide Fund for Nature (WWF)

The organization has over 3.7 million supporters and 29 affiliate and associate national organizations worldwide. WWF has the aim of preserving the genetic, species and ecosystem diversity, reducing pollution, reducing wasteful exploitation and consumption of resources and energy.

(17) The International Union for Conservation of Nature: (IUCN)

The organization was established in 1948 in France. It is a big organization with a membership of 61 states and 121 governments. It aims to conserve soils, lands, water and air of the planet. The main activities are :

- Collection of data on environment
- Analysis of causes of environmental degradation
- Environment protection
- Publication of education books and reports on environment
- Conservation of biodiversity.

(18) African Centre for Technology Studies (ACTS)

The Centre is interested in environment training education, food science and technology, economic development, resources management, economic and sustainable development. The aims and objectives of the centre are to conduct policy research, to train and disseminate information. Several books and reports have been produced by ACTS todate.

K2.11 Environmental Impact Assessment

Environmental impact studies have not been a common feature in development projects in Kenya. There are, however, a few cases where such studies have been undertaken and these are cited in Table K-10

Table K-10 Other EIA's Conducted in Kenya

	Cost of Project (K.Shs.)	M/M for EIA	Cost of EIA (K.Shs.)	EIA Result	Year Ended
1. Mumias Sugar Company Ltd (1980)	20.3 Million	1 mm	120,000	Passed	1971
2. Trans/Discriplinary Ecological Study of the Kamburu/Gitaru Hydro-Electric Dam area on Tana River Basin	NI	NI	NI	NI	1975
3. Furs and wools Kenya Ltd. Project, Ruiru	6.0 million	NI	NI	NI	1978
4. The Impact of River Dischrges on a Kenya Coral Reef Ecosystem	NI	NI	NI	NI	1984
5. Kenya Tannery Project (Industrial promoation Services - Kenya ltd.)	80.5 million	1 mm	80,000	Passed	1984
6. Siltation of Tana Riverline Marine Ecosystem	NI	1 mm	NI	NI	1984
7. The Impact of River Discharges on a Kenya coral Ecosystem -The Athi (Sabaki) River Basin -Malindi Watamu Coastal Environmant	NI	6 mm	NI	NI	1984
8. Kwale Tourist Hotel Development on Marine Ecosystem	NI	2 mm	249,000	NI	1985
9. Effect of Effluent of Ramisi Sugar Company on Marine Ecosystem	NI	1 mm	200,000	NI	1985
10 Pan Paper Mills, Webuye	NI	1 mm	NI	NI	1986
11 Impact Assessment of Tourist on Coral Reef Ecosystem	NI	1 mm	180,000	NI	1986
12 Reclamation of Tana River Delta	NI	3 mm	NI	NI	1988
13 Nakuru Urban Water Project	NI	2 mm	NI	NI	1988
14 Kenya Paper Mill Ltd, Thika	K.Shs. 120 million	NI	NI	NI	1989
15 Magwagwa Hydro Electric Power Project	NI	NI	NI	NI	1991
16 Upgrading of Molo-Olengurone Road on Mau-Forest	NI	3 mm	NI	NI	1991
17 EIA of North East Olkaria Power Development Project (World Bank)	NI	18 mm	$450,000	NI	192

(Data source : Ministry of Environment and Natural Resources, 1992)
NI - No Information
M/M - Man-month

Kenya has no legislations requiring EIA to be undertaken for development projects and procedures for EIA are yet to be developed and approved. We are aware that the pollution of the Nzoia River is continuing due to insufficient institution of the anti-pollution measure that were recommended by the UNESCO sponsored baseline study that was undertaken prior to the establishment of the Webuya Pulp and Paper Mills.

Development of EIA Guidelines for application in Kenya is necessary.

K3. EXISTING WATER-RELATED LEGISLATION

K3.1 Introduction

The Kenya Government has enacted many laws related to water, wastewater, sewerage, public health and solid waste disposal. The important laws in this regard are :

(1) The Water Act (Cap. 372)

(2) The Local Government Act (Cap. 265)

(3) The Public Health Act (Cap. 242)

(4) The Factories Act (Cap. 514)

(5) The Pest Control Product Act (Cap. 346)

(6) The Forest Act (Cap. 385)

(7) The Wildlife and Conservation and Management Act (Cap. 376)

(8) The Agricultural Act (Cap. 318)

(9) The National Water Conservation and Pipeline Corporation Order, (Legal Notice No. 270 of June 24th 1988).

The above laws are reviewed in the context of non-structural measures that are proposed for the reduction of pollutants that discharge into Lake Nakuru.

K3.2 The Water Act (Cap. 372)

The Water Act was established in 1951 to make better provision for the conservation, control, apportionment and use of the water resources. The Act was revised in 1972 and consists of 17 parts and 193 sections. The Water (Amendment) Bill was prepared in 1992 for enactment by Parliament of Kenya but has not yet been debated.

The proposed Amendment makes provision for assessment and protection of water resources. The Section 5 of the Water Bill declares water to be vested in the Government, thus :

> "The water of every body of water under or upon any land is vested in the Government subject to any rights of user in respect thereof which, by or under this Act or any other written law, have been or are granted, or recognized as being vested, in any other person."

The Minister in charge of water affairs exercises controll over every body of water. The Water Act covers most area related to water such as municipal water, irrigation, sewerage, drainage, flood control, reclamation, the protection of the source and course of water.

The most important institutions appearing in the Water Act are the Minister of the Water Resources Authority (WRA) (now ceased to function) and the WAB. The WRA had been assigned to execute planning and investigation of water resources. The Minister executes construction works according to the plans recommended by the WRA. The functions of the WRA are now executed by the MOLRRWD, formerly the MOWD.

Under Section 25 of the Water Act the WAB was established and given duties under Regulations 72-75 to ensure that effluent discharged into water bodies do not contain poisonous matter. The major industries mentioned in the Act are paper mills, leather tanning industries and coffee mills.

The proposed Amendment replaces the WRA with the WAB and the Minister where appropriate. Section 9 is amended to include a sub section (e) that covers the "disposal or control of effluent" and subsection (g) that covers "the river transfer and diversion".

Section 13 is amended to strengthen the pollution control aspects of the Act. The proposal also amends the principal Act to provide for stiffer penalty for pollution of water resources for wherever such penalties appear in the Act.

The Minister has strong influence on local authorities. By Section 27, the Minister may appoint any person, authority, board or committee to be a Local Water Authority for the management and use of water or the drainage or land reclamation, It is under such authority that local authorities manage water affairs in their areas of jurisdiction.

NMC has authority for water management within Nakuru Municipality under which the NMC operate and maintain water and sewerage systems.

K3.3 The Local Government Act (Cap. 265)

The Local Government Act provide for the establishment of authorities for local government ; to define their functions and be provide for matters connected therewith and incidental thereto.

Sections 168 - 176 of the Local Government Act provide for local authorities to establish and maintain sewerage, drainage and water supply systems. These local authority powers are exerted in conjunction with the Water Act. The Water Undertakes Rules made under Section 182 of the Water Act apply to gazetted water undertakers's. NMC is a gazetted water undertaker.

Section 201 of the Local Government Act empowers local authorities to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and well-being of the inhabitants of its area.

The penalties imposed for breach of any by-law made under the Act is restricted to a fine not exceeding two thousand shillings in respect of a first offence and not exceeding three thousand shillings in respect of a second or subsequent offence, or imprisonment for a period not exceeding six months in respect of a first offence and nine month in respect of a second offence or subsequent offence, or both such fines and such periods of imprisonment.

K3.4 The Public Health Act (Cap. 242)

The Public Health Act makes provision for securing and maintaining health.

Part IX of the Act deals with Sanitation and Housing. Section 115 prohibits nuisances and Section 116 stipulates the duty of local authorities to maintain cleanliness and prevent nuisances.

Section 118 lists what constitutes nuisance which includes effluents and gaseous emissions from factories. The council can impose a fine not exceeding two hundred (200) Kenya Shilling to a person causing nuisance which is really not deterrent in the case of factories.

Section 129 of the Act spells out the duty of local authorities as to the protection of water supplies, thus:

> "It shall be the duty of every local authority to take lawful, necessary and reasonably practicable measures :
>
> (1) for preventing any pollution dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes (whatever such supply is derived from sources within or beyond its district); and
>
> (2) for purifying any such supply which has become so polluted, and to take measures (including, if necessary, proceeding at law) against any person so polluting any such supply or polluting any stream so as to be a nuisance or danger to health."

Section 130 empowers the Minister with powers to make rules for protection of water supplies whose duty to enforce may be imposed on local authorities. Rules made under this section are made with due regard to the interest of agricultural and any other industries.

Section 155 allows the Central Board of Health to apply to the Minister for authority to erect additional public latrines on unleased land.

Under Subsidiary Legislation,

Rule 16 of the Public Health (Drainage and Latrine) Rules empowers the local authority to prohibit the passing of solid matter, steam, chemical refuse etc., into sewers and makes it an offence to fail to comply with the rule.

Rule 17 of the Public Health (Drainage and Latrine) Rules empowers the local authority to refuse to admit into any sewer belonging to the Local Authority any trade, brewery or manufacturing liquid waste, sewage or effluent unless the same has been freed of the grosser objectionable matters ----". This Rule thus call for pretreatment of industrial effluents.

Rule 49 of the Public Health (Drainage and Latrine) Rules empowers the local authority to require the owner of any hotel, boarding-house, eating-house, restaurant, or laundry or any factory, workshop or other premises from which waste-water or sewage of a fatty or soapy character to be discharged into any drain or sewer, to provide and fix in

connection with the drainage of such premises a proper and efficient grease trap of an approved material for the reception of all waste-water from such premises before discharge into the said drain or sewer ----"

Rule 62 requires a person to obtain written permission from the local authority to construct any septic tank, storage tank, sewage filter installation or other works for the treatment, reception or disposal of sewage. The rule specifies the standards of such installations, situation and mean of access.

Rule 83 of the subsidiary legislation stipulates that new buildings, including factories and workshops must be provided with latrines which should be kept in a cleanly state.

The Public Health Act (Cap. 242) was last revised in 1972 and the Revised Edition printed in 1986. Further revision especially to provide for stiffer penalty for polluting water resources is now necessary.

K3.5 The Factories Act (Cap 514) 1972 (1962)

Preamble - An act of Parliament to make provision for the health, safety and welfare of persons employed in the factories and other places, and for matters incidental thereto and connected therewith.

S 51(1) provides - "In every factory in which, in connection with any process carried on, there is given off any dust or fume or other impurity of such a character and to such extent as to be likely to be infurious or offensive to the persons employed, or any substantial quantity of dust of any kind, all practicable measures shall be taken to protect the persons employed against inhalation of the dust or fume or other impurity and to prevent its accumulation in any workroom, in particular, where the nature of the process makes it practicable, exhaust appliances shall be provided and maintained, as near as possible to the point of origin of the dust or fume or other impurity, so as to prevent it entering the air of any workroom."

Apart from rules for the health and safety of workers this Act does not provide for any measures for the protection of the Environment.

K3.6 The Pest Control Products Act (Cap. 346) 1983

Preamble - An Act of Parliament to regulate the importation, exportation, manufacture, distribution and use of products used for the control of pests and of the organic function of plants and animal and for connected purposes.

Interpretation - "Pest" mean any injurious, noxious or troublesome insect, fungus, bacterial organism, virus, weed, rodent or other plant or animal pest; and includes injurious noxious or troublesome organic function of a plant or animal;"

"Pest Control Product" means a product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, attracting or repelling any pest and includes:

(1) any compound or substance that enhances or modifies or is intended to enhance or modify the physical or chemical characteristics of a pest control product to which it is added; and

(2) any active ingredient used for the manufacture of a pest control product.

The Act under Section 15 provides that the Minister shall after consultation with the Board established under S 5(1) make regulations inter alia prescribing nomenclature of pests, pest control products and classes and kinds of pests and pest control products, as well as rules for registration, standards for efficacy and safety of any pest control product.

Under the regulation for the Licensing of Premises, it provides for them to be of a suitable design, layout and construction to ensure the health of workers and avoid contamination of the environment.

A person who owns, operates or is in charge of premises used for the manufacturing, formulation and packaging of pest control products shall ensure that during the operation the persons working in the premises wear adequate protective clothing.

K3.7 The Agricultural Act (Cap 318)

This act was enacted to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility, and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry.

Under Section 48 of this Act, the Minister is empowered to make regulations for the conservation of the soil or to prevent adverse effects of soil erosion and to that end may make rules prohibiting, regulating or controlling the breaking or clearing of land for cultivation, the grazing or watering of livestock and the firing, clearing or destruction of vegetation.

