Chapter 3
Socio-economic Conditions

CHAPTER 3 SOCIO-ECONOMIC CONDITIONS

3.1 Socio-economic Condition of Uganda

3.1.1 Ethnic, Language and Religion

The country has been relatively stable over the last two decades since the current president: Mr. Yoweri Kaguta Museveni, came to power in January 1986.

Uganda comprises of a diverse range of ethnic groups and a distribution of main ethnic group is shown in Figure 3-1. A composition rate of main five ethnics is Buganda 17.3%, Ankore 9.8%, Busoga 8.6%, Bakiga 7.0%, Teso 6.6%.（UBoS：2002 Uganda Population and Housing Census, Main Report）The Lango and the Acholi live in the northern Uganda, the Iteso and Karamojong live in the eastern and the Buganda in the southern.

Uganda's ethnic groups are most broadly distinguished by language. In southern Uganda, most of the population speak Bantu languages, Sudanic speakers inhabit the northwest; Nilotic speakers, principally the Acholi and Langi, live in the north; and the Iteso and Karamojong in the northeast.
Uganda has at least forty languages in usage. Luganda is the most common language. English is the official language of Uganda. Luganda, a language widespread in the central Uganda.

Figure 3-1 Ugandan Main Race Distribution

source: http://en.wikipedia.org/wiki/Uganda_Protectorate

According to the census in 2002, 44.5% of population is Roman Catholics, 35.9％ Anglican Church, 12.1% Muslims, 4.6% Judaism and so on.

3.1.2 System of the Government

Uganda has an unicameral National Assembly of 305 members. The members serve five-year term. The executive of the country is headed by the president and assisted by the vice-president, prime minister and cabinet ministers. The president of Uganda is head of the state, head of the government and commander-in-chief of the Uganda peoples' defense forces.

The key function of the judiciary is the adjudication of civil and criminal cases. In addition, it interprets the constitution and gives effect to its provisions, as well as providing the expertise in interpreting of the laws.
The Ministry of Local Government oversees local governments' administration. As of June 2009, there are 80 districts in the country. The administrative classification is as follows.

- LC5 -District
- LC4 -County
- LC3 -Sub-county
- LC2 -Parish
- LC1 -Village

3.1.3 Socio-Economy

Uganda is one of the fastest economic growing economies in Africa with sustained growth averaging 7.8% since 2000. However, this growth has to be sustained in order for per capita income to rise beyond the current US$370. Though the country has made tremendous strides in recovering from years of economic breakdown in the 70s, the social economic indicators show that a lot still needs to be done. Life expectancy at birth is currently around 50 years and a population growth rate of about 3.4% remains one of the highest in the world, which could pose serious development challenges, unless addressed.

Agriculture is the most important sector of the economy, employing over 80% of the work force. Coffee is the major export crop and accounts for the bulk of export revenues. Since 1986, the government - with the support of foreign countries and international agencies - has acted to rehabilitate and stabilize the economy by undertaking currency reform, raising producer prices on export crops, increasing prices of petroleum products, and improving civil service wages. The policy changes are especially aimed at dampening inflation and boosting production and export earnings. In 1990-2000, the economy turned in a solid performance based on continued investment in the rehabilitation of infrastructure, improved incentives for production and exports, reduced inflation, gradually improved domestic security, and the return of exiled Indian-Ugandan entrepreneurs.

The country's firm commitment to poverty reduction, as spelled out in the Poverty Eradication Action Plan (PEAP) --Uganda's Poverty Reduction Strategy Paper -- and the World Bank's and other Development Partners' contributions brought the country closer to reaching the Millennium Development Goals (MDG):

The poverty headcount dropped from 56% in 1992 to 31% in 2006. Poverty, however, remains undisputable high in rural areas and Northern and Eastern Uganda. The Second Uganda Participatory Poverty Assessment Program, carried out by the government in 2003, identified several factors leading to high poverty levels. These includes heavy burden of disease; limited access to land and other assets, insecurity, lack of control over productive resources by women and high fertility rates.

The HIV/AIDS prevalence reduced dramatically from 18% at its peak in1992 to around 6.4% where it has stagnated over the last eight years. Though this is still well below the MDG target for HIV/AIDS, recent evidence indicates that new infections are on the rise with 132,500 new infections reported in 2006.

Some basic economic indicators and general information about Uganda are presented in Table 3-1 Economic Indices and General Information of Uganda.

Table 3-1 Economic Indices and General Information of Uganda

Item	Description
GDP - real growth rate	6% (2007 estimate)
GDP - official exchange rate	$11.23 Billion (2007 est.)
GDP - composition by sectors	Agriculture:30.2%,Industry:24.7%,Services:45.1%(2007 est.)
Budget	Revenues:$2.211Billion,Expenditure:$2.443Billion(2007est.)
Public debt	20.6% of GDP
Inflation rate	6.1% (2007 est.)
Current account balance	-$744.7 Million (2007 est.)
Reserve foreign exchange and gold	$2.56 Billion (2007 est.)
Total labor force	14.02 Million (2007 est.)
Labor force by sector	Agriculture: 82%, Industry: 5%, Services: 13% (1999 est.)
Industries	Sugar, brewing, tobacco, cotton, textile, cement, steel production
Industrial growth rate	5.8% (2007 est.)
Agricultural products	Coffee, tea, tobacco, cassava, potato, corn, livestock, poultry etc.
Export amount	$1.686 Billion (FOB, 2007 est.)
Export commodities	Coffee, tea, fish, fish products, flowers, gold etc.
Export partners	Netherlands (10%), Belgium (9.8%), Germany (7.9%), France 7.2%), Rwanda (5.6%) as of 2007 estimate
Import amount	$2.983 Billion (2007 est.)
Import commodities	Capital-equipment, vehicles, petroleum, medical supplies, cereals
Import partners	Kenya (32%), China (8%), South Africa (6%), India (5%), Japan (5%) as of 2007 estimate
Economic aid received	$1.198 Billion (2005)
Debt - external	$1.498 as of Dec 31, 2007
Exchange rate	Uganda shilling 1,696 to 1 US$ (2007)
Fiscal year	1 July ~30 June
Independence day	9th October

3.2 Socioeconomic Conditions of Lake Kyoga Basin

3.2.1 General Conditions

(1) Population and Ethnic

According to the 2002 census carried out by UBoS (Uganda Bureau of Statistics), the total population in the basin is 7.7 million (country population = 24.2 million). The total number of households is 2 million. Number of people per household varies from 3.8 in Pallisa to 5.5 in Nakapiripirit. Considering the population of the sub-counties only within the basin, the population density varies as low as 13 persons/km^2 in Abim and highest in Mbale, 642 persons/km^2. Figure 3-2 shows the population density distribution by sub-county.

There are about twelve major ethnic groups share the basins. They are Karamojong in the north. Teso mainly live in the middle part of the basin covering Kaberamaido, Soroti, Amuria, Katakwi, Kumi and Bukedea districts. In the south-southwest part is shared by Bosoga and Baganda groups. Eastern part is by Bagisu, Be-ware, Japhadola, Sabiny and Baruri groups. In the north-western part Langi group of people live.

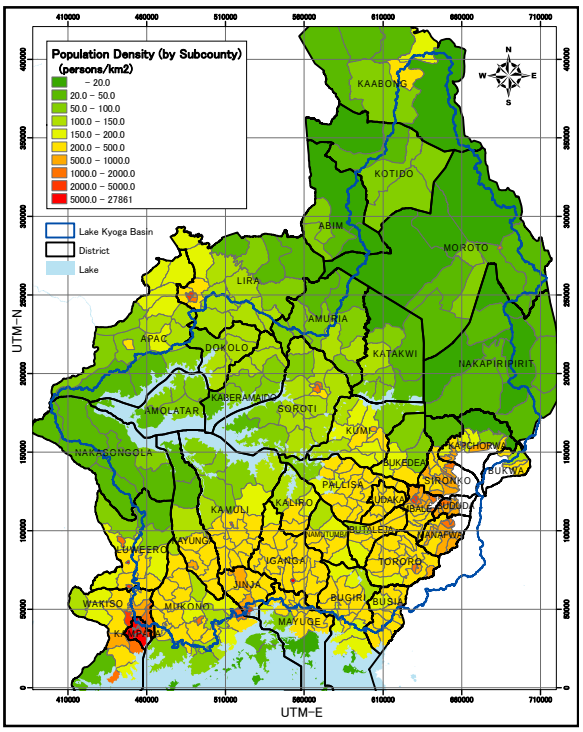


Figure 3-2 Population Density in the Lake Kyoga Basin by Sub-County

(2) Industry

1) Agriculture and Livestock

The people in the Basin maintain lively hood engaging themselves in agriculture, fishing and small retail businesses. Only a little percentage of people (5~10%) involved in employment. They grow variety of crops such as Maize, Cassava, Rice, Cotton, Coffee, Tea, Beans, Sorghum, Potato, Banana, Sugarcane etc. Among horticultural products, Mango, Papaya, Pineapple, Jackfruits, Tomato, Onion, Sorghum, Cabbage, Groundnut are main.

While practice agriculture most of the families maintain small dairy and poultry firms as a side business. Cows, goats and pigs are the main animals. Local chickens are very popular as poultry.

2) Fishery

Fishery has been an important source of income among the communities living along the lake-shores in the country. Lake Kyoga is an important source of Nile Perch, Tilapia and Cat fish. In Study area, Nakasongola, Kayunga, Kamuli, Kaliro, Soroti, Pallisa and Numutumba are the main districts where many inhabitants are involved in fishing activities and earn their living.

3) Trade and others

Many people earn their livings opening a road side retail shop of vegetable, operating small restaurant and many are engaged as Boda-Boda drivers in town centers.

3.2.2 Socio-Economic Survey

(1) Outline of Socio-Economic Survey

The purpose of the socio-economic survey is to collect basic data/information for understanding the socio-economic conditions of the inhabitants living in 125 villages of the Basin as shown in Figure 3-3. The villages were selected by considering three points as below.

- Number of sub-counties in each district
- Even distribution of villages in a whole survey area
- As close as possible to Rural Growth Center (RGC)

The survey was consisted of "Village Survey" which would be clear the general village conditions and "Household Survey" selected three households in the village which would be investigated villagers conditions.

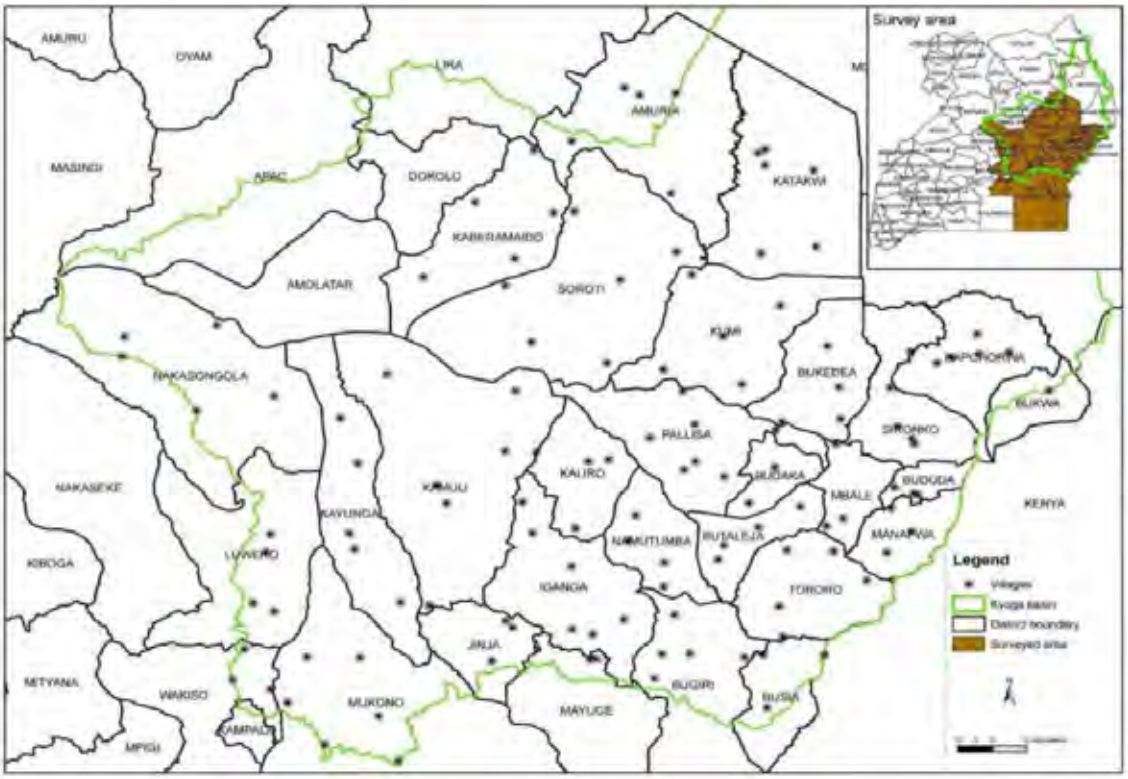


Figure 3-3 Location of Target Villages for Socio-Economic Survey

(2) Survey Results

1) Feature of Surveyed Village

"Village Survey" was conducted as interview survey using by questionnaires to the representative of the village, namely village leader, chairperson or vice chairperson. As of "Household Survey", possible households in different wealth classes were interviewed within each village.

i) Demographic and Ethnic Information

Based on estimated figures from the respondents, village size is varying between 200 to 6,500 people and an average of it is 1,458 people. On the other hand, the total household number is 40,183. Therefore, the household size is calculated as 4.5 people, this is the same range of the result of the Census 2002 (UBoS).