K3.8 The Forests Act (Cap 385)

This act deals with the conservation, management and utilization of forests and forest products. Areas which have been declared nature reserves under Section 6 of this Act are declared as such for the purpose of preserving the natural amenities thereof and the flora and fauna therein.

K3.9 The Wildlife (Conservation and Management) Act (Cap 376)

This Act makes provision for the preservation and control of wild animal life and wild vegetation so that these are allowed to flourish in their natural habitat.

The principal Act was amended in 1989 by an Act of Parliament, (ref. Kenya Gazette Supplement No. 95, Acts No. 9 dated 15th December 1989).

The Wildlife (Conservation and Management) (Amendment) Act, 1989 is cited as an Act of Parliament to amend the Wildlife (Conservation and Amendment) Act to establish a Kenya Wildlife Service as a body corporate and for connected purposes.

Section 3 of the amended Act establishes a uniformed and disciplined Service to be known as the Kenya Wildlife Service which is :

> "a body corporate with perpetual succession and a common seal and shall have power to sue and be sued in its corporate name and to acquire, hold and dispose of movable and unmovable property ----"

Section 3A and 3B (1) stipulates the functions of KWS and the composition of the Boad of Trustee respectively.

K3.10 The National Water Conservation and Pipeline Corporation Order (Legal Notice No. 270 of June 1988)

The Legal Notice No. 270 of June 1988 established the Corporation with the following responsibilities :

(1) Plan, manage, and procure equipment for construction of dam and water supplies;

(2) Promote efficiency in the operations for existing major water project ;

(3) Ensure water projects that are financially viable do actually generate revenue.

K3.11 Review of the Proposed National Environment Bill (NEB) of 1992

Kenya does not have a comprehensive environmental legislation. GOK has laws regulating various aspects of the use and management of the environment. Therefore all laws and regulations leading to protection and enhancement of the environment have been included within the terminology of environmental legislation. However there are very few of the laws which are essentially environmental in character. Among the laws discussed in Section 6, the Wildlife Conservation and Management Act, the Forest Act and the Pests Control Product Act are considered three valid examples. Scattered provisions exist in various statutes which are not primarily on the subject of environment, but merely touch on it.

The main difficulties in enforcing the existing national environmental laws and Bylaws are:

- Lack of sufficient institutional support at all levels
- Inefficient coordination among the different institutions showing responsibility on the same natural resource
- Lack of effective institution for enforcing the environmental laws
- Shortage of properly qualified manpower

- Due to the fact that very little enforcement of the law is done, the law is never interpreted by the courts for clear perspective of limit and scope of the law.

There is therefore justification for the establishment of an environmental institution with mandate in:

- Environmental planning and policy formulation
- Monitoring and enforcement of environmental regulation
- Co-ordination of environmentally related activities of the various governmental and non-governmental agencies
- Provide administrative procedures for transfering the findings of an EIA to the appropriate decision makers of the competent authorities.

(1) Evolution of the National Environment Bill (NEB)

The establishment of the NES in 1974 after the Stockholm Conference on Human Environment worked a first step on consolidation of environmental conservation and management in Kenya.

The NES was initially under the Office of the President and later a Department in the MOENR which was created in 1978.

Between 1978-1980 the NES implement a study project known as GOK/UNEP/UNDP Project in Environment and Development in Kenya which was undertaken by a team of local consultants with the some logistical support from some personnel from the UNDP that funded the Project in collaboration with UNEP. The Project Output was a "Report on Environment and Development in Kenya".

In 1986 NES prepared a Draft Sessional Paper on "Environment and Development" which was used by NES to develop a policy to address Kenya's environmental issues.

The Draft Sessional Paper was used as a basis for drafting the "National Environmental Enhancement and Management Bill", which provided for the creation of a central environmental agency. The Bill was never presented in the Parliament for enactment and has now been superceded by the Draft National Environmental Bill of 1992.

The Draft National Environmental Bill (NEB) of 1992 is a Bill for an Act of Parliament to provide for the regulation of activities which affect the environment, to establish the National Environment Management Commission (and for matters connected therewith and incidental thereto.

A drafting committee was constituted composed of representatives of the following organizations:

- Office of the President
- The Attorney General
- The Law Reform Commission
- The National Environment Secretariat
- The Kenya Mission to UNEP

The Act is cited as the National Environment Act, 1992.

Part I of the Act gives interpretation to the key terms applied in the Act. The Minister who is to administer the Act is however not defined. The assumption is that this refers to the Minister in charge of environmental affairs.

The interpretation of the "competent authority" is rather limited since it refers only to Radiation Protection Board or any other designated as such for specific purpose connected with radiation protection and nuclear safety such other purposes as water and atmospheric pollution should be included.

Part II of the proposed Act established the National Environment Commission and gives the composition and defines the functions of the Commission. The Commission consists of a Chairman who is appointed by the President, public officers and other appointed persons who are not public officers.

The main functions of the Commission are summarized as follows:

(a) Analyses, monitor and interpret projects for the purpose of determining possible environmental effect.

(b) Development of environmental enhancement and protection policy

(c) Establishment of environmental quality standards

(d) Environmental planning and management

(e) Control of waste disposal

(f) International collaboration on environmental conservation

(g) Report at least once a year to the President on the state of the Environment in Kenya.

Part III of the proposed Bill establishes an Environmental Protection Tribunal. Section 5 gives the composition of the Tribunal as follows:

(a) A Chairman appointed by the President

(b) Not less than two and not more than four persons appointed by the President in consultation with the Minister from among persons representing the interest of industry, agriculture, conservation of fauna and flora, water resources and energy. It is noted that the health sector is missing among the above interests.

Section 6 gives the Power of the Tribunal which include:-

(a) Assess the damage that any person may have caused to the environment

(b) Order any person responsible to conform to the recommendations made by the Commission regarding the protection of the environment.

(c) To enforce any order made by the Tribunal under the provisions of the Act.

(d) To appoint inspectors, clerks and other staff for better carrying out of the provisions of this Act.

Section 8 gives the penalty for failure to comply with lawful order of the Tribunal (unspecifed in the Draft).

Part IV empowers the Commission to issue licences for implementation of development projects in consideration of minimal or no adverse environmental impact.

Section 14 empowers the Chairman of the Commission or any authorized person to prosecute under the provisions of this Act.

Section 16 empowers the Minister, in consultation with the Commission, to make regulation as shall be necessary for the better carrying out of the purpose and provision of this Act.

(2) Comments on the Proposed National Environmental Bill

(a) The Bill needs to be revisited in view of the global perspective regarding the agreement made at the Earth Summit in Rio de Janeiro in June 1992 on Biodiversity and Climate Change Conventions.

(b) The drafting team should include in its composition technical experts in the area of environmental management.

(c) The Bill should specify the environmental standards to be enforced regarding the following aspects:-

(i) Air quality standards
(ii) Noise standards
(iii) Water quality standards
(iv) Effluent standards
(v) Solid waste and hazardous waste management
(vi) Toxic substances legislation
(vii) Nuisance abatement

The monitoring procedures should be specified for the various environmental parameter.

(d) The proposed Bill is for the time being too general to be effective for environmental protection and management. Interministerial consultations are necessary to improve on the draft Bill.

K3.12 Proposed Trade Effluent Control By-laws of NMC

As stated in Section 3.2 of this Report, Section 201 of the Local Government Act (Cap 365) empowers local authorities to make By-laws in respect of matters as are necessary or desirable for the maintenance of health, safety and well-being of the inhabitants of the area.

The main objective of the "Trade Effluent By-laws" that have been proposed by the WSD of the NMC is to provide for efficient management of the industrial effluents within the Municipality and to reduce the pollution load into the sewers for better sewage treatment works performance. The proposed By-laws are in the Supporting Report F.

Section 3(1) of the By-law required written permission from the Council to discharge trade effluent into sewers. Where the discharge is into a water course the Council's permission is subject to pollution control regulations made by the Minister for the time being responsible for water development.

Section 4 prohibits discharge of trade effluent into aquifer by well or borehole without the council's consent.

The sewerage charges shall be based on both volume and the organic strength with a maximum $BOD_5^{20°C}$ of 700 mg/L. The Director of Water Development has recommended a lower value of 500 mg/L. Discharge limits have been laid for various substances that will damage sewerage system thus affecting the quality of effluent discharge from the treatment works.

Section 12 of the proposed By-laws empowers the Council to regulate the quantity and frequency of trade effluent discharge.

Section 13 constitutes offense and penalty under the By-laws.

The enactment of the By-laws requires approval by the NMC. The Council then forwards the proposal to the UDD, MOLG which liases with the Attoney General for advise to the Minister for MOLG for the final approval for administration by the NMC.

The enforcement of the Trade Effluent Control By-laws is an important measure for the reduction of pollution load into the sewage treatment works with the ultimate objective of attaining the stringent sewage treatment works effluent standards.

To enforce the By-laws the WSD of the NMC needs to be strenghtened. The proposed strenghening includes a new water quality testing laboratory and the establishment of Trade Effluent Control Unit (TECU) within the WSD. The details of the proposal are presented in Chapter K6 of this report.

Furthermore, there is need to harmonize the Water Act, the Local Government Act, the Public Health Act and Factory Act whenever amendment to the Acts is undertaken in order to achieve efficient enforcement of the Trade Effluent Control By-laws.

In order to circumvent the low penalties provide in the By-laws the court charges under the By-laws should be based on the parameters stipulated in the Effluent Standards in the discharge authorization. The penalties to be imposed will then be based on the individual parameters exceeded.

K4. EXISTING DEVELOPMENT AND MONITORING FOR LAKE NAKURU BASIN

K4.1 Review of the Regional Development Plan

K4.1.1 General Description

The existing development plan is within the 6th National Development Plan which expires at the end of 1993. The 7th National Development Plan, which unlike the previous Development Plan is a 3 year-plan, is under preparation and its details are not yet available to the Study Team. This section reviews the Nakuru District Development Plan (1989 - 1993) in order to identify the postulated effect of the plan on the environment.

K4.1.2 Demographic Profile and Settlement Patterns.

The provisional results of the 1989 National Census indicted that the population of Nakuru District was 862,000 compared to 523,000 in 1979, an increase of 5 % per annum. This population is projected to increase to 1,047,765 in 1993 and to 1,212,919 by 1996 and 1,544,300 by 2000. Table K-11 shows population projections for rural and urban in the various locations of the district.

Table K-11 Population Projections for Nakuru District

(Unit : 1000)

Location	Land Area (sq.km)	Town Name	1990			2000			2010		
			Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
Nakuru District	7,021		932.9	257.7	675.2	1544.3	704.8	839.5	2464.3	1305	1159.3
Weseges	175		33.8	-	33.8	42	-	42	58	-	58
Maji Tamu	95		10.3	-	10.3	12.9	-	12.9	17.8	-	17.8
Subukia	104		17.2	-	17.2	21.3	-	21.3	29.5	-	29.5
Kabazi	108		15	-	15	18.7	-	18.7	25.8	-	25.8
Bahati	302		44.4	-	44.4	55.2	-	55.2	76.3	-	76.3
Dundori	84		32.3	-	32.3	40.2	-	40.2	55.5	-	55.5
Solai	72		10.3	-	10.3	12.9	-	12.9	17.8	-	17.8
Miti Mingi	562	*<-Nakuru	32.5	-	32.5	40.4	-	40.4	155.7	99.9	55.8
Gilgil	437	Gilgil	32.8	14.6	18.2	62.4	39.8	22.6	105	73.8	31.2
Kiambogo	320		13.1	-	13.1	16.3	-	16.3	22.5	-	22.5
Naivasha	797	Naivasha	99.1	38.5	60.6	180.4	105	75.4	298.6	194.5	104.1
Maicla	238		9	-	9	11.2	-	11.2	15.5	-	15.5
Longonot	712		16.7	-	16.7	20.8	-	20.8	28.7	-	28.7
Kampi Ya Moto	284		42.9	-	42.9	53.4	-	53.4	73.7	-	73.7
Rongai	233		23.3	-	23.3	29	-	29	40	-	40
Shawa	188	*<-Nakuru	33.6	-	33.6	41.8	-	41.8	157.6	99.9	57.7
Njoro	209	Njoro	42.9	9.1	33.8	66.9	24.8	42.1	104.1	46	58.1
Kihingu	175		18.8	-	18.8	23.3	-	23.3	32.2	-	32.2
Lare	74		11.8	-	11.8	14.7	-	14.7	20.2	-	20.2
Mau Narok	288	Mau Narok	31.6	-	31.6	41.5	2.2	39.3	57.4	3.2	54.2
Mamara	117		16.4	-	16.4	20.4	-	20.4	28.2	-	28.2
Mau Summit	202		54.6	-	54.6	67.9	-	67.9	93.8	-	93.8
El Burgon	50	El Burgon	27.7	12.4	15.3	52.8	33.8	19	88.8	62.6	26.2
Mar Ashioni	246		7.3	-	7.3	9.5	-	9.5	13.1	-	13.1
Molo South	752	Molo	60.8	10.9	49.9	91.8	29.7	62.1	140.8	55.1	85.7
Chepuchi	75		9.6	-	9.6	11.9	-	11.9	16.5	-	16.5
Amalo	54		12.4	-	12.4	15.4	-	15.4	21.3	-	21.3
Nakuru Municipality	68	Nakuru	172.2	172.2	0	469.5	469.5	0	670	670	0

(Data Source : District Planning Officer)

Apart from Nakuru Municipality and Naivasha the highest population are found in Elburgon, Bahati and Njoro locations. All these are rich agricultural areas in which there has been substantial number of rural center development and pre-urban settlement.