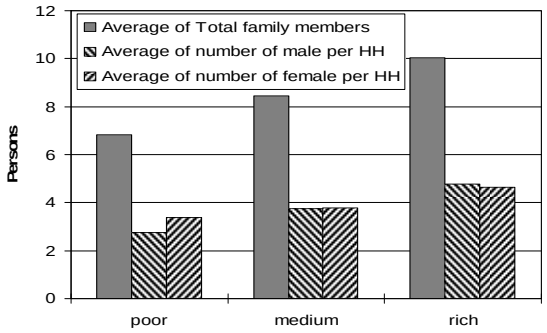


Figure 3-4 Average Household Size

According to the "Household Survey", there are on average 8.2 people per household in the study area. The household size depends on the wealth of the household, with poor households having 6.8 members, and rich households having 10.1 members as shown in Figure 3-4.

The 23 villages are situated in the Central Region, and 102 villages in the Eastern Region of Uganda. The study area is ethnically very heterogeneous: nineteen different ethnical main identities were recorded during the village survey, as shown in Figure 3-5.

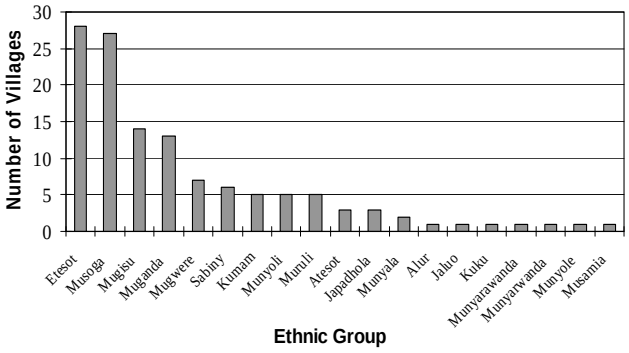


Figure 3-5 Ethnic Variations of the Village Leaders

ii) Socio-Economic Activities

The majority of the population is engaged in agriculture; part of these people also works as a daily laborer and/or fisherman.

Income and wealth information is listed in Table 3-3 Average Wealth Indicators per Household. The average stated annual income is 1.66 Million UGX (750 US$), varying from an average of 0.40 Million UGX for poor households to an average of 4.87 Million UGX for rich households.

Table 3-2 Engagement in Economic Activities

Economic Activity	Av. % of Engagement
Agriculture	82.3
Fishing	6.5
Daily Laborer / casual	25.3

Average expenditure figures were derived from respondents establishing monthly and quarterly expenditures. The people are not saving money. On average, people have a loan of 0.25 Million UGX to finance their expenditures. Especially the relatively rich households borrow money, on average 0.72 Million UGX, which is 15% of their average yearly income. On average, 7% of the household's income is spent on domestic water. Households on average own 3.6 cattle and 6.5 poultry (local chicken). The number of cattle and poultry is directly re-

lated to wealth, with poor households owning 2 cows/goats and 4 local chickens, and rich households having 9 cows/goats plus chickens.

Table 3-3 Average Wealth Indicators per Household

Wealth Indicators		Wealth Class of Household			
		Poor	Medium	Rich	Overall Average
Av. Annual Income	(UGX)	**403,278**	**1,352,132**	**4,871,464**	**1,661,400**
Av. Income from Agriculture	(UGX)	291,571	895,316	1,795,072	845,819
	/Income	72%	66%	37%	5%
Av. Income from Poultry/dairy	(UGX)	11,971	79,464	279,206	91,301
	/Income	3%	6%	6%	5%
Av. Income from Fishery	(UGX)	-	2,426	1,449	1,367
	/Income	0.00%	0.18%	0.03%	0.08%
Av. of other Income	(UGX)	106,948	390,442	2,818,897	761,258
	/Income	27%	29%	58%	46%
Av. Monthly Expenditure	(UGX)	48,178	106,213	401,251	138,365
Av. Annual Expenditure	(UGX)	**578,136**	**1,274,556**	**4,815,012**	**1,660,380**
	/Income	143%	94%	99%	100%
Av. Loan	(UGX)	21,795	585	720,000	247,283
Av. Monthly Expenditure for Water Related	(UGX)	4,525	4,773	22,296	9,452
	/Income	9%	4%	6%	7%
Av. Number of Cattle		1.7	2.9	9	3.6
Av. Number of Poultry		3.6	6.2	12.7	6.5

iii) Cultivated Area and Crops

On average, households own and cultivate 7.6 acres. The households classified as poor and medium own 5.5 acres, whereas the rich households on average own 17 acres. People usually cultivate some five different crops, as they to a large extent are subsistence farming. Often intercropping occurs, making it difficult to establish the amount of acres for a specific crop. The Figure 3-6 shows the kinds of cultivated crops. Maize field constitute 22% of the total stated cultivated area, with cassava and pineapple cultivation using 21% and 15% of the cultivated area, respectively.

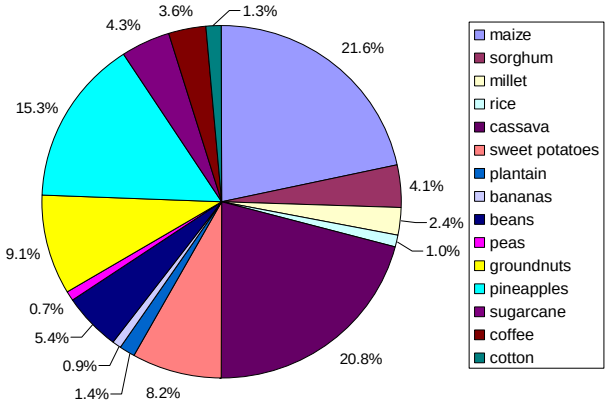


Figure 3-6 Ratio of Cultivated Area by Crops

iv) Existing Facilities and Infrastructure

The visited villages have in total 157 primary schools, corresponding to 1,160 people per primary school. The villages have a total of 41 secondary schools. A total of 93 health centres were registered in the visited villages, which means that one health centre covers on average 1,960 people, or less than one health centre per village. The villages have in total 258 churches of different denominations, which gives an average of 706 people per church, or 2 churches per village. Only 19 banks were present in the 125 villages, or 9592 people per bank.

There is no electricity available in the majority (78%) of the villages. The mobile telephone network is however good, with network in 120 out of the 125 villages.

(3) Water Supply and Sanitation

1) Drinking Water Sources

The ratio of main drinking water sources is shown in Figure 3-7.

The majority of the main water sources consist of deep boreholes (53%). Total of deep borehole, The 68% of vilages have safe water sources: deep borehoel, shallow boreholes equipped with a hand pump, protected springs, and shallow wells equipped with a hand pump. On the other hand, 32% of all surveyed villages are using unsafe water source.

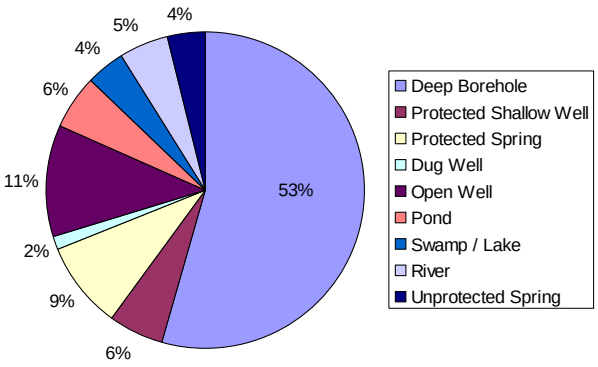


Figure 3-7 Ratio of Main Water Source in Surveyed Villages

2) Water Supply Facilities Used by Villagers

The majority of the households 53% uses a borehole well as its main water supply, followed by the use of a protected shallow well (8%) or shallow borehole (8%). Only two percent of them are using tap water. This means that 71% of the interviewed households uses safe water supply, whereas more than a quarter of the population uses unsafe water for drinking.

The water quality of the sources is described as good by 60% of the respondents, and 40% as bad. The main reason for bad quality stated is turbidity (described as muddy, brownish colour); other reasons are hardness and saltiness of the water, and bad odour.

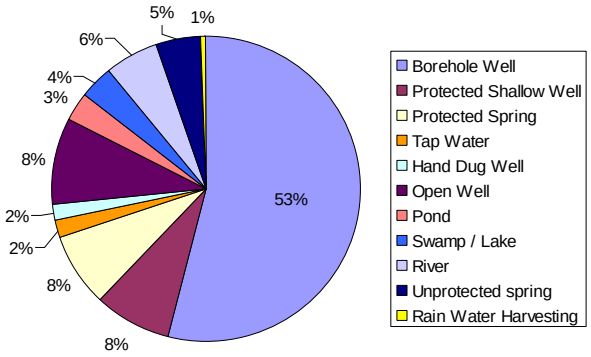


Figure 3-8 Ratio of Main Water Source Facility in Surveyed Villages

3) Time Spent on Collecting Water

The average time required to fetch water, i.e. the total time required to fetch water including waiting time, is 95 minutes, varying from 10 minutes to 6 hours daily. The interviewed people revealed that most of the time is taken by waiting at the source, which means that it is the yields of water sources rather than the distribution of sources that forms the problem. (refet to Figure 3-9)

4) Water Consumption and Fee

People use on average 18 iter/capita/day for domestic purposes, including drinking, cooking and washing. Although someone pay the water fee monthly and others pay by jerrycan, etc., they are paying 1.47 UGX per one liter in whole average. However, poor class people are paying less than 1 UGX per liter, they are considered to fetch water from river or pond which they don't need to pay water fee. They spent on average one and a half hours per day to collect water; this includes waiting time at the source (refer to Table 3-4 Water Collection and Consumption).

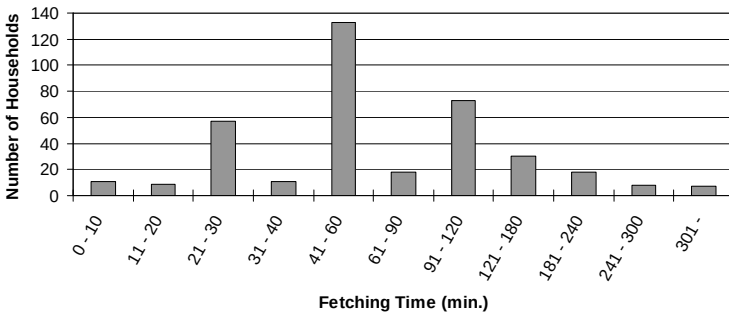


Figure 3-9 Time Spent on Collecting Water

Table 3-4 Water Collection and Consumption

	Wealth Class of Household			Overall Average
	Poor	Medium	Rich	
Average of Time Required to Fetch Water (minute)	82	97	114	95
Average of Amount of Water Used in a Day (litters)	107	149	200	143
Average of Total Family Members	7	8	10	8.2
Average of water price per litter	1	1	2	1.47
Water Used (person/day/litters)	16	18	20	17.5
Willingness to pay for improved water system (% of yes)	95	89	99	93.1

5) Willingness to Pay for Operation & Maintenance

Water supply is a big issue for the population, and people spend a lot of time for collecting it. Therefore, most people indicate they would be willing to pay for the operation and maintenance cost of tap water suply system. Also, if the existing system is improved and an extra fee is charged, the people are willing to pay for it. The whole population is in favor of applying strict rules for water fee collection.

6) Waterborne Diseases and Sanitation

Waterborne diseases are reported in 60 villages out of 125 surveyed villages. A total of 13,534 water-borne diseases were recorded. It follows that Diarrhea is most prevalent in the study area (with 36% of the reported cases of water borne diseases), followed by symptoms of vomiting According to the result of "Household survey", 33% of the respondents indicated that household members suffered from waterborne diseases in the last year. Diseases mentioned included mostly diarrhoea, occurring in 30% of the cases. Other water borne diseases included Malaria, skin diseases, Typhoid and Cholera. Vomiting was also mentioned, which can be due to a variety of diseases. (refer to Figure 3-10)

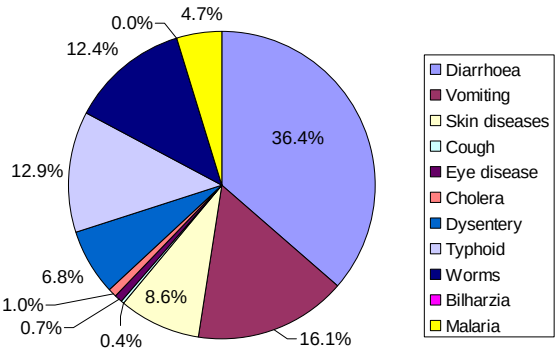


Figure 3-10 Occurrences of Reported Cases of Waterborne Diseases (a) (Village Survey)

On average, the villages report that improved latrine coverage is 63%. The 60 villages that report to have had water borne diseases over the last year have a slightly lower reported latrine coverage of 61%, as compared to 66% latrine coverage in villages without reported water-borne diseases. There may be many parameters impacting on the prevalence of water-borne diseases, including hand washing practices and other sanitary improvements other than water source or latrine coverage.

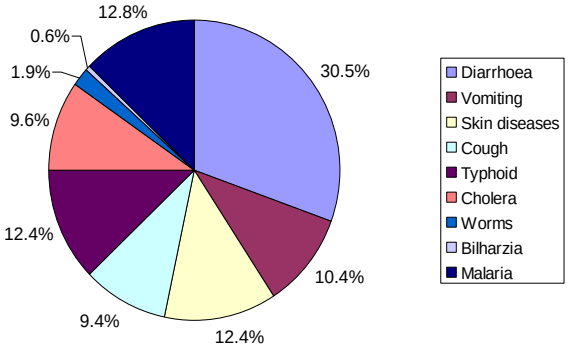


Figure 3-11 Occurrences of Reported Cases of Waterborne Diseases (b) (Household Survey)

(4) Development Needs in the Surveyed Villages

According to the result of "Village survey", needs for development in the surveyed villages is the highest in the field of water supply (88% of the villages identified the need for water supply), followed by improvement of infrastructure. Improvement of infrastructure mainly aims at improvement of road condition. Needs in the agricultural field are introduction of farm machines and improved seeds. Needs for construction or extension of health centers/hospitals and schools are also high (see also Figure 3-12)

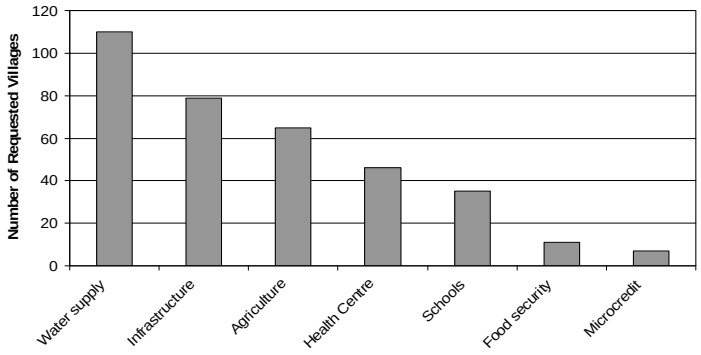


Figure 3-12 Needs for Development in the Surveyed Villages

3.3 Political, Legal and Organizational Frameworks

3.3.1 Policy and Legal Frameworks

The key policy and the legal frameworks in the field of water and environment sector are summarized in the Table 3-5.

Table 3-5 Key Policies and Legal Framework

Category	Name	Contents
Legal Framework	(1) The Constitution, 1995	The Constitution includes basic policy statements related to the water sector. It stipulates the fallowing objectives. ・The state shall ensure that all Ugandans have right to access to clean and sage water. ・The state shall take measures to promote a good water management system at all levels. ・The state shall promote sustainable development and public awareness of the need to manage water resources.
	(2) Local Government Act, 2000	It provides for the system of local governance. And it has defined roles for different levels of governance in the management of water related services and activities.
	(3) Water Act, 1995	It provides the framework for the use, protection and management of water resources and supply. And it provides for constitution of water and sewerage authorities and facilities the devolution of water supply and sewerage under takings. The objectives are: (i) to promote the rational management and use of waters, (ii) to allow for the orderly development and use of water resources, (iii) to control pollution. The detailed provisions regarding acquisition of permits for water use are contained in "The Water Resources Regulations, 1998." As regards industrial and other activities that would result in the generation of effluent and waste water, the provisions for waste water discharge permits and related matters are contained in "The Waste Discharge Regulations, 1998." In the event that the developer seeks to construct a private sewer or establish a sewerage works, the provisions of "The Sewerage Regulations, 1999" should be taken into account. And also regarding water supply facilities, the provisions of "The Water Supply Regulations, 1999" should be followed.
	(4) The National Water & Sewerage Corporation Act, 2000	It provides for a corporation that operate and provide water and sewerage services in areas entrusted to it under the water Act, 1995. The main objectives are; (i) to manage the water resources in ways which are most beneficial to the people. (ii) to provide water supply services for domestic, industrial and environmental uses. (iii) to provide sewerage services where it may be appointed to do so under the water Act, 1995. (iv) to develop the water and sewerage system in urban centers and big national institutions throughout the Country.
	(5) National Environment Act	It provides tools for environmental management that had not been deployed, including EIAs. The Act imposes a duty on a project developer to have an environmental impact assessment (EIA) conducted before planning a project. EIA should be conducted based on the Act and "The Environment Impact Assessment Regulations, 1998." The provisions of "The National Environment (Standards for the Discharge of Effluent into Water or on Land) Regulations, 1999" require that prescribed standards. be met prior to discharge of any effluent into the environment to ensure sustainable development, similarly, provision is made in "The National Environment (Waste Management) Regulations, 1999" for management of all waste in an environmentally sound manner.
	(6) Land Act, 1998	The Constitution of the Republic of Uganda, 1995 and Land Act, 1998 set out the various land tenure systems in Uganda. Both Government and private owners of land can set up facilities on land they occupy and own. Any location of a water supply project must respect the proprietary rights of the landowner or occupier as protected by the constitution, 1995 and this Act.
Policy	(1) National Environment Management Policy, 1994	The main objective of this policy is the environmental quality management in harmony with the sustainable economic and social development. The policy clearly states that an environmental impact assessment (EIA) should be conducted for any policy on project that is likely to have adverse impacts on the environment.
	(2) National Water Policy, 1999	The policy states guiding principles with respect to domestic water supply, development of water for agricultural production, water for industrial development and the discharge of effluent from industrial areas.
	(3) National Gender Policy, 1999	On the basis of this policy, the level of women participation in decision-making is guaranteed. An organization has been nationally agreed and is respected. With respect to water, the policy. Recognizes women and children as the main carriers and users of water.
	(4) National Health Policy, 1999	The policy treats the main causes and measures of diseases including malaria, HIV/AIDS, TB and diarrhea. This is to be achieved trough the promotion of personal, household, institutional, community sanitation and hygiene.
	(5) The Water Action Plan, 1995	The plan was prepared through assistance by Danida. Improvements to the water resources management framework arising from the action plan include the creation of policy and legal framework comprising a National Water Policy, 1999 and regulations such as the Water Resources Regulations, The water (waste water) Discharge Regulations, National Water Quality Standards, and Water Supply Regulations.

3.3.2 Organizational Framework

(1) National Level

The institutional framework for the sector comprises a number of institutions that participate directly in the provision of water and sanitation services at the national, district and community levels as indicated in Figure 3-13.

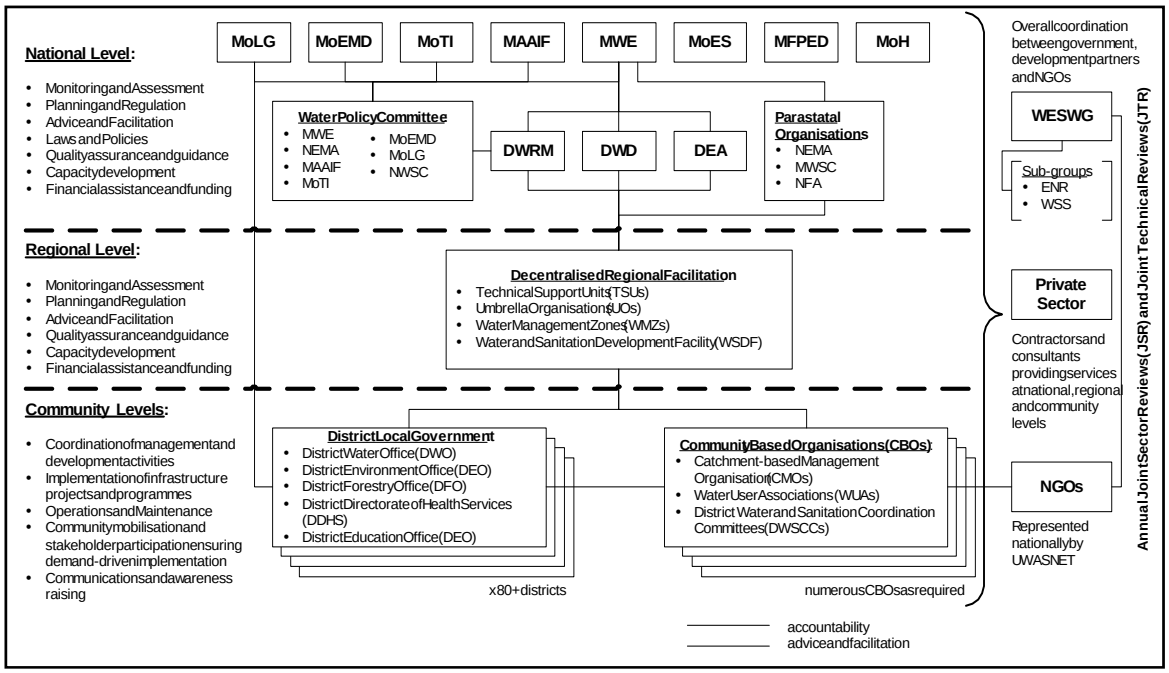


Figure 3-13 Institutional Setting for Water and Environment Sector in Uganda

1) Ministry of Water and Environment (MoWE)

MoWE has the overall mission: "To promote and ensure the rational and sustainable utilization, development and effective management of water and environment resources for socio-economic development of the country". The minstry comprise of three directrates. MoWE has the responsibility for setting national policies and standards, managing and regulating water resources and determining priorities for water development and management. It also monitors and evaluates sector development programs to keep track of their performance, efficiency and effectiveness in service delivery.

i) Directorate of Water Resources Management (DWRM)

DWRM has a mandate "To promote and ensure rational and sustainable utilization, effective management and safeguard of water resources so that there is water of adequate quantity and quality to meet the social welfare and economic development needs of Uganda". The Directorate is responsible for monitoring, assessing, allocating and regulating water resources through the issuance of water abstraction and wastewater discharge permits. It also coordinates Uganda's participation in joint management of trans-boundary waters resources and peaceful cooperation with Nile Basin riparian countries. The DWRM is to provide water ab-

straction permits to the Water Authorities, and waste discharge permits for those towns with sewerage as well as monitoring compliance with the permit conditions. The DWRM does not link with districts directly but is in the process of decentralising the WRM functions to Water Management Zones (WMZs) and catchment level.

ii) Directorate of Water Development (DWD)

DWD is responsible for management of water services and for providing the overall technical oversight for the planning, implementation and supervision of the delivery of urban and rural water and sanitation services including water for production. It also provides capacity development and other support services to Local Governments, Private Operators and other service providers.

DWD fulfils its responsibilities through three departments: Urban Water and Sewerage Department; Rural Water Supply and Sanitation Department and the Water for Production (WfP) Department. The WfP Department is responsible for regulation, quality assurance and monitoring of off-farm activities related to WfP as well as planning and implementation of bulk water/ multi-purpose water infrastructure. The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) is responsible for the on-farm activities related to water for production.