Population movements within the district has been considerable. It is apparent that the usual pattern of migration in the district involves males moving from rural areas to places where they can obtain wage employment not only in the urban areas but also in the areas with large farms or rural industries while women are left behind to manage the family holdings. Thus there is a high sex-ratio of migrations into the district where the largest male majorities are found in urbanized areas such as Nakuru Municipality and Gilgil, Naivasha and Rongai. The females are mainly found in rural areas of Bahati, Subukia and Olengoruone locations.

One major resultant of population increase is that it stimulates the establishment of basic facilities and infrastructure such as roads water and sewerage systems. Nakuru being a newly settled District, with a large influx of people over a short period of time has definitely experienced a short fall in some of these infrastructure. However over the years the progress in the socio-economic development in the district has been quite tremendous.

K4.1.3 Agricultural Development Plan

Nakuru District is mainly an agricultural area. The main activities for higher agricultural production are :

(1) To improve management of coffee estates and expand tea and pyrethrum field.

(2) To rehabilitate cattle dips and boreholes and intensify artificial insemination services for increased livestock production.

(3) To establish a Farmer Training Centre to strengthen agricultural extension.

According to the district development plan, projected crop production is as presented in Table K-12 and crop production targets are as presented in Table K-13. Further cattle population is projected to increase as given in Table K-14.

Table K-12 Projected Cash Crop Production (1989 - 1993)

Crop	Ton/Ha	1989	1990	1991	1992	1993
Coffee	Ha/	2,754	2,790	2,826	2,863	2,900
	Ton/Ha	1.60	2.82	4.03	5.25	6.41
Tea	Ha	936	972	1,008	1,044	1,080
	Ton/Ha	6,953	7,161	7,376	7,597	7,825
Citrus	Ha	373	375	375	375	380
	Ton/Ha	18.40	18.80	19.20	19.60	20.00
Barssicas	Ha	3,447	3,460	3,474	3,487	3,500
	Ton/Ha	12.6	13.2	13.8	14.4	15.0
Tomatoes	Ha	616	617	618	619	62-
	Ton/Ha	26	27	28	29	30
Onions	Ha	295	295	295	295	295
	Ton/Ha	10.8	11.8	12.8	14.0	15.0
Sunflower	Ha	306	306	318	324	331
	Ton/Ha	0.6	0.7	0.8	0.9	1
Pyrethrum	Ha	5,000	5,000	5,000	5,000	5,000
	Ton/Ha	410	420	430	440	450

(Data source : MOA, Nakuru, 1988)

Table K-13 Crop Production Targets

Crop	Item	Current	1993 Target
Maize	Acreage	60,000 Ha	60,000 Ha
	Yield	37 bags/ha	47 bags/ha (4.7 % increase)
Beans	Acreage	24,000 ha	31,000
	Yield		9 bags/ha (8.75 % increase)
Wheat	Acreage	27,865 ha	30,760 ha (34 % increase)
	Yield	30 bags/ha	35 bags/ha (17 % increase)
Potatoes	Acreage	1,073 ha	1,373 ha (28 % increase)
	Yield	10.5 ton/ha	20 tons/ha (49 % increase)
Coffee	Acreage	2,719 ha	2,900 ha (6 % increase)
	Yield	0.350 ton/ha	6.664 ton/ha
	per tree	5 kg/tree	10 kg/tree
Tea	Acreage	900 ha	1,350 ha
	Yield	6,750 kg	7,825 kg (15 % increase)

(Data source : MOA, Nakuru)

Table K-14 Projected Acaricide Supply (1989 - 1993)

Year	1989	1990	1991	1992	1993
Cattle Pop.	412,281	426,358	443,070	467,770	519,402
Acaricide e.g. Supa Dip & DEF in lts.	42,877,224	43,341,232	46,079,280	48,448,080	54,017,308

(Data source : MOLD, Nakuru, 1988)

K4.1.4 Water Development Plan

The planned activities for improvement of water supply are :

(1) To construct more dams and pans for rainwater harvesting

(2) To rehabilitate and expand water supply in rural and urban areas

(3) To expand sewerage systems and construct new ones in major towns to cope with increasing population

The safe water supply is one of the most important development activities and 42 water supply schemes have been planned to be realized under the current district development plan. Of the total, 8 schemes are located within Lake Nakuru catchment basin.

K4.1.5 Industrial Development Plan

The following activities are planned for industrial development

(1) Identification and development of new industries

(2) Selected government investment in urban infrastructure to make towns attractive to investors. Emphasis is on housing, sewerage, water supply systems and electrification.

Within the district, industrial activities mainly concentrate on Naivasha and Nakuru. According to the district development plan, manufacturing sector generates 10 % of the district's earnings in modern sector wage employment. In Naivasha and Nakuru, shares of industrial sector in town's earning were 32 % and 26 % respectively for 1984.

K4.1.6 Environmental Conservation

The planned activities regarding environmental conservation are :

(1) Reactivation of Soil Conservation Units within the Ministry of Agriculture

(2) Encourage the public to adopt environmentally friendly land use practices and to protect water catchments

(3) Prevent soil erosion and enforce the relevant legislation

(4) Protection of wildlife

K4.1.7 Social Services

The following is proposed:

(1) Reduction of population growth by establishment of an effective family planning programme

(2) Expansion of existing hospitals

(3) Construction of educational facilities

(4) Establish a District Information and Documentation Centre to facilitate better planning

K4.2 Physical Development of NMC

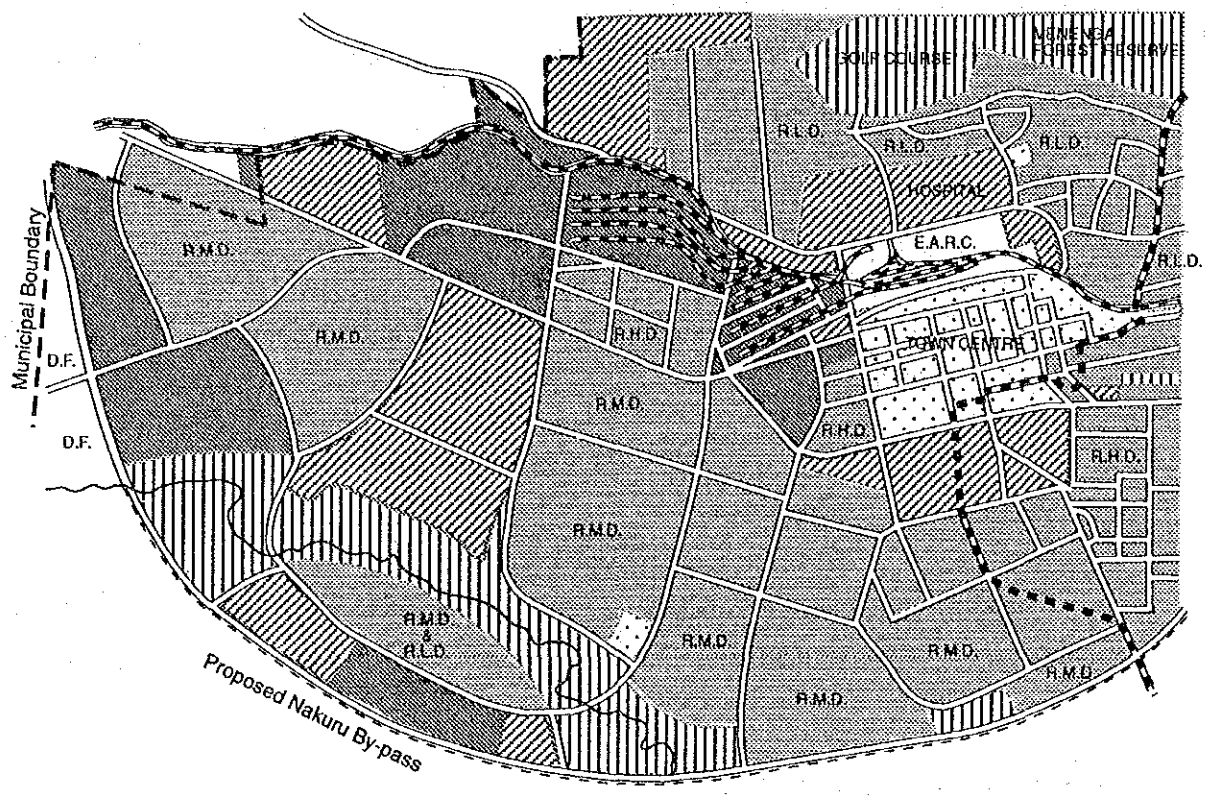
Fig. K-11 shows the Physical Development Plan for Nakuru Municipality. A new physical plan map is in preparation in the Physical Planning Department and is expected to be finalized early 1994.

Table K-15 Proposed Physical Development Plan of Nakuru Municipality

Land Classification	Area (km^2)	Proportion (%)
Residential area	25.5	35.1
Industrial area	7.9	10.9
Open space	11.9	16.5
Public purpose land	15.1	20.9
Commercial area	1.4	1.9
Utility purpose land	2.9	4.0
Others	7.8	10.7
Total	72.6	100.0

(Data source : NMC)

Fig. K-11



LEGEND

	Residential	R.H.D.	Residential High Density
	Industrial	R.M.D.	Residential Medium Density
	Commercial	R.L.D.	Residential Low Density
	Recreation	D.F.	Deferred
	Public Purposes	▪ ▪ ▪ ▪	Catchment Division between Town Site and Njoro River Site after Construction of the Interception Sewer

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K4.3 Existing Monitoring Activities

Existing information indicates that there is no systematic environmental monitoring activities in Lake Nakuru drainage basin. However scattered data are to be found on the following activities :

(1) Water quality of Lake Nakuru and the rivers discharging into the Lake have been monitored by the KWS/WWF.

(2) Lake Nakuru water levels have been monitored over the years by the Hydrology Section of the MOLRRWD and the KWS.

(3) Annual census of birds and animals is undertaken by the National Museum.

(4) Monitoring of vegetation of Lake Nakuru National Park.

(5) Sewage effluent characteristics by the MOLRRWD.

(6) In 1988, with support from British ODA, the WWF initiated the Lake Nakuru Conservation and Development Project (LNCDP). The project seeks the long term protection of Lake Nakuru National Park. In coordination with the KWS, the LNCDP has established an ecological monitoring programme for Lake Nakuru.

Coordination of monitoring activity needs to be addressed. Proposal for the institutional organization for such coordination is presented in Chapter K6 of this Report.

Results of these sporadic monitoring activity have revealed relationship between various environmentally parameters. Coordination of monitoring activity needs to be addressed.

K5. NEED FOR ENHANCEMENT AND STRENGTHENING INSTITUTIONAL SUPPORT

K5.1 Postulated Effect of Development Plan on the Environment

(1) Population growth

The projected rapid population growth in the region will create increased demand on the natural resources and demand for land for cultivation and livestock production will increase. The result will be encroachment of marginal areas. Water demand will also be increased. The increased water consumption results in increase in sewage production and hence increased pollution load.

Fuel wood will also be in higher demand and this will encourage cutting of more trees hence removing the soil cover, eventually leading to deforestation and soil degradation and sediment transport into the Lake.

Infrastractural development such as construction of roads will contribute to soil erosion if the roads are not properly drained.

(2) Effect of agricultural development

Expansion of agricultural activities will have the following effects:

(a) Encroachment into the marginal areas leading to overgrazing and the consequential soil degradation.