DWD is still to some extent involved in designing, construction and operation and mainte-

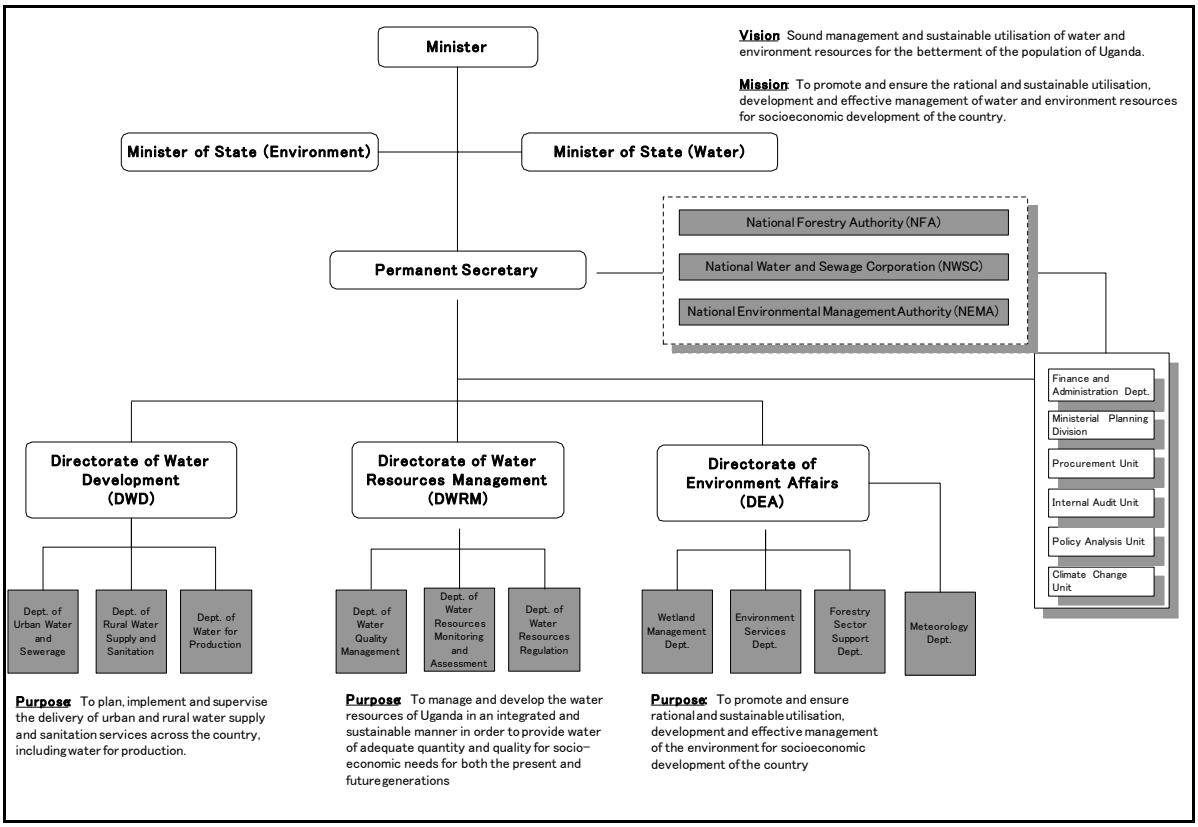


Figure 3-14 Organization of Ministry of Water and Environment

nance of water infrastructure mainly due to lack of capacity at the districts. As capacity is developed in the districts and more flexible mode of infrastructure financing such as the Water and Sanitation Development Facility (WSDF) is becoming operational, DWD will be limited to design, construction and support to operation of major multipurpose multi-district water infrastructure (dams for water supply and WfP, strategic reservoirs and bulk transfer systems); and planning and regulation of urban and rural water services within the overall assessment and planning framework provided by DWRM.

In relation to sanitation, DWD is responsible for planning and investment in sewerage services and public sanitation facilities in towns and Rural Growth Centers (RGCs), as well as technical capacity building and development for sanitation service delivery. NWSC and the local authorities are mandated (by DWD) to manage and support the use of adequate standards for the onsite sanitation and the sewerage systems in urban centers.

iii) Directorate of Environment Affairs (DEA)

DEA is responsible for promoting and ensuring rational and sustainable utilization, development and effective management of the environment for socio – economic development of the country. Of special relevance for the water sector is the Meteorology Department responsible for collecting, analysing and disseminating meteorological data.

iv) National Water and Sewerage Corporation (NWSC:)

NWSC is a parastatal under MoWE that operates and provides water and sewerage services for 22 large urban centres across the country including Kampala.

v) National Environment Management Authority (NEMA)

NEMA is a parastatal under MoWE responsible for management of the environment i. NEMA compliments the efforts of DWRM in ensuring compliance with discharges into public waters and the maintenance of environment flow through limitation of excess abstraction of water.

2) Other Related Ministry

i) Ministry of Health (MoH)

The Environmental Health Division (EHD) of MoH is the lead agency in hygiene and sanitation promotion and is responsible for providing overall policy and technical oversight for planning, implementation, and supervision of hygiene and sanitation promotion in the country. It is also responsible for planning, implementation, management, and monitoring of household hygiene and sanitation improvement through the management of the Public Health Care Conditional Grants (PHCCG).

ii) Ministry of Education and Sports (MoES)

MoES is responsible for hygiene education and provision of sanitation facilities in primary schools. It also promotes hand washing after latrine use in the schools.

iii) Ministry of Local Government (MoLG)

MoLG is responsible for capacity building in local governance and policy supervision of local authorities. MoLG is responsible for establishing, developing and facilitation of management of effective decentralised local government systems. It also oversees the implementation of Local Government Development Plans that also includes water supplies and improvement of hygiene and sanitation in institutions and public places.

iv) Ministry of Gender, Labour and Social Development (MGLSD)

MGLSD responsible for gender responsiveness and community development/mobilization. It assists the sector in gender responsive policy development, and supports districts to build staff capacity to implement sector programs.

v) Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)

MAAIF spearheads agricultural development. This includes the on-farm use and management of water for production (irrigation, animal production and aquaculture).

vi) Ministry of Trade, Tourism and Industries (MoTTI)

MoTTI is responsible for in house water facilities for rural industries, wildlife and recreation with the MoWE/ WfP Department responsible for the bulk water supply infrastructure.

vii) Ministry of Energy and Mineral Development (MoEMD)

MoEMD is responsible for hydropower generation. It plans for the implementation of hydro-power infrastructure in collaboration with DWRM. Its water use is largely non-consumptive.

viii) Ministry of Works and Transport (MoWT)

The Uganda National Roads Authority (UNRA) of MoWT is responsible for policies and regulation of water transport as well as development and maintenance of non-national roads. UNRA is responsible for development and maintenance of national roads, as well as the provision of large passenger water vessels. The latter offers technical advice on specifications, procurement and operation and maintenance of mechanical equipment for maintenance of open waters and water ways. Their functions ensure that water ways remain clear and that no pollution/contamination is occasioned by the vessels.

ix) Ministry of Finance, Planning and Economic Development (MFPED)

MFPED mobilises funds, allocates them to sectors and coordinates development partner inputs. MFPED reviews sector plans as a basis for allocation and release of funds, and reports on compliance with sector and national objectives.

x) Ministry of Foreign Affairs (MoFA)

MoFA plays a lead role in negotiations over international waters, in particular the use of the Nile waters; in development of trans-boundary projects on Lake Victoria and the Nile with neighbouring countries and in development of institutional frameworks for cooperative frameworks for management trans-boundary waters. The MoFA also plays a lead role in the communication and negotiation with international Development Partners in the water sector.

The country has considerable Development Partner support for the development budget. These include ADB, Austria, BADEA, DANIDA, EU, France, Germany, JICA, UNICEF and SIDA.

The NGOs working in the sector are coordinated at the national level through Uganda Water and Sanitation NGO Network (UWASNET) an umbrella organization, which has been largely funded by sector development partners through MoWE.

(2) District Level

Local Governments (Districts, Town Councils, Sub-Counties) are empowered by the Local Governments Act (2000) to provide water services. They receive funding from the center in the form of a conditional grant and can also mobilize additional local resources for water and sanitation programs. Local Governments, in consultation with MoWE appoint and manage private operators for urban piped water schemes that are outside the jurisdiction of NWSC.

(3) Private Sector

Private Sector firms undertake design and construction in the sector under contract to local and central government. Private hand pump mechanics and scheme attendants provide maintenance services to water users in rural and peri-urban areas. Private operators manage piped water services in small towns and rural growth centers.

(4) Community Level

Communities are responsible for demanding, planning, contributing a cash contribution to capital cost, and operating and maintaining rural water supply and sanitation facilities. A water user committee (WUC), which is sometimes referred to as a Water and Sanitation Committee (WSC) should ideally be established at each water point.

(5) Catchment Management Organizations

At the catchment or watershed-level within Uganda, Catchment Management Organizations usually encompass water management and development activities involving two or more Districts. Examples where such management is presently taking place include the Ruizi Catchment Management Organization, the Lake George Basin Organization, and the Lake Albert IWRM Project. Trans-boundary catchments organizations are also evolving for the Kagera River basin (shared with Burundi, Rwanda, Tanzania and Uganda) and the Sio-Malaba-Malakisi River basins (shared between Kenya and Uganda).

(6) Capacity Building and Support Institutions

1) Technical Support Units (TSUs)

The TSUs have focussed on capacitating Districts for their role in the rural sub-sector ,however; their mandate also covers water for production

2) Umbrella Organisations (UOs)

Umbrella Organisations (UOs) are regional organisations constituted as associations of the local Water Supply and Sanitation Boards (WSSBs) with the principal objective of providing Operation and Maintenance (O&M) back-up support. The organisations provide training, technical, legal and organisational support to their member boards, including specific services such as the supervision of rehabilitation and extension works and water quality monitoring.

3) Water and Sanitation Development Facility (WSDF)

The Water and Sanitation Development Facility (WSDF) is a mechanism for supporting water supply and sanitation facilities for rural growth centres, small towns and large gravity flow schemes intended to promote a demand responsive approach where Water Authorities/Town Councils or Town Boards apply for funding. The successful applicant Water Authorities are assisted by the WSDF to develop piped water supply systems.

4) Water Management Zone (WMZ)

As one of decentralization on water resources management, WMZ is planned. The purposes are; (i) the separation of regulatory functions from service provision; (ii) raising the profile of the government department responsible for Water Resources Management and attaching greater importance to this subsector; changing from centralized to catchment-based water resources management; (iii) using hydrological boundaries as opposed to political/administrative boundaries for catchment delineation; further consolidation of IWRM (Integrated Water Resources Management) approaches; (iv) integrating transboundary concerns in national planning; and (v) increasing cross-sectoral coordination.

5) Organization for Sector Coordination

The legal and institutional frameworks provide for organs that coordinate the activities of the sector. These are the Water Policy Committee (WPC), Water and Environment Sector Working Group (WESWG) and Annual GoU/Donor Joint Sector Reviews (JSR).

6) Water Policy Committee (WPC)

The WPC advises on water policy, standards for service delivery, and priorities for water resources management. The WPC also advises on revisions to legislation and regulations for water resources and also coordinates formulation of international water resources policy. The membership includes government ministries, and representatives from district local governments, private sector and NGOs.

7) Water and Environment Sector Working Group (WESWG)

WESWG is made up of representatives from MoWE, NWSC, MoH, MoES, MoLG, MFPED, Development Partners, NGOs (represented by UWASNET) and Local Governments represented by the Uganda Local Governments Association (ULGA).

8) Annual GoU/Donor Joint Sector Reviews (JSR)

Annual GoU/Donor Joint Sector Reviews (JSR) are held and have the following objectives: i) Progress and performance of the sector is assessed in relation to 10 key sector performance golden indicators, ii) Agreement is reached on key strategic policy issues, and iii) Guidance is provided for resource allocation and use with particular emphasis on accountability and transparency.

9) District Water and Sanitation Coordination Committees (DWSCCs)

DWSCCs have been established in the districts. The DWSCC membership consists of administrative and political leaders, technocrats and NGO/ CBO representatives at district level. The role of the DWSCC is to oversee the implementation of WSS programmes, strengthen collaboration and coordination with other sectors (health, education, social development and agriculture) and other players (private sector, NGO and CBOs and civil society).

3.4 Present Situation of Water and Sanitation

3.4.1 General

The Government of Uganda has undertaken to reform the water and environmental sector since 1998. Reform studies for the water sector were conducted 1998 to 2005 in the four sub-sectors: i) Urban Water Supply, ii) Rural Water and Sanitation, iii) Water for Production and iv) Water Resources Management. In 2005, a first sector investment plan for the water and sanitation sector was prepared covering all the sub-sectors

Since 2005, it has become apparent that the strategies and investment plans needed to be reviewed in order to harmonize them to minimize duplication and contradictions and to bring on board emerging issues: i) population growth, ii) internal movements of people, iii) creation of new districts and town boards, iv) increased incidences of climatic variability, v) the impact of water resources management on the economy, and vi) the operationalization of the Integrated Water Resources Management (IWRM) strategies.

In July 2008, the government started the review of the investment plan with the overall objective to consolidate the Sector Investment Plan for more efficient achievement of the sector targets and goals. The updated Sector Investment Plan is based on the targets and objectives of "Poverty Eradication Action Plan" (PEAP) and the Vision 2035 targets by providing investment estimates with target setting in the year of 2015, 2020 and 2035. The plan also links to the national planning framework with 5-year and 10-year development plans.

3.4.2 Sector Objectives

The mission is to promote and ensure the rational and sustainable utilization, development and effective management of water and environment resources for socio-economic development of Uganda for the purpose of sound management and sustainable utilization of water and environment resources for the betterment of the population in the country. The overall policy objectives of the Government for water resources management, domestic water supply, sanitation and water for production are fully in line with the PEAP:

- To manage and develop the water resources of Uganda in an integrated and sustainable manner, in order to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations with the full participation of all stakeholders;
- To achieve sustainable provision of safe water within easy reach and hygienic sanitation facilities, based on management responsibility and ownership by the users, to 77% of the population in rural areas and 100% of the urban population by the year 2015 with an 80-90% effective use and functionality of facilities; and
- To develop and efficiently use water supply for production (agriculture, irrigation, livestock watering, aquaculture, rural industries, hydropower, tourism).

3.4.3 Present Situation of Water Supply

(1) Drinking Water Supply

In Uganda, the drinking water supply is categorized into the urban and the rural water supplies as follows:

- Urban water supply covers the small towns of which populations are more than 5,000, and large towns such as district capitals.
- Rural water supply covers the villages and towns of which populations are less than 5,000.

1) Urban Water Supply

The urban water supply includes all urban areas, namely: town boards, town councils, municipalities and the city of Kampala. It is divided into large towns and small towns.

i) 23 Large Towns

23 towns gazetted for operation by National Water and Sewerage Corporation (NWSC) inclusive of 30 other satellite urban areas are supplied by these 23 NWSC systems.

ii) 160 small towns

The private operators contracted by water authority of municipalities, town councils and town boards are responsible to supply water.

In the Lake Kyoga Basin, there are the following large-scale piped water supply systems under the operation of NWSC.

All of the above systems take their raw water from surface streams or lakes and ponds available near the service areas. The treated water of the Jinja and the Soroti systems are transmitted to the Iganga and the Kaberamaido towns, respectively, and their system will be extended to Mayuge and Amuria as well in the future according to NWSC as shown in Table 3-6 Large Scale Water Supply Systems in Lake Kyoga Basin.

Table 3-6 Large Scale Water Supply Systems in Lake Kyoga Basin

Area	Water Supplied (m^3/day)	Water Sold (m^3/day)	Total No. of Accounts	Active Accounts (No.)	Inactive Accounts (No.)	Metered Accounts (No.)	Total No. of Kiosks	Length of Water Mains (km)	Length of Sewer Mains (km)	Sewer Connections (No.)
Jinja/Lugazi	4,452	3,349	12,391	10,061	2,330	12,391	17	274.5	0.0	16
Tororo	909	804	3,552	3,226	326	3,533	11	125.9	7.1	16
Mbale	1,221	1,109	6,656	5,704	952	6,656	6	268.6	30.1	36
Soroti	749	499	3,524	2,913	611	3,524	4	108.5	0.0	8
Total	7,331	5,761	26,123	21,904	4,219	26,104	38	778	37	76

Source: Water and Sanitation Sector Performance Report (Sep. 2008)

As for the systems for small towns, the following systems are in operation in the Basin. As shown in Table 3-7, the total supplied water reaches 889,828m^3/year in the Basin. Out of this total, 542,932m^3/year equivalent to about 61% of surface water is used for water supply for them and the groundwater is used for the remaining 39%.

The total surface water volume used for the urban water supply consisting of large and small towns is 3,218,747 m^3/ year, while that of groundwater is 346,896 m^3/ year. Approximately 90 % of the urban water supply takes their water from surface water resources such as rivers, streams and lakes in the Basin.

Figure 3-15 Water Supply System of Large Town

2) Rural Water Supply

The rural water supply covers the rural communities of which population is less than 500 and the rural growth centers (RGCs) having population from 500 to 5,000. The district headquarter of which population is less than 5,000 is to be treated as a small town, and the piped urban water

Table 3-7 Water Supply Systems for Small Towns in Lake Kyoga Basin (2007 - 2008)

District	Small Town	Water Source	Water Supplied (m^3/y)	Water Sold (m^3/y)	Total Connection	Active Connection
Kayunga	Kangulumira	Groundwater	18,618	17,052	288	282
	Kayuhnga	Sezibwa River	37,036	22,164	677	571
Mukono	Nkoikonjeru	Groundwater	13,174	7,387	250	-
Nakasongola	Nakasongola	Lake Kyoga	17,661	15,835	270	236
Budaka	Budaka	Groundwater	16,008	9,625	246	143
Bugiri	Bugiri	Groundwater	26,973	23,829	671	579
Bukedea	Kachumbala	Groundwater	1,304	1,216	81	-
Busia	Busia	Groundwater	187,453	141,711	723	611
Butalejja	Busolwe	Groundwater	17,209	14,681	254	-
Iganga	Busembatya	Groundwater	44,026	39,392	236	225
Jinja	Buwenge	Groundwater	38,560	30,413	653	603
Kaliro	Kaliro	Groundwater	20,573	18,884	345	260
Kamuli	Kamuli	Groundwater	56,484	46,530	936	825
Kapchorwa	Kapchorwa	Tim Tim River	145,521	41,954	425	386
Katakuwi	Katakwe	Groundwater	18,641	16,993	158	146
Kumi	Kumi	Groundwater	19,658	17,684	318	219
	Ngora	Agu River	56,599	33,920	182	139
Manafuwa	Lwakhakha	Sovro River	20,336	14,154	338	306
Palisa	Pallisa	Lake Lemwa	25,596	17,235	522	-
Sironko	Budadiri	Gibala River	38,238	13,094	507	414
	Sironko	Sironko River	5,909	5,615	424	394
Soroti	Serere	Groundwater	7,457	4,876	58	55
Dokolo	Dokolo	Groundwater	22,937	17,949	81	-
Kotido	Kotido	Groundwater	33,857	27,044	126	94
Total			889,828	600,237	8,769	-
Sub-total for Groundwater:			346,896			
Sub-total for Surface Water:			542,932			

Source: Water and Sanitation Sector Performance Report (Sep. 2008)

supply systems are provided for such towns. According to "Long-term Strategy for Investment Planning, Implementation and Operation & Management of Water Supply and Sanitation in Rural Growth Centers, 2005", piped water systems are recommended for the RGCs of which population is more than 1,500, but such pipe systems are simple without treatment facilities.

The RGC generally consists of a core-trading center and a fringe. Most of the RGCs have settlements around the commercial or core zone, which tends to be densely populated. The main income sources of residents in RGC are trade followed by peasant farming. The few agro-based industries may exist there. Some institutions such as schools, health and administrative centers also exist. These institutions are commonly located away from the commercial zones and add prominence to RGCs in terms of boosting overall population and the water demand.

The RGCs are centers in rapid transition from villages to small towns. The social settings and decision-making systems in the rural areas are breaking up, and new and more urban structures are created. The population in the RGCs is more complex and less stable than in the rural hinterland, which makes the RGCs more subject to rapid and major changes.

i) Water Sources for Drinking Water Supply

The types of water sources i.e. spring, groundwater, surface water and rainwater as presented in Table 3-8 are considered for rural water supply in the country.

Table 3-8 Definition of Main Improved Water Supplies

Type of Water Source	Facility	Definition
(1) Spring	Small Spring	Construction of collection box with one spout delivery (1 - 2 liter/s)
	Medium Spring	Construction of collection box with two spouts delivery (2 - 4 liter/s)
	Extra large Spring	Construction of collection box with three spouts delivery (> 4 liter/s)
	Piped Water Supply System (Gravity Flow Scheme)	Protection of the spring, construction of treatment plant, laying of pipes and construction of taps
(2) Groundwater	Shallow Well - Hand Dug	Construction of max 15m depth at 1 - 2 m diameter using hand tools in high water table area, installed with hand pump.
	Shallow Well - Hand Augured	Construction of max 15m depth at 200 mm diameter using a tripod and winch with drill bits and rods in high water table area, installed with hand pump.
	Shallow Well - Motorised Drilled	Construction of max 30m depth at 200 mm diameter using drilling rig in high water table area, installed with hand pump. Can be consolidated or unconsolidated formation.
	Deep Boreholes Drilling (Hand Pump)	Drilling more than 30m depth, abstraction is by a hand pump. Can be consolidated or unconsolidated formation.
	Deep Borehole Drilling (Motorised Pump)	Drilling more than 30m depth, abstraction is by powered motorisation (usually a submersible pump).
	Piped Water Supply System (Borehole Pumped)	Siting and drilling of borehole, laying of pipes and construction of taps
(3) Surface Water	Valley Tanks	Construction of tank with a volume of (maximum of 3,000 m^3)
	Dams	Construction dam
	Piped Water Supply System (Surface Water)	Construction of treatment plant, laying of pipes and construction of taps
(4) Rainwater	Domestic Roof Water Harvesting	Collection of rainwater from household rooftops and storage at the home.

Source: District Implementation Manual March 2007

Spring, ground water, surface streams and rain water are utilized for drinking water supply in Uganda. Most of the water supply system of NWSC takes surface water such as Lake Victoria, etc. and such systems have a system consisting of coagulation, sedimentation, rapid filtering and chlorination. In the rural areas, point water sources are widely applied of which utilizing springs and groundwater with shallow and deep wells and such facilities are managed by the respective communities. The communities of centers of trading and commerce of which population are rather dense are provided with the pipe water schemes consisting of reservoirs, kiosks and simple distribution pipelines. It is recommended by the government to apply the piped water schemes for such RGCs population of which are 1,500 - 5,000 to realize effective water supply as well as to improve the coverage of water supply. Table 3-9 shows water sources ratio of each district.

Table 3-9 Ratio of Water Sources for Each District

(Unit: %)

Districts	Spring	Deep Groundwater	Shallow Grolundwater	Spring/Stream Water	Other Sources Rainwater etc.	Districts	Spring	Deep Groundwater	Shallow Grolundwater	Spring/Stream Water	Other Sources Rainwater etc.
Kayunga	3	68	28	0	0	Katakwi	0	87	12	0	1
Luwero	1	52	44	0	3	Kumi	12	53	28	0	7
Mukono	38	22	18	20	2	Manafwa	21	12	0	65	1
Nakasongola	0	77	9	0	14	Mayuge	14	47	20	20	0
Wakiso	23	29	46	2	1	Mbale	9	11	1	79	0
Amuria	2	86	11	0	1	Namtumba	5	47	45	0	3
Budaka	8	91	1	0	0	Pallisa	9	74	16	0	0
Bududa	25	1	0	74	0	Sironko	11	2	1	85	0
Bugiri	21	48	22	0	9	Soroti	8	66	21	0	5
Bukedea	14	11	14	57	5	Tororo	15	81	3	0	0
Bukewa	8	0	0	91	1	Abim	0	90	10	0	0
Busia	25	62	8	0	5	Amolatar	0	100	0	0	0
Butaleja	1	35	3	61	1	Apac	17	51	20	0	12
Iganga	3	71	24	0	2	Dokolo	15	23	25	36	1
Jinja	27	34	40	0	0	Kaabong	0	85	11	0	4
Kareramaido	7	69	18	0	7	Kotido	0	98	0	0	2
Kaliro	0	96	4	0	0	Lira	19	20	17	43	0
Kamuli	0	71	29	0	0	Moroto	0	55	0	45	0
Kapchorwa	23	1	0	75	1	Nakapiripirit	2	77	5	8	8
Numbers of the districts where the respective water source is the most predominant:							**1**	**25**	**2**	**10**	**0**

Spring, ground water, surface streams and rain water are utilized for drinking water supply in Uganda. Most of the water supply system of NWSC takes surface water such as Lake Victoria, etc. and such systems have a system consisting of coagulation, sedimentation, rapid filtering and chlorination. In the rural areas, point water sources are widely applied of which utilizing springs and groundwater with shallow and deep wells and such facilities are managed by the respective communities. The communities of centers of trading and commerce of which population are rather dense are provided with the pipe water schemes consisting of reservoirs, kiosks and simple distribution pipelines. It is recommended by the government to apply the piped water schemes for such RGCs population of which are 1,500 - 5,000 to realize effective water supply as well as to improve the coverage of water supply.

ii) Type of Water Supply Facility

a) Spring Water Supply Facility

Most of spring water supply facilities are small-scaled and their performance deeply depends on the natural condition of rainy and dry seasons. Some of the facilities are not always safety because no protection fences are installed for animals' intrusion or rainwater pouring into the upper intake of the facilities. However, a large number of piped water supply facilities are provided in the neighborhoods of the Mt. Elgon because of rich yields of such spring resources therein.

b) Groundwater

Water supply facilities include the point water supply system with a hand pump and the piped water supply system with several deep wells in area of comparatively rich groundwater yield and densely-populated area such as RGC.