(b) Increase in soil erosion leading to lewered productive capacity of the land.

(c) Increase in nutrients and agro-chemical residues that pollutes water systems and may eventually pollute Lake Nakuru.

(d) Removal of soil cover is contributing to the drying up of some perennial rivers and hence the need for developing soil friendly farming and pastoral practices.

(3) Effect of water development

Increase in water supply will lead into increased generation of sewage. This leads to overloading of sewage treatment systems for NMC and production of sub-standard effluent that will pollute Lake Nakuru, adversely affecting the Lake Nakuru ecology.

(4) Effect of industrial development

Increased industrial development will lead to increase of pollutants that will eventually find their way to Lake Nakuru through sewerage system, town drainage system or rivers. Of greatest concern are the heavy metals that accumulate in the lake and have adverse environmental impact on the lake ecology. Industrial solid waste that are toxic and hazardous will also increase in the catchment area.

From the foregoing discussions there is need for institutional organization for supervision and coordination of implementation of development plan for environmental conservation. The need for institution coordination is discussed in Section K5 of this Report.

K5.2 Institutional Issues

K5.2.1 Coordination

Several institutions reviewed in Section K2 deal with various aspect of environmental management. There is lack of clearly defined role and responsibilities of each institution and lack of coordination of the various activities to achieve the development objective of resources utilization on sustainable bases and conservation of environment. Protection of Lake Nakuru requires proper coordination of the various institutions that are implementing agencies of the various conservation activities.

K5.2.2 Staffing and Financial Constraints

The WSD of the NMC was created recently. The WSD has shortage of qualified staff to undertake responsibilities in sewerage for reduction of pollution load into the sewers. Qualified staff are required for inspection of factories, monitoring of quality of trade effluent, operation and maintenance of sewage works and enforcement of By-laws related to water and environmental conservation.

It is has been shown in the review that only 3.3 % of the entire NMC budget for the Fiscal year 1993/94 is allocated to sewerage sector. This allocation is very small indeed and has affected the provision of sewerage services in the Municipality.

K5.3 Legislative Issues

K5.3.1 Deficiencies in Existing Legislation

Review of the various legislation dealing with water supply, sewerage, pubic health and solid waste disposal reveals deficiencies in the legislation. The Water Act (Cap 372) should better provide for protection of the water resource from pollution. The penalty for polluting water resources needs to be reviewed upwards. The Local Government Act (Cap 265) should be amended to provide for enforcement of By-laws.

Trade Effluent By-laws are lacking and the proposal that has been forwarded to the NMC by the WSD needs to be enacted for pollution reduction.

The proposed National Environment Bill needs to provide for coordination of implementation of environmental conservation legislation.

K5.3.2 Implementation of Legislation

There are difficulties in enforcing the existing national environmental laws and By-laws. The main difficulties have been identified as :

(1) Lack of sufficient support at all levels

(2) Inefficient coordination among the different institutions having responsibility on the same natural resource.

(3) Shortage of properly qualified manpower for law enforcement.

(4) Due to the fact that very little enforcement of law is done, the law is never interpreted by courts for clear perspective of limit and scope of the law.

There is therefore need for institutional coordination of enforcement of environmental laws.

K5.4 Development Plan Issues

Implementation of activities in the development plan for the Lake Nakuru Basin discussed in Chapter K4 in this report has adverse environmental impacts. Supervision and coordination of the various activities by the IWG will ensure reduction of pollutants in the Lake Nakuru basin mainly for the protection of Lake Nakuru.

K5.5 Monitoring Issues

K5.5.1 Need for Trade Effluent Monitoring

The major contributors to the pollution load into Lake Nakuru is the effluent from the Njoro and Town STWs. The quality of the effluent discharged is dependent upon the quality and quantity of influent into the sewage works from the domestic and the industrial sources. The toxic substances, such as heavy metals in the industrial discharges, are of particular importance in this regard. Heavy metals are known to be toxic to microorganisms. The toxicity is known to increase with time due to bioaccumulative effect of the substances.

Organic substances in the effluent deplete the Dissolved Oxygen of the waste receiving system causing asphyxiation of the aerobes in the lake for that matter.

The proposed Trade Effluent Control By-laws establishes limits for the various effluent quality parameters.

The levels are regarded to be within the limits that will cause minimum adverse effect on and eventually no adverse effect on the ecology of Lake Nakuru. Based on this premises it is then necessary to monitor the trade effluent within the Nakuru Municipality and the lake basin at large.

The responsibility for monitoring the trade effluent within the Municipality rests with the WSD of the NMC and to a lesser extent the Pollution Control Section of the MOLRRWD. Monitoring of trade effluents outside the Municipality is the responsibility of the MOLRRWD which has the overall responsibility for pollution control nationwide and administers the Water Act (Cap. 372).

K5.5.2 Need for Environmental Monitoring of Lake Nakuru Basin

Fertilizers and other nutrients such as phosphates and nitrates are known to cause eutrophication of water systems. Some of the agro-chemicals have direct toxic effects and can accumulated in the biota or in the lake sediments where they can be solubilized and become available to exert the toxic effect.

Knowledge on the existing levels of these substances in the environment is therefore essential. The relationships between the concentrations of the substances and the other environmental parameters such as plant and animal populations and biodiversity will be important tools for environmental conservation and management.

There is a lack of comprehensive monitoring programmes in this regard for Lake Nakuru as revealed by this Study. Such monitoring should be undertaken as a non-structural strategy for reduction and management of pollutants in Lake Nakuru basin.

K6. SHORT-TERM PLAN FOR ENHANCEMENT & STRENGTHENING INSTITUTIONAL SUPPORTING SYSTEM

K6.1 Proposed Enhancement of Institutional Framework

K6.1.1 Proposed Short Term Action on Water-related Legislation

There are many Acts, Rules Regulations and By-laws with regard to water supply, sewerage, public health and environmental conservation. There are also a multiplicity of agencies involved in the implementation of the legislations. Much of the administration seem to be handled by the control administration and prosecutions are by the Attorney General. Most of the problems encountered arise from a low level of implementation and enforcement of the law, rather than any serious deficiencies in the legal provisions. There is also lack of coordination of the various agencies that are involved and experience of enforcement procedures by officials.

It is recommended that, in regard to the environmental conservation and protection of Lake Nakuru catchment, the IWG coordinates and supervises the implementation of the various relevant legislations. The following short term actions are recommended :

(1) Approval of the Trade Effluent Control By-laws that have been proposed by the Nakuru Municipal Council. The By-laws should make provision for handling and storage of hazardous and toxic substances.

(2) The proposed amendment to the Water Act (Cap 372) should be enacted. It is anticipated that this will be accomplished during the current Parliamentary Session since the relevant amendment Bill has been published in the Kenya Gazette.

(3) The Local Government Act (Cap 265) needs to be amended in line with the provisions of the By-laws especially as regards Section 201 which the By-law may appear to contradict.

(4) The proposed National Environment Bill (NEB) should be gazetted for enactment to provide for regulation and coordination of activities that affect the environment.

K6.1.2 Enactment of the Trade Effluent By-laws

In order to control the effluent discharge into the sewers, the proposed Trade Effluent By-laws should be enacted as soon as possible. The enactment involves the initial approval by the NMC and final approval by the MOLG in consultation with the Attorney General. It is recommended that this approval be accomplished by mid-1994.

K6.1.3 Enhancement of Activity and Role of IWG

Development in the urban and rural areas within Lake Nakuru catchment basin will result in increase of pollutants that will drain into Lake Nakuru with imminent adverse impact on the ecology of Lake Nakuru.

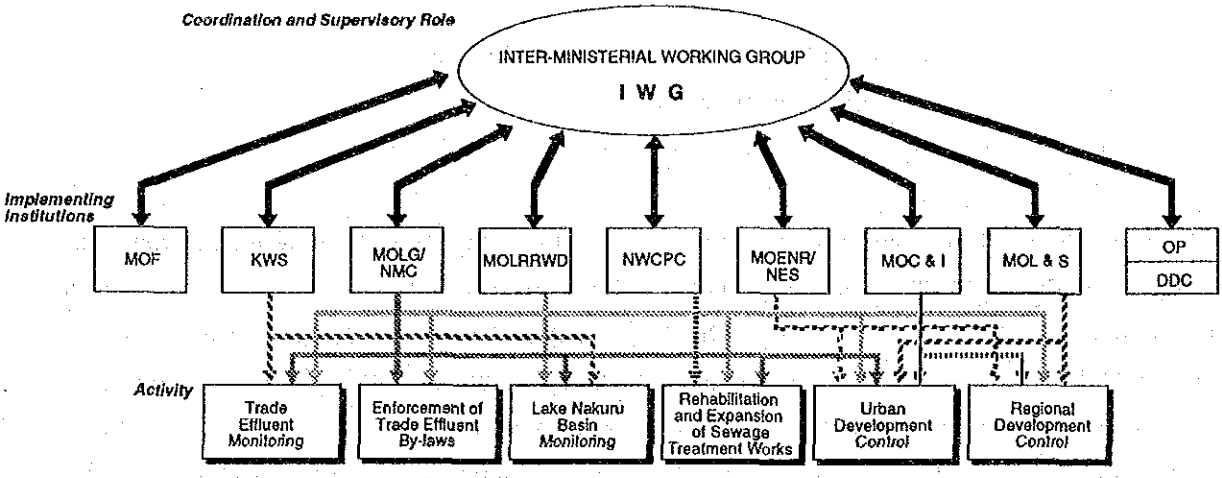
Structural measures involving rehabilitation and expansion of sewage treatment works for the Nakuru Municipality and efficient treatment and disposal of hazardous solid wastes are important for the protection of the Lake. However, in order to attain the high effluent discharge standards that have been stipulated by the GOK for Lake Nakuru, the non-structural measures that have been presented in this study must be implemented in parallel with the structural measures.

The institutions that are concerned with environmental management have been reviewed in Chapter K2 of this Report. In order to achieve the declared objective of protection of Lake Nakuru, the already established IWG should be recognised as an important institution for the coordination and supervision of activities of the various institutions that are geared towards environmental protection and management. Fig. K-12 shows the proposed institutional organization.

The main activities for environment management are :

- Trade effluent monitoring
- Enforcement of Trade Effluent By-laws of the Nakuru Municipal Council (NMC)
- Urban development control
- Regional development control within Lake Nakuru catchment basin
- Lake Nakuru basin development and ecological monitoring

Fig. K-12



Legend

Coordination and Supervisory Relationship

Activity Implementation Relationship

Abbreviation

MOF	- Ministry of Finance
KWS	- Kenya Wildlife Services
MOLG	- Ministry of Local Government
NMC	- Nakuru Municipal Council
MOLRRWD	- Ministry of Land Reclamation, Regional & Water Development
MOENR	- Ministryof Environment and Water Resources
MOC & I	- Ministry of Commence and Industry
OP	- Office of President
NWCPC	- National Water Conservation and Pipeline Corporation
MOL&S	- Ministry of Lands and Settlement
DDC	- District Development Committee
NES	- National Environment Secretariat

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K6.2 Monitoring Plan for Lake Nakuru and Industrial Effluents

K6.2.1 Introduction

A Monitoring Plan for Lake Nakuru and industrial effluents is proposed. Main objectives of the Monitoring Laboratory are as follows:

(1) to monitor the pollutant loads flowing into Lake Nakuru
(2) to monitor the Lake water quality
(3) to monitor industrial effluents in liaison with NMC

Main pollutant loads flowing into Lake Nakuru consists of organic matter, nutrient, inorganic matter, nutrients and heavy metals. These material flow into Lake Nakuru through rivers, drainage channels and springs. Since Lake Nakuru is a closed lake system with no outlets and its unique water environment requires better understanding of its environment. Data on pollutant loads flowing into the lake together with lake water quality is basic for this understanding. Therefore, it is proposed that pollutant load inflow and lake water quality be monitored throughout the year.

Monitoring of industrial effluents is necessary for the enforcement of Trade Effluent By-Laws by the NMC. Enforcement would result in reduced loads to the sewage treatment works.

K6.2.2 Monitoring Plan

Monitoring plan is classified into four categories as described in the following sections.