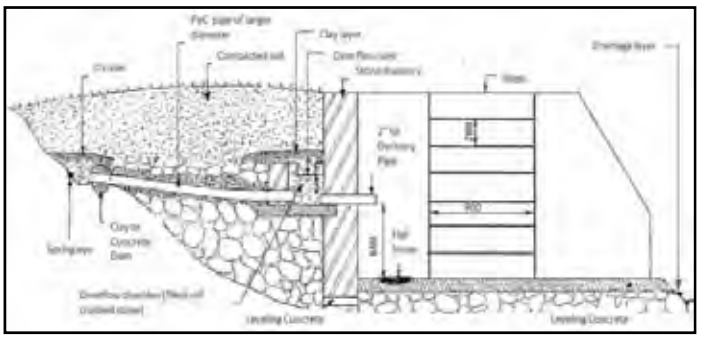


Figure 3-16 Typical Spring Water Supply Facility

Water Supply System with Hand Pump (Point Water Source)

The facilities are furnished with a hand pump, an apron and a soak pit. U2 and U3 type hand pumps, remodeled type of Indian Mark II, are popular and widely utilized in Uganda

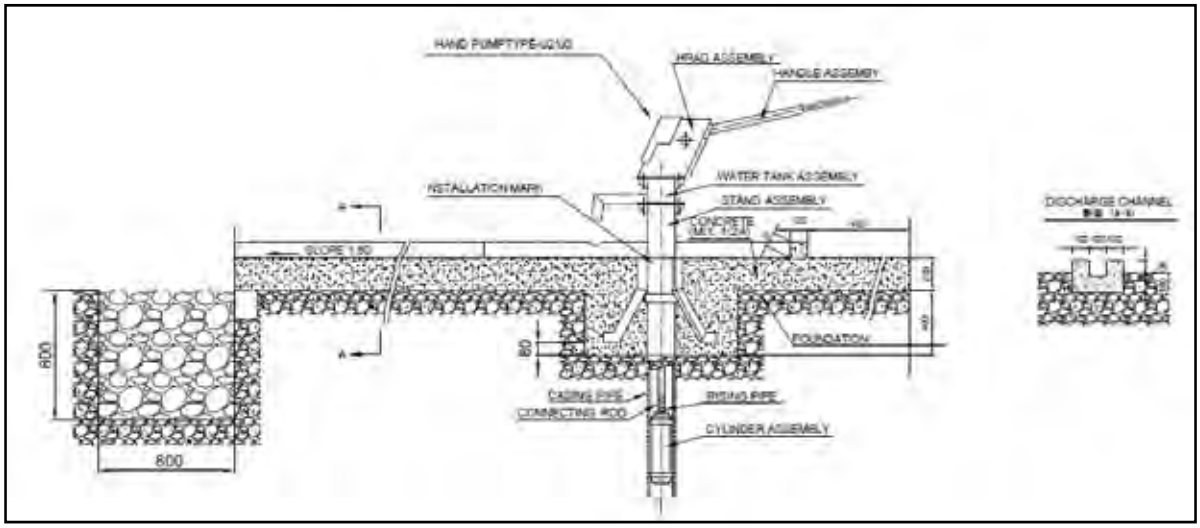


Figure 3-17 Typical Groundwater Supply Facility (Hand Pump)

Piped Water Supply Facility in Rural Area

A typical piped water supply sysen in rural area is shown in Figure 3-18.

<Water Source Facility>

Most of water intakes use submersible motor pumps with protection fence and utilize commercial electricity of 415V, 3-phases.

<Water Conveyance Pipe, Reservoir, Water Distribution Pipe>

Steel elevated tanks are constructed in flat area, in contrast, ground reservoirs are done in comapartively precipitous terrians. The water is ditributed to kiosks and/or yard taps by gravity.

<Yard Taps>

Water service facilities usually apply kiosk type, but some of houses utilize yard taps by which the water is distibuted into the house inside.

c) Rainwater Harvesting Facilities

Small scale facilities of rainwater harvesting are widely applied in the communities because of their low costs requied, but they are considered as the facilities supplementing the other main facilities since rainwater is considered as unstable seasonally.

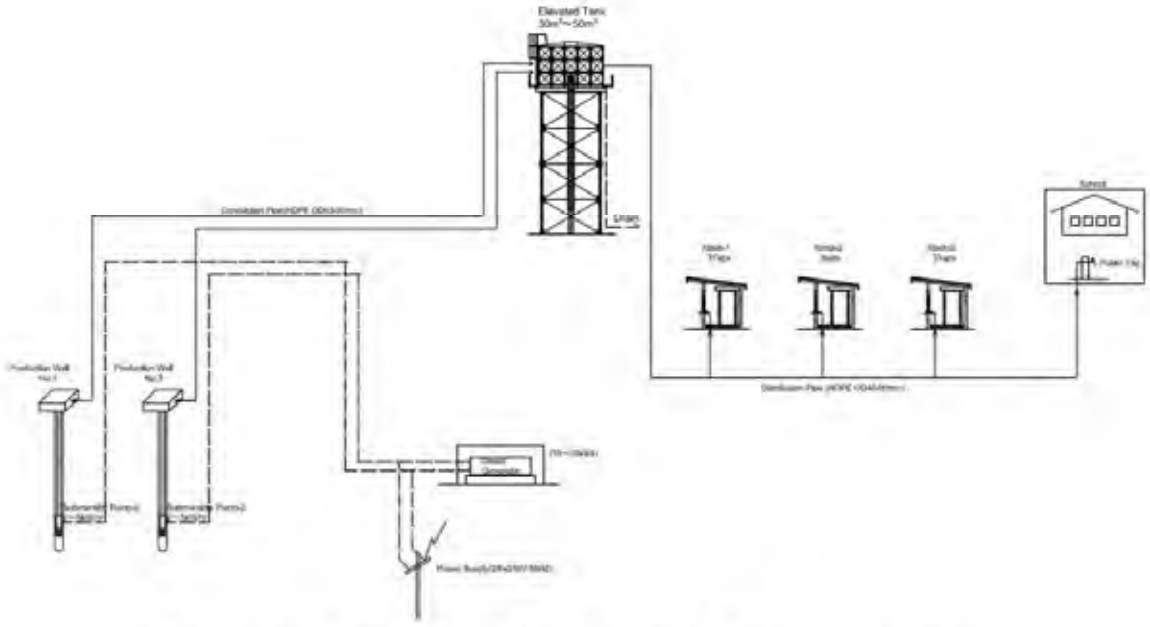


Figure 3-18 Typical Piped Water Supply Facility (Groundwater)

Rainwater collecting facilities are provided for schools utilizing their large roofs. The rainwater collecting facility of the school or health center makes it possible to collect the water of $10m^3$ under 20-30mm rain fall with the roof of $500m^2$.

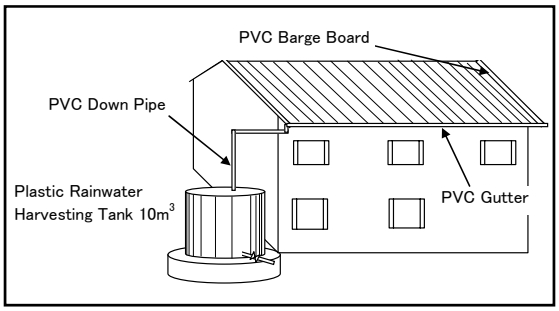


Figure 3-19 Rainwater Harvesting Facility

d) Gravity Flow System (GFS)

In the middle of Mt. Elgon, a large number of piped water facilities are installed, collecting surface and/or spring waters, and distributing them to the villages. The facility allows steady and constant water supply through a year without water pollution influenced by animals and people's activities, but the water does not reach to some areas because the service area has been expanded.

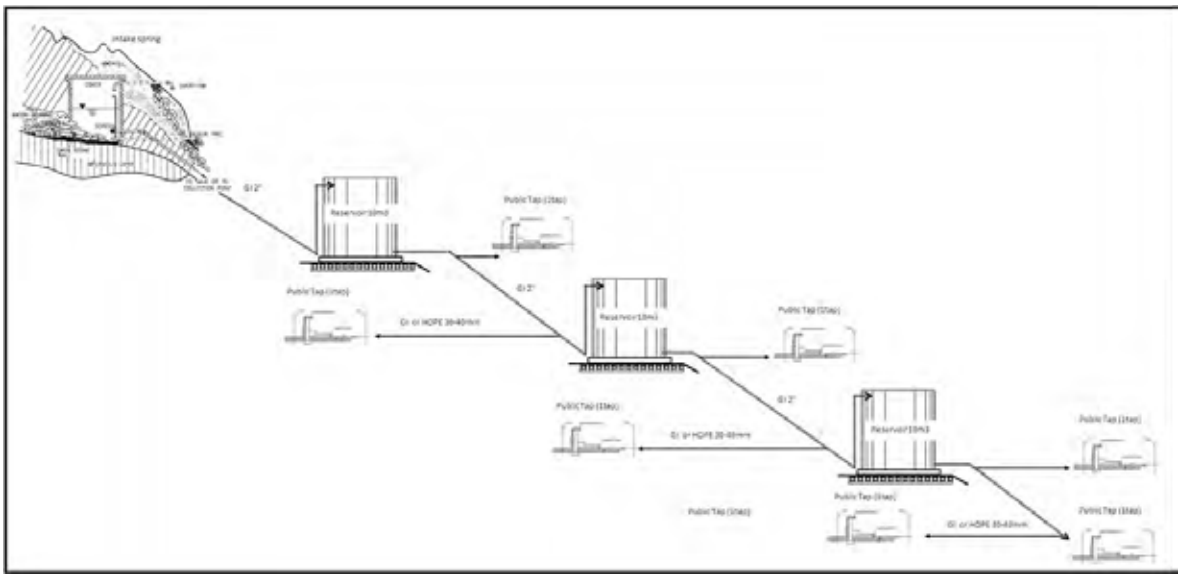


Figure 3-20 Typical Gravity Flow System

3) Coverage and Equity of Access to Safe Water

The present coverage rate of water supply in the related 38 districts to the Basin is shown in Table 3-10. The ratio of urban and rural water supply is high in the central region (uraban: 69%, rural:63%) and low in the northern region (urban: 51%, rural:44%).