(1) Rivers, Channels and Springs

Monitoring of rivers, channels and springs is proposed to be conducted once a month using grab samples. All the rivers, Town Stormwater Drainage Channel and three springs reaching the lake is necessary. For river monitoring is recommended to be conducted near the river mouth and near the boundary of Lake Nakuru National Park. In addition to the rivers reaching the Lake, two rivers namely, Lamudiak River and Ngosorr River, which disappear into subsurface need to be sampled to monitor the development within the drainage area of these rivers. Sampling locations are proposed as follows:

1) Njoro River, before Njoro STW Discharge
2) Njoro River Mouth
3) Town Stormwater Drainage Channel
4) Makalia River
5) Makalia River Mouth
6) Nderit River
7) Nderit River Mouth
8) Lamudiak River
9) Ngosorr River
10 Baharin Spring
11) Spring near Special Camp Site
12) Spring near Lion Hill

Parameters to be analysed are as shown in Table K-16 which includes organic matters, nutrients, heavy metals and others. Frequency of analysis is proposed to be once a month for organic material (BOD and COD) and nutrients while for heavy metals is once in two months.

(2) Industrial Effluents and Sewage Treatment Works Effluents

Industrial effluents are categorized into two namely high organic matter containing effluents and heavy metal containing effluents. Presently there are 12 industries discharging high organic containing effluents and 4 industries discharging heavy metal containing effluents. It is anticipated for 15 industries with high organic containing effluents and 8 heavy metal containing effluents in the future. Frequency of monitoring is proposed to be twice a year for both type of industries. Table K-17 shows the parameters to be measured and the total number samples for each parameter.

In addition to industrial effluents, monitoring of sewage treatment works influents and effluents are also necessary for detecting any heavy metal discharges as well as discharges from other sources. Frequency of monitoring is proposed to be once in two months for both influent and final effluent of sewage treatment works at Njoro and Town.

Table K-16 Monitoring Plan for Lake Nakuru and Industrial Effluents - Rivers, Drainage Channels and Springs

	Parameters	Njoro River		Town Stormwater Drainage Channel	Makalia River	Makalia River Mouth	Nderit River	Nderit River Mouth	Lamudiak River	Ngosorr River	Baharin Spring	Spring near Special Camp Site	Spring near Lion Hill	Annual Sub Total	Annual Total
		Before STW Discharge	River Mouth												
1	Flowrate	12	12	12	12	12	12	12	12	12	12	12	12	144	144
2	Temperature	12	12	12	12	12	12	12	12	12	12	12	12	144	144
3	pH	12	12	12	12	12	12	12	12	12	12	12	12	144	144
4	Conductivity	12	12	12	12	12	12	12	12	12	12	12	12	144	144
5	DO	12	12	12	12	12	12	12	12	12	12	12	12	144	144
6	ORP	12	12	12	12	12	12	12	12	12	12	12	12	144	144
7	BOD	12	12	12	12	12	12	12	12	12	12	12	12	144	144
8	COD	12	12	12	12	12	12	12	12	12	12	12	12	144	144
9	SS	12	12	12	12	12	12	12	12	12	12	12	12	144	144
10	T-N	12	12	12	12	12	12	12	12	12	12	12	12	144	144
11	NH4-N	12	12	12	12	12	12	12	12	12	12	12	12	144	144
12	NO3-N	12	12	12	12	12	12	12	12	12	12	12	12	144	144
13	T-P	12	12	12	12	12	12	12	12	12	12	12	12	144	144
14	PO4-P	12	12	12	12	12	12	12	12	12	12	12	12	144	144
15	Sechi Depth													0	0
16	Chlorophyll a													0	0
17	Plankton count													0	0
	HEAVY METALS														
18	Chromium (Cr)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
19	Hexavalent Chromium (Cr6+	6	6	6	6	6	6	6	6	6	6	6	6	72	72
20	Lead (Pb)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
21	Copper (Cu)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
22	Cadmium (Cd)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
23	Zinc (Zn)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
24	Nickel (Ni)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
25	Iron (Fe)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
26	Total Manganese (Mn)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
27	Cyanide (CN-)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
28	Total Mercury (Hg)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
29	Arsenic (As)	6	6	6	6	6	6	6	6	6	6	6	6	72	72
	OTHERS														
30	Oil	6	6	6	6	6	6	6	6	6	6	6	6	72	72
31	Anionic Surfactant (MBAS)	6	6	6	6	6	6	6	6	6	6	6	6	72	72

Table K-17 Monitoring Plan for Lake Nakuru and Industrial Effluents - Industrial and Sewage Treatment Works Effluents

No.	Parameters	Organic 1 Waste Containing Effluents	Heavy 2 Metal Containing Effluents	Njoro STW Influent / Effluent	Town STW Influent / Effluent									Annual Sub-total	Annual Total
1	Flowrate	30	15	12	12									69	213
2	Temperature	30	15	12	12									69	213
3	pH	30	15	12	12									69	213
4	Conductivity	30	15	12	12									69	213
5	DO	30	15	12	12									69	213
6	ORP	30	15	12	12									69	213
7	BOD	30	15	12	12									69	213
8	COD	30	15	12	12									69	213
9	SS	30	15	12	12									69	213
10	T-N	30	15	12	12									69	213
11	NH4-N	30	15	12	12									69	213
12	NO3-N	30	15	12	12									69	213
13	T-P	30	15	12	12									69	213
14	PO4-P	30	15	12	12									69	213
15	Sechi Depth													0	0
16	*Chlorophyll a*													0	0
17	Plankton count													0	0
	HEAVY METALS														
18	Chromium (Cr)		8	12	12									32	104
19	Hexavalent Chromium (Cr6+)		8	12	12									32	104
20	Lead (Pb)		4	12	12									28	100
21	Copper (Cu)		6	12	12									30	102
22	Cadmium (Cd)		4	12	12									28	100
23	Zinc (Zn)		4	12	12									28	100
24	Nickel (Ni)		4	12	12									28	100
25	Iron (Fe)			12	12										
26	Total Manganese (Mn)			12	12										
27	Cyanide (CN-)		8	12	12									32	104
28	Total Mercury (Hg)		4	12	12									28	100
29	Arsenic (As)			12	12									24	96
	OTHERS														
30	Oil	10		12	12									34	106
31	Anionic Surfactant (MBAS)	10		12	12									34	106

Note: 1 - a total of 15 high organic strength factores are envisaged.

2 - a total of 7-8 heavy metal containing effluents are envisaged.

Frequency of sampling is twice per year.

(3) Lake Water Quality

Monitoring locations within the lake are proposed based on the following monitoring objectives. They are;

(a) to monitor the water environment within the Lake

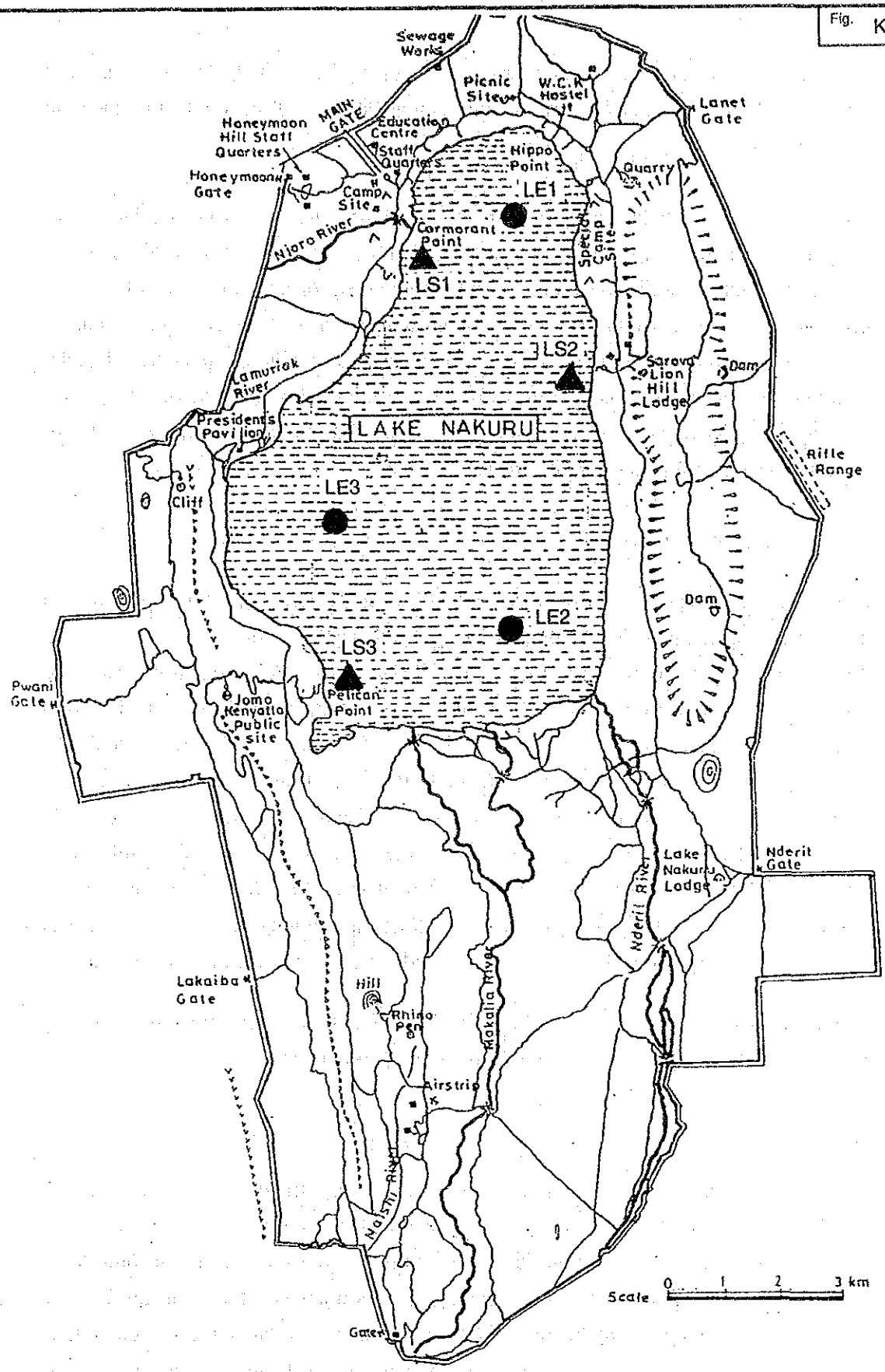
(b) to monitor the water quality related to living environment of flamingoes namely food and water (chlorophyll a, plankton count (spirulina), sechi depth, etc.)

For the first objective, three locations within the lake as shown in Fig. K-13 (LE1, LE2 and LE3) are proposed. Locations LE1 and LE2 in the northern and southern part of the lake are selected since man-made pollution occur in the northern part through Njoro River and Town Stormwater Drainage Channel while in the southern part mainly natural landscape is drained by Nderit and Makalia Rivers. The third location at LE3 in the south-west corner of the lake is proposed since there are no surface water inflow on this side except during storm events. Monitoring water quality and sediment quality at these locations regularly will be useful for assessing the environmental quality within the lake and to observe and differences between man-made and natural inflow.

Table K-18 shows parameters to be analysed. Water quality analysis is proposed to be once in two months while that for sediments is once six months. Three water quality parameters namely chlorophyll a, plankton count and sechi depth are added since they relate to the lake environment. BOD measurement is considered to be not necessary.

Flamingoes and other birds graze along the shorelines of Lake Nakuru. Water quality of the lake along the shoreline indicates the productivity and food availability to flamingoes. Therefore, monitoring points for the second objective is proposed to be located near the shorelines (about 50-100 m) of the lake. Lake bed is almost flat and the shoreline varies very much resulting in different sampling locations for different lake water level. Three locations are proposed as shown in Fig. K-13 near the shoreline at Njoro River Mouth (LS1), west of Lion Hill Lodge (LS2) and Pelican Point (LS3) in the south-west corner of the lake. These locations are selected to observe any spatial differences due to river water inflow (LS1) and those away from external water flow (LS2 and LS3) and also considering the locations of LE1, LE2 and LE3.

Fig. K-13



THE REPUBLIC OF KENYA MINISTRY OF LOCAL GOVERNMENT	THE STUDY ON THE NAKURU SEWAGE WORKS REHABILITATION AND EXPANSION PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE MONITORING LOCATIONS FOR LAKE WATER QUALITY

In addition to water quality parameters, lake water depth shall also be monitored regularly. Stainless steel or ceramic staff gauges should be installed to replace the existing gauges.

Care should be taken when sampling lake water near the shore and when the lake water depth is low (below 1 m). Mixing of lake water and underlying sediment occurs when approaching the sampling location due to the movement of large number of birds and the sampling crew. It would b necessary to allow some time before collecting samples. When the water depth is high paramters to be measured on-site (temperature, pH, DO, conductivity and ORP) shall be measured near the lake bottom and near the water surface. For laboratory analysis, composite samples shall be made form the lake water collected near the lake bottom and surface.

(4) Stormwater Drainage

Stormwater drainage is another source of pollution mainly from developed area in Nakuru through Town Stormwater Drainage Channel, underdeveloped areas along Njoro River and through Makalia River and Nderit River. Pollution from developed area of Nakuru Town occurs very frequently. Annual average of number of rainfall events with intensity of more than 3 mm/d is about 80. Since, a stormwater detention pond is proposed under the study, frequent monitoring is desired and is proposed to be five times a year. For other rivers, namely Njoro, Makalia and Nderit Rivers unless a storm of high intensity occurs during wet season, increase in run-off could not be expected due to the porous nature of the catchment area. Monitoring flowrates during storm events would be necessary before embarking on sampling. For those three rivers annually, sampling two storm events is proposed which will be during rainy season.

Composite samples shall be collected for analysis. For this purpose it would necessary to establish sampling locations and height-discharge relationship.

K6.2.3 Phasing

Due to the extensive nature of the monitoring program, it is proposed that the monitoring program be realized in two phases. In the First Phase, monitoring of rivers, channels and springs together with industrial effluents is proposed and in the Second Phase monitoring of lake water quality and storm drainage be commenced. Even during the First Phase, sampling frequency could be reduced to once in two months for pollutant load monitoring in the beginning and could be increased when the staff become accustomed to the sampling and analysis routine.

Table K-18 Monitoring Plan for Lake Nakuru and Industrial Effluents - Lake Water Quality

No.	Parameters	LE1	LE2	LE3	LS1	LS2	LS3	Sediment						Annual Sub-total	Annual Total
1	Flowrate	-	-	-	-	-	-	-						0	213
2	Temperature	6	6	6	12	12	12	6						60	273
3	pH	6	6	6	12	12	12	6						60	273
4	Conductivity	6	6	6	12	12	12	6						60	273
5	DO	6	6	6	12	12	12	-						54	267
6	ORP	6	6	6	12	12	12	-						54	267
7	BOD	-	-	-	-	-	-	-						0	213
8	COD	6	6	6	6	6	6	6						42	255
9	SS	6	6	6	6	6	6	6						42	255
10	T-N	6	6	6	6	6	6	6						42	255
11	NH4-N	6	6	6	6	6	6	6						42	255
12	NO3-N	6	6	6	6	6	6	6						42	255
13	T-P	6	6	6	6	6	6	6						42	255
14	PO4-P	6	6	6	6	6	6	6						42	255
15	Secchi Depth	6	6	6	6	6	6	-						36	36
16	Chlorophyll a	6	6	6	6	6	6	-						36	36
17	Plankton count	6	6	6	6	6	6	-						36	36
	HEAVY METALS														
18	Chromium (Cr)	6	6	6	6	6	6	6						42	146
19	Hexavalent Chromium (Cr6+	6	6	6	6	6	6	6						42	146
20	Lead (Pb)	6	6	6	6	6	6	6						42	142
21	Copper (Cu)	6	6	6	6	6	6	6						42	144
22	Cadmium (Cd)	6	6	6	6	6	6	6						42	142
23	Zinc (Zn)	6	6	6	6	6	6	6						42	142
24	Nickel (Ni)	6	6	6	6	6	6	6						42	142
25	Iron (Fe)	6	6	6	6	6	6	6						42	42
26	Total Manganese (Mn)	6	6	6	6	6	6	6						42	42
27	Cyanide (CN-)	6	6	6	6	6	6	6						42	146
28	Total Mercury (Hg)	6	6	6	6	6	6	6						42	142
29	Arsenic (As)	6	6	6	6	6	6	6						42	138
	OTHERS														
30	Oil	6	6	6	6	6	6	6						42	148
31	Anionic Surfactant (MBAS)	6	6	6	6	6	6	6						42	148

Table K-19 Monitoring Plan for Lake Nakuru and Industrial Effluents - Rivers, Drainage Channels During Storm Drainage

	Parameters	Njoro River		Town Stormwater Drainage Channel	Makalia River	Makalia River Mouth	Nderit River	Nderit River Mouth	Lamudiak River	Ngosorr River	Baharin Spring	Spring near Special Camp Site	Spring near Lion Hill	Annual Sub-total	Annual Total
		Before STW Discharge	River Mouth												
1	Flowrate		2	5		2		2						11	224
2	Temperature		2	5		2		2						11	284
3	pH		2	5		2		2						11	284
4	Conductivity		2	5		2		2						11	284
5	DO		2	5		2		2						11	278
6	ORP		2	5		2		2						11	278
7	BOD		2	5		2		2						11	224
8	COD		2	5		2		2						11	266
9	SS		2	5		2		2						11	266
10	T-N		2	5		2		2						11	266
11	NH4-N		2	5		2		2						11	266
12	NO3-N		2	5		2		2						11	266
13	T-P		2	5		2		2						11	266
14	PO4-P		2	5		2		2						11	266
15	Sechi Depth													0	36
16	Chlorophyll a													0	36
17	Plankton count													0	36
	HEAVY METALS														
18	Chromium (Cr)		2	5		2		2						11	157
19	Hexavalent Chromium (Cr6+)		2	5		2		2						11	157
20	Lead (Pb)		2	5		2		2						11	153
21	Copper (Cu)		2	5		2		2						11	155
22	Cadmium (Cd)		2	5		2		2						11	153
23	Zinc (Zn)		2	5		2		2						11	153
24	Nickel (Ni)		2	5		2		2						11	153
25	Iron (Fe)		2	5		2		2						11	53
26	Total Manganese (Mn)		2	5		2		2						11	53
27	Cyanide (CN-)		2	5		2		2						11	157
28	Total Mercury (Hg)		2	5		2		2						11	153
29	Arsenic (As)		2	5		2		2						11	149
	OTHERS														
30	Oil		2	5		2		2						11	159
31	Anionic Surfactant (MBAS)		2	5		2		2						11	159

K6.2.4 Major Analytical Equipments

Analytical equipments are required for analysis the following parameters:

1) BOD (Biochemical Oxygen Demand)
2) COD (Chemical Oxygen Demand)
3) SS (Suspended Solids)
4) T-N (Total Nitrogen)
5) NH_4-N (Ammonia Nitrogen)
6) NO_3-N (Nitrate Nitrogen)
7) T-P (Total Phosphorous)
8) PO_4-P
9) Chromium (Cr)
10) Hexavalent Chromium (Cr^{6+})
11) Lead (Pb)
12) Copper (Cu)
13) Cadmium (Cd)
14) Zinc (Zn)
15) Nickel (Ni)
16) Iron (Fe)
17) Total Manganese (Mn)
18) Cyanide (CN^-)
19) Total Mercury (Hg)
20) Arsenic (As)
21) Oil
22) Anionic Surfactant (MBAS)
23) Chlorophyll a

Table K-20 shows the major equipments required. Though analysis and equipments are not proposed for bioassay and other biological analyses, space is proposed to be allocated for future expansion.

Table K-20 Major Laboratory Equipment and Other Accessories

No.	Name	Number of Units	Specification
1	Incubator (20°C)	1	80 cm x 70 cm x 120 cm, 220 - 240 V, 0.7 - 1.2 kW, for about 100 BOD bottles
2	COD (Cr) Digestion Unit	1	for 12 samples
3	Drying oven (102°C)	1	about 10 ~ 15 Litres
4	Kjeldahl Nitrogen Digestion Unit	1	for 12 number of samples
5	Spectrophotometer	1	double beam with 1, 2 and 5 cm cells
6	Water Bath	1	for 20 petri dishes
7	Vacuum Pump Unit	2	manually operated with water (non-oil)
8	Water Distillation Unit	1	for about 20 Litres/day
9	Atomic Absorption Spectrophotometer	1	for Cr, Pb, Cu, Cd, Zn, Ni, Fe, Mn, Hg, As, K and Na
10	Balance	1	1 ~ 500 g/ 0.001 g accuracy, digital
11	pH meter	1	for laboratory use
12	Composite sampler	2	for use at sewage treatment works
13	Rubber Boat	1	for 5 persons (600 kg)
14	Velocity Meter	2	0.1 ~ 2m/s
15	Microscope	1	for plankton identification and plankton count
16	Centrifuge	1	chlorophyll a analysis maximum five samples
17	Refrigerator (1)	1	for sample preservation
18	Refrigerator (2)	1	for reagent reservation
19	Lake Level Gauge	3	with either stainless steel or ceramic scales, graduated to 0.05 cm
20	Binoculars	1	for 2 ~ 3 km able to read 0.05 cm

(Data source: Study Team)

K6.2.5 Organization and Staffing

(1) Related institutions

The implementing institutions for water quality monitoring are the MOLG/NMC, the MOLRRWD and the KWS. The role of the respective institution are as follows :

(a) MOLG /NMC

The WSD of the NMC through the Trade Effluent Control Unit (TECU) will ensure regular sampling of trade effluent from the various industries.

(b) MOLRRWD

The Ministry will be responsibility of maintaining a comprehensive laboratory to be established preferably within the Lake Nakuru National Park. The Ministry will ensure regular sampling and analysis of samples (composite samples) of industrial effluents and final effluents from Njoro and Town STWs.

(c) KWS

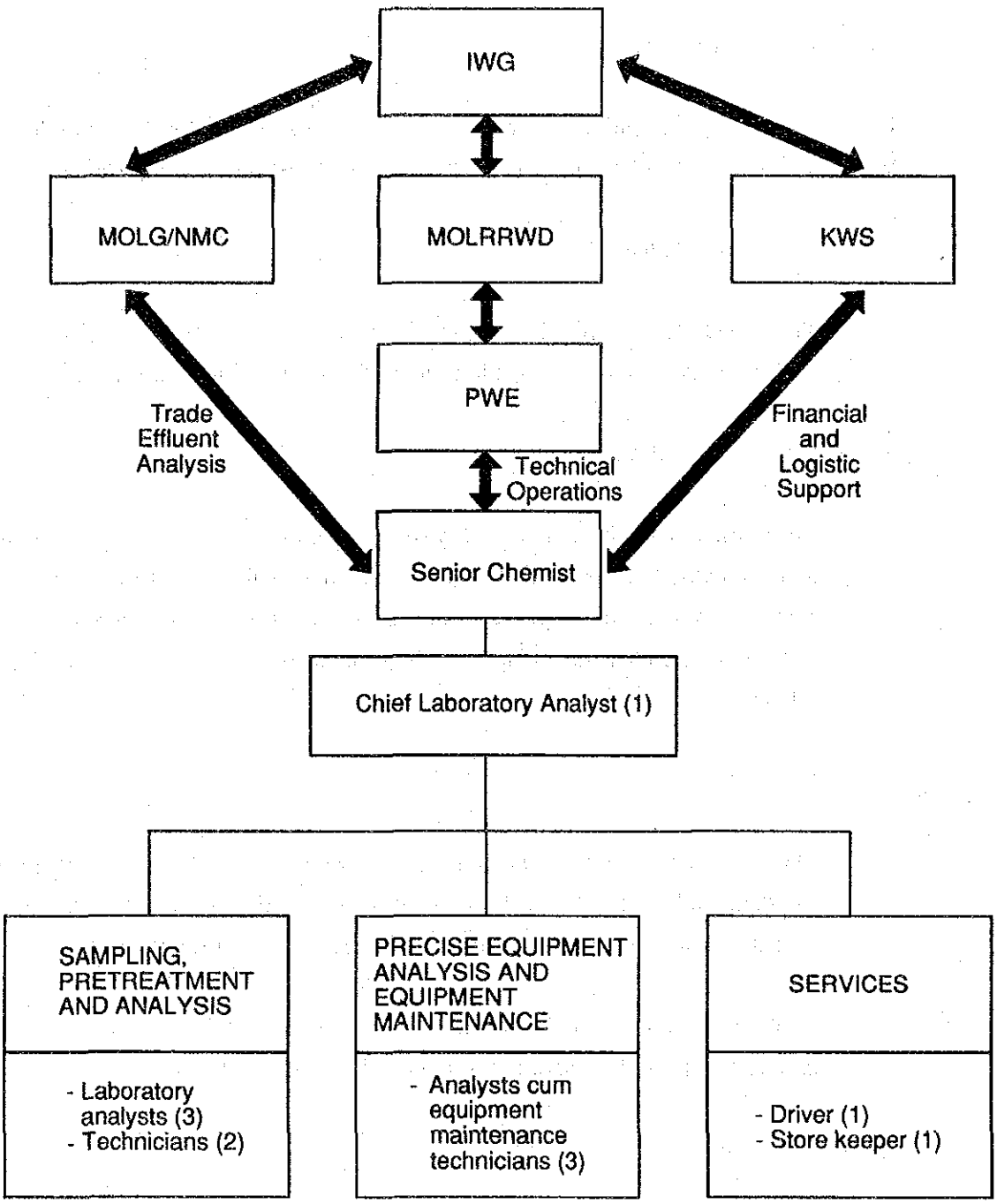
The KWS will sample river, spring, lake water, etc. The KWS will provide financial and logistic support for the operations in the laboratory complex. The operation and maintenance costs should largely be met by KWS.