Table 3-10 Population Served and Coverage of District

No.	Region	District	Urban Water Supply					Rural Water Supply		
			Town	Category	Targeted Population	Coverage Population	Coverage Rate (%)	Targeted Population	Coverage Population	Coverage Rate (%)
1	Central	Kayunga	Kayunga	Small Town	22,700	22,440	99	306,541	185,706	61
2		Luweero	Luweero	Small Town	28,000	26,600	95	329,683	243,927	74
			Bombo	Small Town	19,900	14,082	71			
			Woblenzi	Small Town	22,400	12,672	57			
			Kikyusa	Town Board	2,679	900	34			
			Busula	Town Board	6,750	2,700	40			
			Zirobwe	Town Board	2,069	1,200	58			
			Bamunanika	Town Board	3,203	600	19			
			Ndejje	Town Board	6,482	1,500	23			
3		Mukuno	Nkonkonjeru	Small Town	13,300	10,872	82	764,775	585,622	77
			Katosi	Town Board	8,856	450	5			
			Buikwe	Town Board	12,969	3,150	24			
			Nakifuma	Town Board	6,256	2,682	43			
			Kasawo	Town Board	7,430	3,900	52			
4		Nakasongola	Nakasongola	Small Town	7,500	7,125	95	135,259	94,771	70
			Migyeera	Town Board	3,735	3,522	94			
5		Wakiso	Wakiso	Small Town	19,400	17,256	89	1,061,167	524,169	49
			Kakiri	Small Town	5,600	5,320	95			
Sub-total/Average			-	-	199,229	136,971	**69**	2,597,425	1,634,195	**63**
6	Eastern	Amuria	Amuria	Small Town	4,600	900	20	257,129	214,442	83
7		Budaka	Budaka	Small Town	20,400	8,184	40	164,062	96,464	59
8		Bududa	Bududa	Small Town	3,800	2,280	60	147,123	113,082	77
9		Bugiri	Bugiri	Small Town	23,500	21,864	93	518,023	173,606	34
			Nankoma	Town Board	6,435	1,344	21			
10		Bukedea	Bukedea	Small Town	33,500	2,418	7	156,775	127,250	81
			Katumbala	Town Board	3,136	3,004	95			
11		Bukwa	Bukwa	Small Town	4,400	1,068	24	62,324	34,342	55
12		Busia	Busia	Small Town	44,300	23,679	53	220,016	152,617	69
13		Butaleja	Butaleja	Small Town	7,900	1,200	15	183,939	110,298	60
			Busolwe	Small Town	7,900	5,988	76			
14		Iganga	Busenbatia	Small Town	14,600	8,023	55	602,843	350,917	58
			Namungalwe	Town Board	7,048	450	6			
			Idudi	Town Board	8,169	600	7			
			Kiyunga	Town Board	7,249	750	10			
15		Jinja	Jinja	Large Town	260,600	199,883	77	348,571	236,027	68
			Buwenge	Small Town	17,200	15,689	91			
16		Kaliro	Kaliro	Small Town	12,700	9,468	75	185,912	106,500	57
			Nakaikoke	Town Board	4,644	450	10			
			Namwiwa	Town Board	3,635	900	25			
			Bulumba	Town Board	4,128	450	11			
17		Kapchorwa	Kapchorwa	Small Town	11,700	11,115	95	168,938	110,259	65
18		Kamuli	Kamuli	Small Town	14,200	13,490	95	650,676	367,100	56
			Kasambira	Town Board	8,962	2,160	24			
19		Kaberamaido	Kaberamaido	-	-	-	-	163,677	149,916	92
20		Kumi	Kumi	Small Town	11,900	11,496	97	330,913	174,900	53
			Ngora	Town Board	31,419	5,094	16			
21		Katawaki	Katawaki	Small Town	7,700	7,128	93	161,423	114,421	
22		Mayuge	Mayuge	Small Town	11,100	1,950	18	379,788	144,850	38
23		Mbale	Mbale	Large Town	86,200	61,542	71	312,454	161,400	52
24		Manafwa	Manafwa	Small Town	14,800	3,180	21	313,799	128,669	41
			Lwakhakha	Small Town	10,000	9,500	95			
			Tsakhana	Town Board	3,116	300	10			
			Buwangani	Town Board	2,578	300	12			
			Bugobero	Town Board	3,259	450	14			
			Magale	Town Board	6,382	900	14			
			Bukhaweka	Town Board	2,066	300	15			
			Masaaka	Town Board	1,031	300	29			
			Butiru	Town Board	3,112	1,200	39			
			Bumbo	Town Board	6,042	1,050	17			
25		Namutumba	Namutumba	Small Town	10,000	2,658	27	201,567	161,562	80
26		Pallisa	Pallisa	Small Town	30,000	14,652	49	433,264	222,800	51
			Kibuku	Town Board	6,219	1,500	24			
			Tirinyi	Town Board	6,586	2,100	32			
			Kabwangasi	Town Board	2,500	450	18			
27		Soroti	Soroti	Large Town	62,400	28,915	46	433,264	222,800	51
			Serere	Town Board	3,784	2,442	65			
28		Sironko	Sironko	Small Town	13,300	12,635	95	313,933	221,838	71
			Buyaga	Town Board	3,077	750	24			
			Muyembe	Town Board	5,577	2,676	48			
			Budadiri	Town Board	16,396	14,220	87			
			Bulegeni	Town Board	1,025	1,002	98			
29		Tororo	Tororo	Large Town	50,300	37,775	75	402,463	249,374	62
			Nagongera	Small Town	11,200	8,484	76			
			Merikit	Town Board	2,056	-	-			
			Magodesi/Molo	Town Board	1,643	600	37			
Sub-total/Average			-	-	961,474	570,906	**59**	7,119,492	4,269,296	**60**
30	Northern	Amolator	Amolator	Small Town	14,000	1,836	13	116,958	60,300	52
31		Abim	Abim	Small Town	15,700	750	5	91,646	29,000	32
32		Apac	Apac	Small Town	12,900	750	6	495,826	293,060	59
			Aduku	Town Board	10,746	7,086	66			
33		Dokolo	Dokolo	Small Town	16,702	6,708	40	157,322	129,841	83
34		Kotido	Kotido	Small Town	20,300	7,302	36	243,319	70,503	29
35		Lira	Lira	Large Town	102,200	81,229	79	528,666	324,000	61
36		Moroto	Moroto	Small Town	11,000	10,450	95	254,825	129,200	51
			Matany	Town Board	7,662	1,050	14			
			Kangole	Town Board	10,182	2,700	27			
37		Nakapiripirit	Nakapiripirit	Small Town	2,400	1,140	48	214,591	89,647	42
38		Kaabong	Kaabong	Small Town	20,900	2,700	13	610,382	70,824	12
Sub-total/Average			-	-	244,692	123,701	**51**	2,713,535	1,196,375	**44**
Total/Average			-	-	1,405,395	831,578	**59**	12,430,452	7,099,866	**57**

Source:Water and Environment Sector Performance Report 2009

In the case of rural water supply, the increased coverage rate of safe water supply to rural communities is directly affected by the distribution of the water points. Equity is concerned with fair distribution of improved water facilities to communities. An indicator of equity in access to safe water is defined as the mean sub-county deviation form the district average in persons per water point as shown in Figure 3-21. In the Basin, the indicator values of the Bugiri and the Kaabong districts are found to be very high in comparison with other districts.

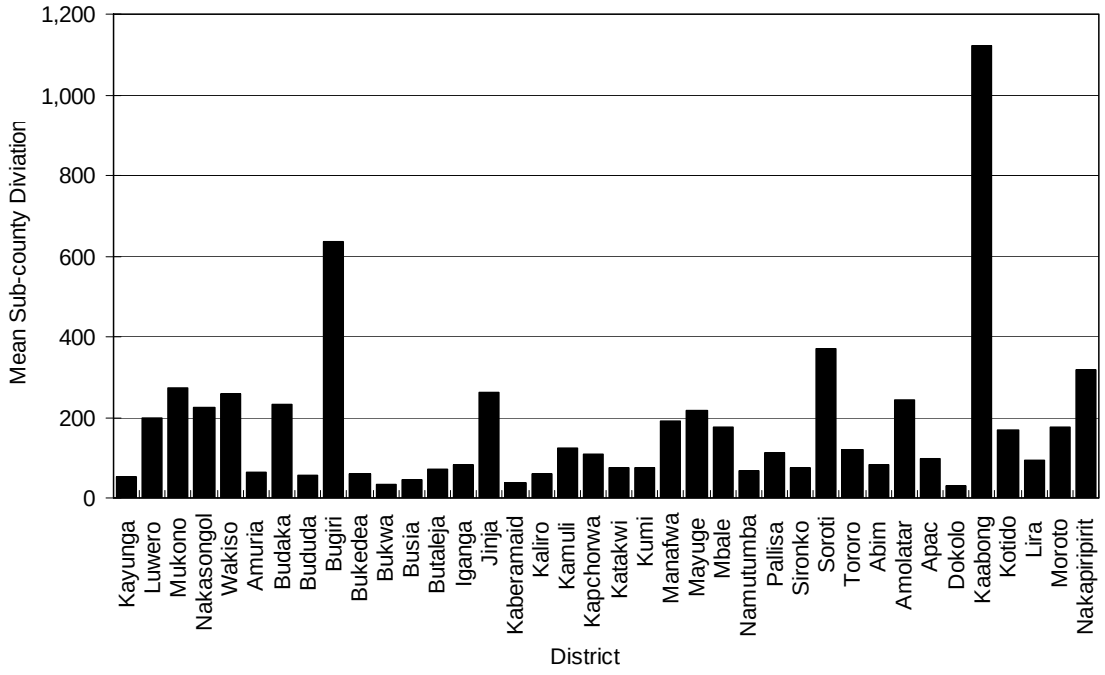


Figure 3-21 Equity of Access to Safe Water for Each District

4) Functionality

The water supply facilities for the village level communities are operated and maintained by the water user's groups formed in each beneficial community based on the community-based management (CBM), while the facilities in urban areas are operated and maintained by NWSC and/or private operators.

Table 3-11 presents such number of the functional and the non-functional facilities for deep and shallow wells in each district of the Basin. The functionality defined as the ratio in % of functional facilities to the whole number of facilities is also calculated in the table for each district. The functionalities of deep and shallow wells are calculated to be 85 % and 82 %, respectively, for the entire basin, varying from 61 % to 98 % for deep wells and from 33 % to 100 % for shallow wells.

In Uganda, the functionality is considered as one of the important factor to indicate the extent in each district mobilization of community, the decrease of the functionality is considered as one of the issue in the rural water supply sub-sector providing the high priority of budget allocation to the rehabilitation of such non-functional facilities.

Table 3-11 Functionality of Deep Borehole and Shallow Well

Districts	Deep Boreholes		Func-tion-ality	Shallow Wells		Func-tion-ality	Districts	Deep Boreholes		Func-tion-ality	Shallow Wells		Func-tion-ality
	F*	NF*	(%)	F*	NF*	(%)		F*	NF*	(%)	F*	NF*	(%)
Central							Kumi	309	39	89	285	121	70
Kayunga	364	35	91	151	33	82	Manafwa	128	5	96	5	0	100
Luwero	429	45	91	363	0	100	Mayuge	257	14	95	109	19	85
Mukono	538	72	88	463	88	84	Mbale	209	47	82	20	0	100
Nakasongola	203	61	77	34	18	65	Namutumba	248	14	95	239	23	91
Wakiso	287	7	98	868	63	93	Pallisa	498	46	92	110	24	82
Sub-total	1,821	220	89	1,879	202	90	Sironko	74	11	87	36	10	78
Eastern							Soroti	712	73	91	244	69	78
Amuria	423	91	82	55	114	33	Tororo	567	30	95	32	6	84
Budaka	205	18	92	6	5	55	Sub-total	7,300	817	90	2,475	635	80
Bududa	7	2	78	1	0	100	Northern						
Bugiril	251	38	87	118	32	79	Abim	52	29	64	6	9	40
Bukedea	80	40	67	100	18	85	Amolatar	156	33	83	-	-	-
Bukwa	-	-	-	-	-	-	Apac	455	117	80	182	70	72
Busia	309	35	90	41	0	100	Dokolo	105	25	81	140	61	70
Butaleja	276	26	91	22	2	92	Kaabong	186	25	88	25	0	100
Iganga	769	60	93	261	46	85	Kotido	166	65	72	-	-	-
Jinja	283	13	96	337	20	94	Lira	282	105	73	240	77	76
Kaberamaido	304	82	79	82	43	66	Moroto	254	156	62	-	-	-
Kaliro	313	26	92	13	3	81	Nakapiripirit	142	115	55	11	13	46
Kamuli	787	61	93	321	52	86	Sub-total	1,798	670	73	604	230	72
Kapchorwa	14	9	61	-	-	-	Total	10,919	1,707	86	4,958	1,067	82
Katakwi	277	37	88	38	28	58							

Source: Strategic Investment Plan for the Water and Sanitation Sector, 2009

Note: F: Functional, NF: Not Functional

(2) Water for Production

1) Irrigation Water Supply

Since the total areas of related 38 districts to the Basin are approximately 100,000km^2, their total

Table 3-12 Cultivated Lands in Lake Kyoga Basin

Region /District	Commercial Farmlands	Cultivated Land	Region /District	Commercial Farmlands	Cultivated Land
CENTRAL			EASTERN		
Kayunga	3.3	890.1	Bugiri	11.8	1,157.40
Luweero	3.9	2,392.90	Busia	1.6	561.2
Mukono	151.4	1,795.60	Iganga	0.9	2,209.50
Nakasongola	0.7	958.2	Jinja	81.9	505.6
Wakiso	24	1,256.20	Kaberamaido	-	947.4
Sub-total	183.3	7293	Kamuli	2.4	2,613.70
NORTHERN			Kapchorwa	5.4	611.5
Apac	12.6	4,527.20	Katakwi	-	2,300.10
Kotido	-	2,276.30	Kumi	3.7	1,704.90
Lira	6.1	4,800.50	Mayuge	6.6	743.6
Moroto	-	1,344.30	Mbale	-	1,076.40
Nakapiripirit	0.8	738.2	Pallisa	2.1	1,463.00
Sub-total	31.3	36,320.10	Sironko	2.3	592.5
			Soroti	4.3	1,831.60
			Tororo	36.9	1,513.10
			Sub-total	159.9	19831.5
			Total	50.8	50,006.60

Note: Figures are based on projections. Actual vegetation studies were undertaken in 1994 based on 1992 satellite imagery and the districts are as of 1995.