Ecological studies of Lake Nakuru National Park including the lake should be undertaken by KWS under the auspices of the Research Unit of the KWS.

(2) Organization

Organization for the Monitoring Laboratory is proposed as shown in Fig. K-14 which includes two main sections under the Chief Laboratory Analyst. One is the Sampling, Pretreatment and Analysis Section which mainly deals with the sample collection and analysis. Analyses which requires specialised equipments such as atomic absorption spectrophotometer and spectrophotometer shall be exclusively done by specially trained personnel. Pretreatment of the samples for use with the spectrophotometers could be done by the Sampling, Pretreatment and Analysis Section.

Fig. K-14



Note: Numbers in parentheses indicate the number of staff proposed

THE REPUBLIC OF KENYA MINISTRY OF LOCAL GOVERNMENT	THE STUDY ON THE NAKURU SEWAGE WORKS REHABILITATION AND EXPANSION PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ORGANIZATION OF THE PROPOSED WATER QUALITY LABORATORY

(3) Staffing

Proposed staffing are also shown in Fig. K-14. The qualification of the key staff is shown in Table K-21.

Table K-21 Qualification and Duties of Staff in the Proposed Water Quality Laboratory - Nakuru

	Staff	Qualification	Duties
1.	Senior Chemist	- BSC (Chemistry) - Postgraduate (Environmental Chemistry) - 2 Years experience in Water and Wastewater Analysis	- Head of Water Quality Laboratory for Technical Operation and Administration - Execute Lake Nakuru monitoring programme - Ensure proper analysis of water and wastewater samples - Train and supervise junior staff - Prepare budget for Laboratory operations - Prepare Technical Reports
2.	Chief Laboratory Analyst	- BSc (Chemistry) - Post Graduate (Env. Chemistry)	- Analyze water and wastewater sample and compile technical reports - Supervise and train junior staff
3.	Laboratory Analyst	- 'O' Level Graduate - Ordinary Diploma in Water Engineering or Water Technology from Kenya Polytechnic (HND added advantage) - Field experience in Trade Effluent and analysis - Training in Court Prosecution Procedures at Mombassa Polytechnic	- Analyze trade effluent, water and sewage sample - Compile technical reports - Maintain Laboratory equipment
4.	Laboratory Technicians	- 'O' Level Graduate - Ordinary Diploma in Water Engineering or Water Technology from Kenya Polytechnic and KEWI - Field experience in Trade Effluent Survey	- Analyze trade effluent, water and sewage sample - Ensure cleanliness in the laboratory
5.	Analyst cum Equipment maintenance Technicians	- 'O' Level Graduate - Sewerage Inspector Certificate Kenya Water Institute - Field experience in Trade Effluent Survey	- Analyze water, sewage and trade effluent samples - Maintain Laboratory equipment - Ensure cleanliness in the laboratory

K6.2.6 Treatment and Disposal of Hazardous Wastes Generated from Laboratory

Some of the chemicals used for analysis in the laboratory contain hazardous elements namely chromium, mercury and silver from COD analysis and total nitrogen analysis. Proper disposal of these hazardous wastes is required to avoid environmental contamination. Hazardous liquids shall be collected in separate containers. Periodically, collected wastes shall be treated with lime or alum for flocculating and settling the heavy metals as sludge. Settled sludge shall be dried and shall be solidified by mixing with cement. Solidified material shall be stored for disposal at Industrial Sludge Dumping Site to be established by the NMC. Laboratory premises will be designed for pretreatment facilities of hazardous wastes. Approximately six hundred samples are to be anlaysed for COD and total nitrogen and about 120 m^3 of liquid hazardous waste is expected.

K6.3 Proposed Improvement and Strengthening of WSD

K6.3.1 Sewage Analysis Laboratory at the Njoro STW

The laboratory at Njoro STW should be strengthened in order to have capacity for the determination of the performance of both Njoro and the Town STWs. Equipment and apparatus being installed at Njoro STW have been investigated and additional testing equipment and apparatus required are proposed as presented in Table K-22.

Table K-22 Supplemental Equipment and Appratus at Njoro STW Laboratory

	Name of Equipment	Number of Equipments
1.	Low Temperature Incubator	1
2.	Drying Oven	1
3.	Aspirator	1
4.	Air Pump	1
5.	Portable pH Meter	1
6.	Portable DO meter	1
7.	Portable Conductivity Meter	1
8.	Portable ORP Meter	1
9.	Balance	1
10.	Analytical Balance	1
11.	Automatic Sampler	1
12.	Sampling Bottles	1 set
13.	Glassware and Accessories	1 lot

(Data source: Study Team)

K6.3.2 Establishment of the Trade Effluent Control Unit (TECU)

(1) For efficient enforcement of the Trade Effluent By-laws it is recommended to establish an operational unit to be known as the Trade Effluent Control Unit (TECU) within the WSD. The functions of the TECU will be as follows:

(a) Inspection of industries in Nakuru Municipality to check on the chemicals, materials and water usage in the industries to ensure efficiency and good house keeping and reduction of chemical spillages. Re-use and re-cycle of materials should be encouraged as much as possible in order to reduce pollution load for the individual industry.

(b) Collection of fee for the analytical services through the sewerage tariffs levied by the NMC.

(c) Take legal action where the Trade Effluent By-laws are contravened. The legal charges should be based on the number of the parameters exceeded in order to give weight to the offense.

(2) Proposed organization

Fig. K-15 shows the proposed organization of the Trade Effluent Control Unit (TECU). It is proposed that a new Cadre of staff to be named Trade Effluent Superintendent and Trade Effluent Inspectors be established within WSD.

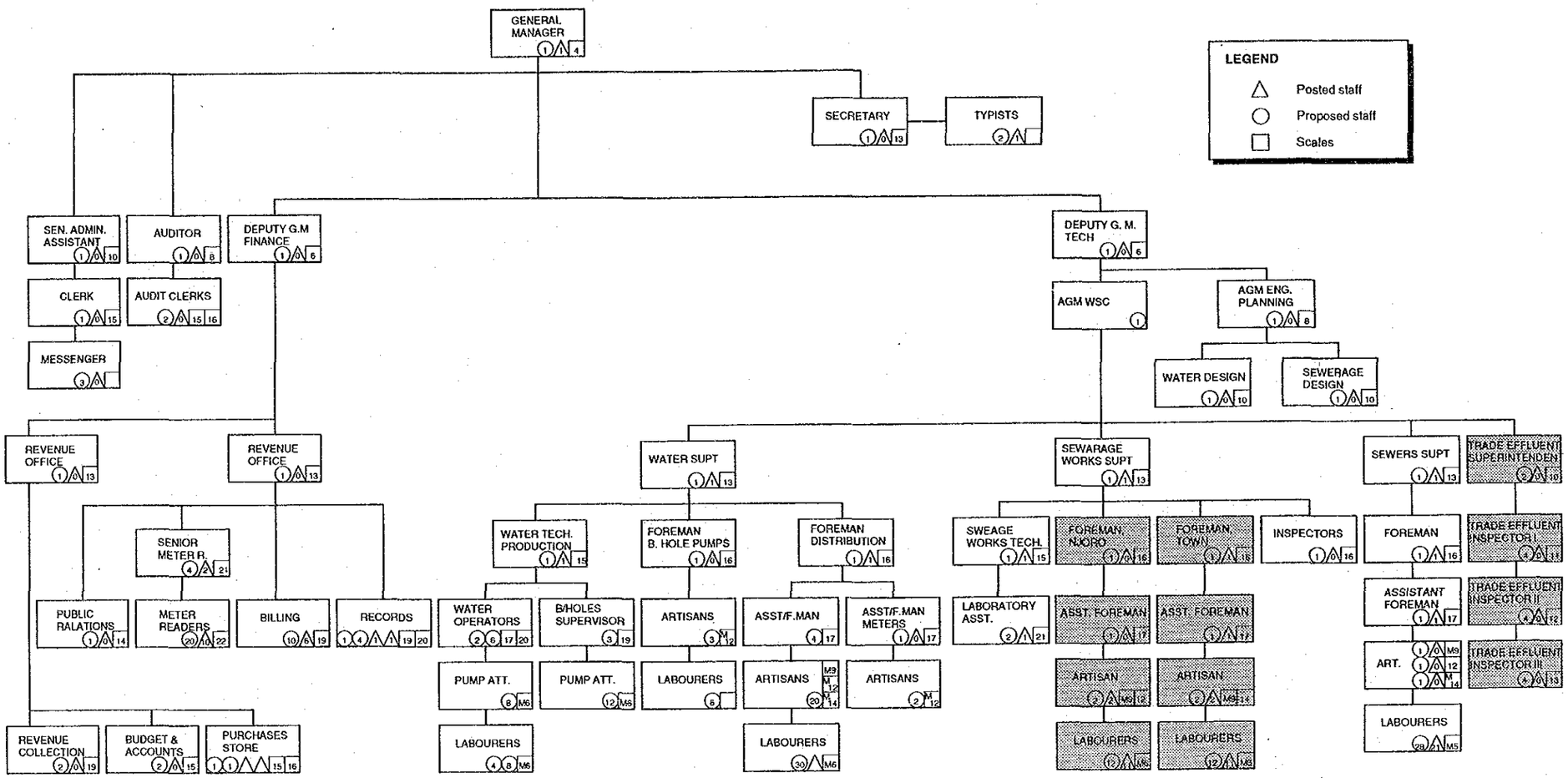
(3) Staffing

The proposed staffing are presented in Table K-23.

Table K-23 Proposed Staff Requirements and Projections for TECU

Position Description	1st year	2nd year	3rd year
Trade Effluent Superintendent	1	1	2
Trade Effluent Inspector I	2	2	4
Trade Effluent Inspector II	2	2	4
Trade Effluent Inspector III	3	4	4
Total	8	9	14

Fig K-15



Data souce : Nakuru Municipality

Proposed addition/improvement

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(a) Trade Effluent Superintendent

It is proposed to establish 2 posts for this cadre but that only one post should be filled up to 1996 when the other post is also filled. Due to expansion of sewerage services the Municipality may be divided into 2 zones and each of the Trade Effluent Superintendent will be incharge of one zone for execution of the specified duties and responsibilities in trade effluent control.

(b) Trade Effluent Inspector I

It is proposed that 4 posts be established in this Cadre. Two of the Inspectors will serve under one of the Trade Effluent Superintendent. The posts are proposed to be ultimately filled by 1996 when the magnitude of work in the sewerage sector will justify.

(c) Trade Effluent Inspector II/III

This cadre of staff may be considered to be mainly under training from the more experienced staff in the TECU. The number proposed is reasonable considering the possibility of staff turnover and poaching by other Municipalities and agencies that may require the expertise.

(4) Qualification and duties of staff

The proposed qualification and duties of key staff are as shown in Table K-24 :

Table K-24 Qualification and Duties of Staff in the Proposed TECU

	Staff	Qualification	Duties
1.	Trade Effluent Superintendent	- 'O' Level (Graduate of Secondary Shool) Ordinary Diploma in Water - Engineering from Kenya Polytechnic and Kenya Water Institute (KEWI) - Higher National Diploma in Water Engineering from Kenya Polytechnic - Field experience in Trade Effluent sampling and analysis - Training in Court Prosecution Procedures at Mombasa Polytechnic (organised by the Directorate of Personnel Managment and the Attorney General Chambers), especially as applied to the Local Government Act (Cap. 265), the Water Act (Cap. 372), Local Government By-laws and other water related legislation	- Head of TECU for Technical Operations and Administration - Ensure that all industries in Nakuru Municipality are operated - efficienly and in environmentally sound manner - Ensure the execution of an industrial and Effluent Sampling Programme - Ensure proper analysis of samples and interpretation of results - Maintain Waste Analysis Laboratory and ensure proper functioning of equipments and apparatus - Take Legal Action for breach of Trade Effluent By-laws - Supervise and train junior staff within TECU - Prepare Draft budget for TECU and submit to GM through DGM - Prepare Draft Forward Plan for TECU - Prepare Annual Reports on the Operations of TECU
2.	Trade Effluent Inspector I	- 'O' Level Graduate - Ordinary Diploma in Water - Engineering or Water Technology from Kenya Polytechnic (HND added advantage) Field experience in Trade Effluent and analysis Training in Court Prosecution Procedures at Mombasa Polytechnic	- Inspect factories on a regular basis to ensure that the operation is environmentally sound - Sample trade effluent for quality monitoring - Compile technical reports on the performance of industries in regard to pollution reduction - Take Legal Action on breach of Trade Effluent By-laws
3.	Trade Effluent Inspector II	- 'O' Level Graduate - Ordinary Diploma in Water Engineering or Water Technology from the Kenya - Polytechnic and KEWI - Field experience in Trade Effluent Survey	- Inspect factories on a regular basis - Sampling effluent for quality assessment - Compile Technical Reports on Performance of factories regarding pollution reduction
4.	Trade Effluent Inspector III	- 'O' Level Graduate - Sewerage Inspector Certificate - Kenya Water Institute Field experience in Trade Effluent Survey	- Inspect factories - Sampling of factory Effluents for quality assessment - Prepare Technical REport on factories performance

K6.3.3 Proposed Strengthening of Sewerage Section

A part from TECU, it is proposed to strengthen Sewerage Section in order to ensure a sustained operation of the sewerage facilities after completion of the contemplated Project.

(1) Organization

The WSD's proposed organization is adequate in general sense but it is proposed to reorganize the Sewerage Section slightly as shown in Fig. K-15. Under the proposed organization, the Sewerage Section is divided into Njoro and Town Sewage Works Sub-sections in order to clearly demarcate the responsibility of operation and maintenance of the two sewage works among the staff. Each sub-section is head by a Foreman who will be seconded by Assistant Foreman, and assumes full responsibility for operation and maintenance works of the sewage works assigned.

(2) Staffing

Along with rehabilitation/expansion of sewage works and provision of additional operation and maintenance staff, the number staff of Sewerage and Sewer Sections need to be augmented. The proposed staffing schedule is as given in Table K-25.

Artisan includes mechanics and at present there are four artisan in total, which are proposed to be apportioned equally into two sewage treatment works.

Within category of labourers, included are watchmen and vehicle drivers. Three watchmen are proposed at each sewage treatment works, assuming that they will be on duty on a basis of three shift. One driver is also proposed for each sewage treatment works, while three drivers are proposed to be included in the Sewer Sub-section for operation of maintenance equipment.

Table K-25 Proposed Staffing for Sewerage Section

	Positions	Proposed	Posted	Proposed for 1993/94	Vacant
(a)	*Assistant General Manager, Water and Sewerage Quality Control*	1	0	0	1
(b)	Sewage Works Section				
	b.1 Sewage Works Superintendent	1	1	0	0
	b.2 Sewage Works Technician	1	1	0	0
	b.3 Inspectors	1	0	1	0
	b.4 Laboratory Assistant	2	1	1	0
(c)	Njoro Sewage Works Sub-section				
	c.1 Foreman	1	0	0	1
	c.2 Assistant Foreman	1	0	0	1
	c.3 Artisan	2	(2)	0	0
	c.4 Laborours	10	(10)	0	0
(d)	Town Sewage Works Sub-section				
	d.1 Foreman	1	1	0	0
	d.2 Assistant Foreman	1	0	0	1
	d.3 Artisan	2	(2)	0	0
	d.4 Laborours	8	(8)	0	0
(e)	Sewers Section				
	e.1 Sewer Superintendent	1	1	0	0
	e.2 Sewer Foreman	1	1	0	0
	e.3 Asst. Sewer Foreman	1	1	0	0
	e.4 Artisans	3	0	3	0
	e.5 Laboroures	28	21	4	3

(Data source: WSD and Study Team)

Note: Figures in parentheses are estimate ones.

K6.3.4 Financial Management in WSD

At the moment the financial management is under the Treasurers Department. There are constraints due to allocation of insufficient funds to the WSD especially for provision of sewerage services.

It is recommended that a Financial Management Unit be established by the WSD within the WSD under the Deputy General Manager (Finance). This has already been proposed (see Fig. K-5) and should be implemented as earlier as possible. The Financial Management Unit will ensure more efficient and revenue collection system for the WSD and also ensure that sufficient funds are made available for water and sewerage services.

K6.3.5 Operation and Maintenance Equipment

WSD is not provided with sufficient and adequate facilities for operation and maintenance of sewerage facilities. It is proposed to construct a new workshop at Town STW with adequate maintenance equipment and tools, transportation facilities, and sewer cleansing facilities. In consultation with WSD, the required operation and maintenance equipment have been estimated as shown in Table K-26.

K6.3.6 Staff Housing

It is normal practice in Kenya that executing agency furnishes accommodation facilities for its permanent employees. In fact 12 staff houses are to be built up at Njoro STW under Nakuru Sewerage Project. It is reported that Town STW is not properly operated during a night time owing to absences of operation staff.

The required accommodation is assessed in compliance with the Kenyan standard as shown in Table K-27:

Table K-26 Proposed Operation and Maintenance Equipment

	Description	Unit	Quantity
(1)	Workshop Equipment		
	1) Tool box with assorted tools	lot	1
	2) Electric angle grinder 8 inch	set	1
	3) Drill bits, 2 to 12 mm dia. with stand	set	1
	4) Portable electric blower, 50 cm dia.	set	1
	5) Gear puller	set	1
	6) Tap and dies, M2 to M12 fine thread	set	1
	7) Gas welding set	set	1
	8) Electric welder, 100 A	set	1
	9) Electric tool box with assorted tools	lot	1
	10) Drilling machine	set	1
	11) Air Compressor	set	1
	12) Vice	set	1
	13) Chain block	set	1
	14) Hydraulic jack	set	1
	15) Shelf with rock	set	1
	16) Gate crane, movable type	set	1
(2)	Operation & Maintenance Equipment		
	1) Mud pump for sludge pumping Town & Njoro	set	3
	2) Generator for the above item 1)	set	2
	3) High pressure sewer cleaner, vehicle, 4 t	unit	1
	4) High pressure sewer cleaner, vacuum car, 4 t	unit	1
	5) High pressure sewer cleaner, water tanker, 4 t	unit	1
	6) Plug for water stop	pc	6
	7) Pick up truck, 1 t	unit	2
	8) Tractor shovel w/back-hoe attachment	unit	1
	9) Truck, 6 t	unit	2
	10) Gas mask	set	6

Table K-27 Accomodation Required for Staff Housing

House Type	Area (m^2)	Staff to be Accommodated	Number of Houses			
			Total	Existing	Nakuru Sewerage Project	Additional Requirement
C	38.92	- Foreman - Assist. Foreman - Laboratory Assist	6	2*	4	0
D	35.25	- Artisan - Labourers (excl. driver)	20	0	8	12

(Data source: Study Team)

* : One at Nakuru STW and another at Meroroni Water Works. 12 Type D houses will be required additionally, 3 and 9 at Njoro and Town STWs respectively.

6.3.7 WSD Office

At present, WSD has no specific office so that their daily routine works are inefficient and unrational. In order to attain autonomy of WSD and to attain more efficient and rational activities, it is deemed essential to be provided with a specific office efficient to accommodate the key staff of the proposed staffing.

WSD is in opinion that the office could be located at the space between the New Town Hall and the Ardhi House to provide a convenient access to their customer and it should be composed of 25 rooms manager down to technical level. It is recommended that the Council takes necessary action for its realization immediately.

K6.4 Treatment and Disposal of Industrial Solid Wastes

Industrial solid waste in Nakuru Municipality is normally stored in factories yard and then transported to the controlled tipping site where domestic refuse is also disposed.

Some of the industrial waste from the Eveready Batteries K (Ltd.), the Nakuru Tanners Ltd and the Metal Plating Factory is toxic and hazardous. There are possibilities of groundwater contamination by lecheate from the dumping site. The industrial solid waste therefore requires better treatment and disposal methods.

The following method is proposed:

(1) The NMC should identify a separate site for industrial solid disposal

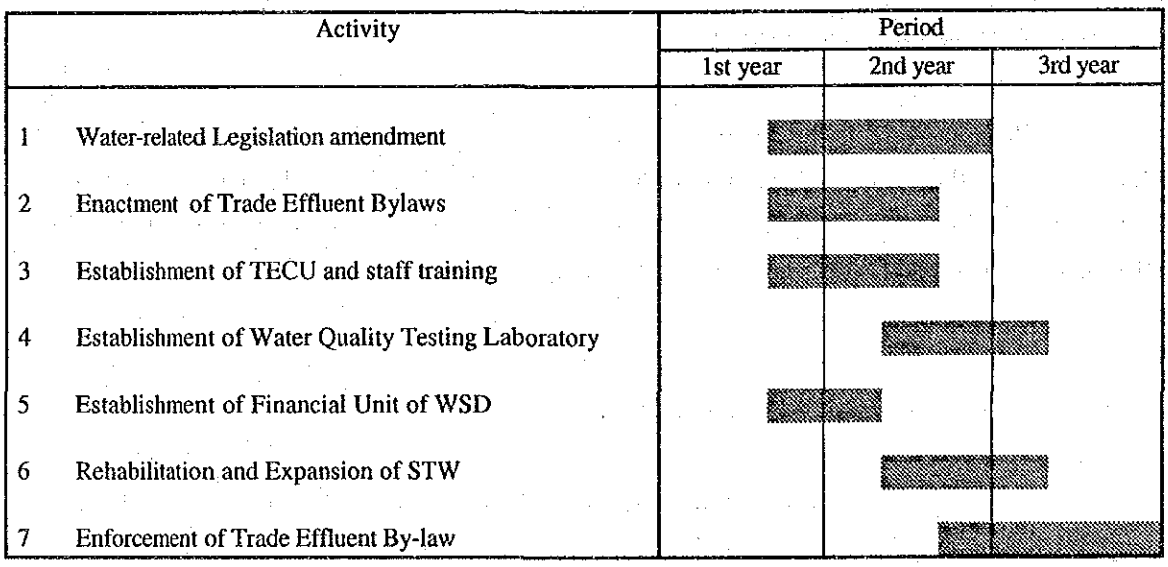
(2) The factories should reduce the volume of their solid waste by compression, dewatering or incineration

(3) The residue solid waste can then be compounded with concrete and then disposed in a concrete lined dumping site indentified in (1) above. The site should be fenced for security purposes.

K6.5 Action Plan

The strengthening of the WSD should be phased. Fig. K-16 shows the proposed implementation schedule for the proposed shor-term plan.

Fig. K-16 Proposed Implememtation Schedule for Short-term Plan



K7. MEDIUM AND LONG TERM PLAN

K7.1 Lake Nakuru Basin Monitoring

The proposed monitoring plan for Lake Nakuru and Industrial Effluents are expected to be continued. This will provide various baseline data and information for formulation of a master plan for development of Lake Nakuru catchment.

K7.2 Urban and Regional Development Control

As a strategy for the reduction of pollutants it is proposed that the urban and regional development activities for the Lake Nakuru basin area be controlled.

The development control plan is proposed to include, but not limited to the following :

(1) Restricting the size and type of industries to be located in Lake Nakuru catchment.

(2) Industries producing effluents with heavy metals (such as tanneries and metal plating industries) should be located outside the catchment area.

(3) Industries that use huge quantities of water and generating huge quantities of effluent should also be located elsewhere to prevent excessive hydraulic loading of the lake which may have adverse impact on the lake ecology.

(4) Allocate sufficient land to allow for effluent pre-treatment of full treatment of industrial effluents as appropriate.

(5) Excessive use of fertitizers and agro-chemicals should be avoided and environmentally friendly land use practices, including organic farming, should be encouraged within the cacthment area.

(6) EIA should in all cases of development projects be undertaken and the outcome used as a management tool for environmental conservation. Project budgets should include provision for institution of mitigatory measure for possible adverse environmental impacts.

The proposed implementing institutions for the Urban and Regional Development Control are the MOLS, the MOLG, MOLRRWD, MOC & I and the MOENR with the supervision and coordination by the IWG.

K7.3 Master Plan Study for Lake Nakuru Cacthment

The importance of Lake Nakuru both nationally and internationally as a conservation area is sufficient justification for a comprehensive study of the catchment area. It is proposed to formulate a Master Plan Study with the main objectives stated as follows :

(1) To assess development potential of the natural resources available in the catchment atrea.

(2) To develop policy guidelines for the future development of the resources on an environmentally sustainable basis for posterity.

(3) To develop strategies for the protection of Lake Nakuru from degradation.

L : ENVIRONMENTAL ASSESSMENT

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