Source: National Forestry Authority, Ministry of Water, Lands and Environment.

cultivated lands including commercial farmlands which amount for 50,006 km^2 as shown in Table 3-12 almost half of them.

Essential annual crops are cereals, legumes, tubers and other oil-seeds, etc., and these crops are more or less grown in the cultivated lands widely in the Basin. Most of these crops are grown under rainfed cultivation. Paddy cultivation is recently appreciated as one of the cash crops, and its cultivated lands are increasing mainly in low-laying wet lands. Irrigation of such paddy lands is also made by the farmers for supplemental purpose, and the irrigated water volume is considered quite less. Most of the schemes are small except for the following ones.

- Kibimba Rice Scheme: Irrigation command area is 600 ha taking irrigation water from the Kibimba river. The scheme is operated on commercial basis for double cropping of paddy. Irrigation facilities are provided from intake to lateral canals, and a certain level of water management is conducted.
- Doho Rice Scheme: Irrigation command area is 1,000 ha taking irrigation water from the Manafwa river. The scheme is operated and managed by the committee formed of the owners of lands in the scheme, but the water management is not able to carry out properly since the facilities were constructed under the Chinese assistance about 30 year ago and many parts of the facilities are damaged. The double cropping of paddy is carried out in the scheme and its yield is about 4.0 t/ha.
- Lwoba Rice Scheme: Irrigation command area is about 400 ha taking irrigation water from the Manafwa river. About 1,350 farmers are cultivating paddy fields in the area.

In Uganda the arable land areas are defined dividing them into the following two (2) categories according to the irrigation potentials expected.

- Area A of which soil condition is considered favourable and situated close to the main water sources.

Area B of which irrigation potential is defined as the arable land that could be irrigated provided

Table 3-13 Potential Areas for Irrigation in Lake Kyoga Basin

Sub-basin	Area A (ha)	Area B (ha)	Total (ha)
(1) Okok	4,626	14,187	18,813
(2) Okere	11,744	13,863	25,607
(3) Awoja	26,192	139,847	166,039
(4) Lwere	9,778	11,480	21,258
(5) Akweng	9,714	5,574	15,288
(6) Abalan	17,876	9,777	27,653
(7) Kyoga	23,210	44,672	67,882
(8) Mpologoma	59,091	309,774	368,865
(9) Lumbuye	5,376	65,097	70,472
(10) Victoria Nile	8,735	107,064	115,799
(11) Sezibwa	9,519	74,971	84,490
Total	185,859	796,307	982,166

Data Source: National Forestry Authority, Ministry of Water, Lands and Environment.

bulk water supplies including water storage in the dry season would be available.

The estimated areas of the above categories are summarized for each sub-basin as shown in Table 3-14.

Table 3-14 Irrigation Water Requirements for Doho and Lwoba Schemes

Month	Water Req. (m^3/s)	
	Doho	Lwoba
January	2.08	0.88
February	1.25	0.52
March	0.00	0.00
April	2.44	1.02
May	0.73	0.31
June	1.39	0.59
July	1.33	0.56
August	0.66	0.28
September	0.00	0.00
October	2.61	1.09
November	1.75	0.73
December	1.81	0.76
計	16.05	6.74
	506.2 mcm/y	212.6 mcm/y

(mcm/y:Million Cube Meter/year)

The command areas of the Doho and the Lwoba schemes extend along the same Manafwa river, and both schemes are in conflict each other of the use of river water especially during the dry season from January to April when the water flow of the Manafwa river decreases. This river is one of the water sources of the NWSC water supply system for Mbale town. Its use for town water supply and at least 1.2 m^3/s of the maintenance flow for downstream ecological requirements has to be assured. It is proposed to construct a storage facility of 7,000,000m^3 capacity to realize the irrigation for both schemes throughout a year. The irrigation water requirements of both schemes are summarized in Table 3-14 Irrigation Water Requirements for Doho and Lwoba Schemes.

2) Livestock

In the Lake Kyoga Basin, the livestock animals shown in Table 3-15 are fed, and indigenous (local) cattle, goats and sheep are considered as the predominant animals. The districts are categorized into Cattle Corridor (CC) and non-CC districts according to the economic importance of livestock in the districts. In CC districts the livestock water facilities are considered important to feed their animals especially in the dry season.

According to "Design Standards for Rural Water Supply System" (EWRA: Ethiopian Water Resources Authority (1976), livestock needs 20 to 30 l/ TLU/day. TLU: Tropical Livestock Units are considered to estimate the carrying capacity (the number of cattle to be fed in the available lands). One (1) TLU is equivalent to one (1) exotic crossbreed cattle, 0.7 indigenous cattle, 0.15 goats or sheep, or 0.4 pigs in Uganda. When a unit water demand per one TLU is 25 l, total present water demand of livestock becomes 29.0 MCM/year.

There are many small earth dams and valley tanks mainly for livestock and domestic use in Lake Kyoga Basin. At present, most of existing facilities have largely decreased their original capacities by silting, and some of small earth dams has not been functioned by silting or dike break. They have not only water supply function but also flood control function.

Table 3-15 Number of Livestock in Kyoga Basin

District	Exotic Crossbreed Cattle (no.)	Indigenous Cattle (no.)	Goats (no.)	Sheep (no.)	Pigs (no.)	Poultry (no.)
Abim	5,205	247,088	209,825	202,088	2,869	108,504
Amolatar	664	27,427	63,202	6,362	2,616	159,785
Amuria	255	40,121	52,988	14,072	7,281	132,179
Apac	885	36,570	84,269	8,482	3,488	213,046
Budaka	704	24,408	25,739	3,290	1,891	104,690
Bududa	3,304	23,731	21,391	1,548	4,973	142,943
Bugiri	662	14,751	23,771	1,486	1,637	113,834
Bukedea	525	68,691	66,506	6,344	14,486	185,238
Bukwa	2,035	12,439	9,737	991	638	36,920
Busia	2,031	31,659	22,993	1,408	2,637	67,134
Butaleja	485	34,709	29,440	3,860	5,370	164,591
Dokolo	1,250	31,582	67,045	6,430	3,454	159,932
Iganga	1,817	36,686	36,849	1,924	4,059	213,025
Jinja	6,730	15,458	27,339	762	5,678	247,353
Kaabong	5,205	247,088	209,825	202,088	2,869	108,504
Kaberamaido	498	23,864	47,734	12,595	6,911	102,186
Kaliro	1,817	36,686	36,849	1,924	4,059	213,025
Kampala	27,558	20,864	10,293	1,561	4,761	390,771
Kamuli	7,959	204,036	166,048	6,005	19,122	807,883
Kapchorwa	4,747	29,023	22,721	2,313	1,488	86,148
Katakwi	255	40,121	52,988	14,072	7,281	132,179
Kayunga	4,405	46,755	30,861	2,729	6,779	120,624
Kotido	6,940	329,451	279,767	269,451	3,825	144,672
Kumi	525	68,691	66,506	6,344	14,486	185,238
Lira	2,916	73,690	156,438	15,004	8,060	373,175
Luweero	11,731	195,039	31,125	7,215	18,374	199,972
Manafwa	3,304	23,731	21,391	1,548	4,973	142,943
Mayuge	2,730	15,155	25,466	899	1,508	106,628
Mbale	4,405	31,641	28,522	2,064	6,630	190,591
Moroto	13,326	289,337	190,374	211,886	1,494	33,543
Mukono	18,947	53,666	59,598	6,553	31,473	516,314
Nakapipirit	2,817	326,468	178,473	108,421	978	56,289
Nakasongola	12,818	179,684	34,604	4,601	9,472	134,969
Namutumba	662	14,751	23,771	1,486	1,637	113,834
Pallisa	939	32,544	34,319	4,387	2,522	139,586
Sironko	8,154	42,295	30,625	3,932	6,381	205,561
Soroti	1,545	87,087	114,299	17,241	13,170	262,800
Tororo	1,133	80,987	68,692	9,008	12,530	384,046
Wakiso	41,535	32,679	26,320	4,887	41,282	721,122
Sub-total	213,423	3,170,653	2,688,703	1,177,261	293,142	7,921,777
Sub-total of TLU	213,423	2,219,457	403,305	176,589	117,257	47,531
Total TLU	3,177,562					

Note: The shaded districts are those considered as Cattle Corridor.

Source: DWD

3) Fishery

The fishery is also considered one of the important activities requiring the water resources in the Basin. As shown in the Table 3-16, there are many fish ponds of which total surface area is measured to be 2,480,523m^2. Main fish products are catfish, carp, Nile parch and prawns and total production of such fishes is calculated to be 3,281ton in the Basin.

Table 3-16 Fish Pond and Production in Lake Kyoga Basin

Sub-basin	Area of Ponds (m^2)	Talapia (t)	Catfish (t)	Carp (t)	Nile Perch (t)	Prawns (t)	Total Production (t)
(1) Okok	16,704	10.9	14.3	0	0	0	25.1
(2) Okere	65,490	20.1	30.2	0.2	0	0	50.5
(3) Awoja	160,488	72.9	118.3	7.3	0	0	198.5
(4) Lwere	51,271	27.9	59.1	1.4	0	0	88.3
(5) Akweng	161,651	67.6	81.9	2.8	0	0	152.3
(6) Abalan	111,833	124.5	158.5	0.8	0	0	283.8
(7) Kyoga	234,447	92.1	144.9	0.5	0	0	237.6
(8) Mpologoma	576,500	408.5	599.3	9.9	0	0	1,017.70
(9) Lumbuye	96,784	75.7	101.6	0	0	0.1	177.4
(10) Victoria Nile	475,840	202.3	287.4	0.6	0	1.3	491.6
(11) Sezibwa	529,515	238.3	317.7	1.5	0.4	0	557.9
Total	2,480,523	1,340.90	1,913.20	25.1	0.5	1.4	3,281.00

Source: SIP

4) Industrial Water Supply

The extraction of water either groundwater or surface water has to be implemented subject to the permission by the DWRM. Industrial water in the Basin based on SIP is estimated to approximately 3.8 MCM/yer (2008).

(3) Hydropower Stations

1) Large Scale Hydropower Stations

Nalubare and Kiira stations are existing large-scale hydropower stations in Lake Kyoga Basin, which are located at the outlet of Lake Victoria to Nile River. Their installed capacities of power generation are 180MW and 200MW respectively and almost all of Uganda's current developed hydropower (397MW) is

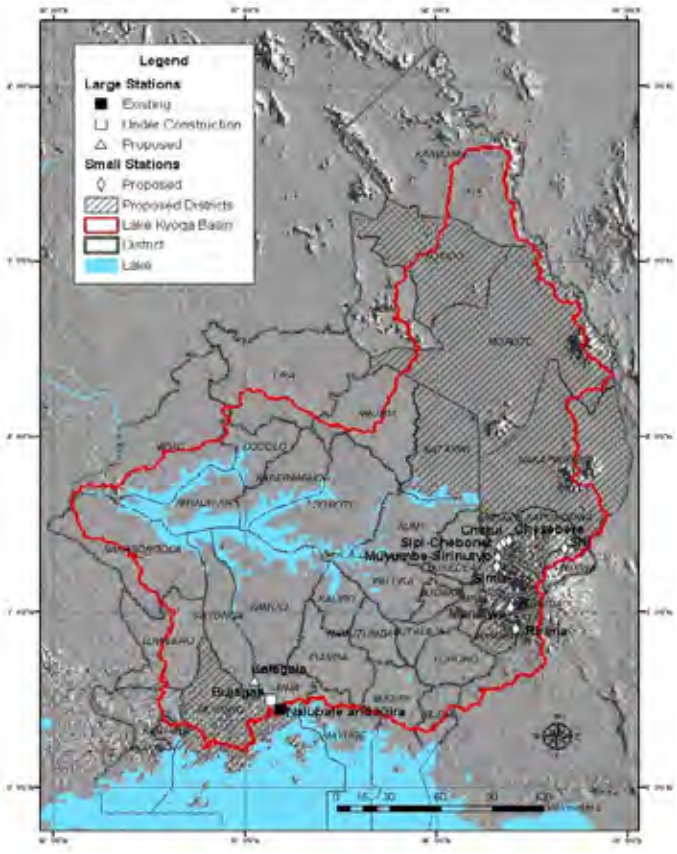


Figure 3-22 Locations of Existing and Planned Hydropower Stations

generated in these two stations[1,2]. Bujagali hydropower station with 250MW capacity is under construction at 8km downstream of these two stations and the completion is expected in mid 2011. As for potential large-scale hydropower scheme in Lake Kyoga Basin, there are Kalagala scheme with 350MW in the downstream of the Bujagali station, of which feasibility study has completed. All the above stations are located along Nile River and are for hydropower generation purpose.

2) Small Scale Hydropower Stations

Hydropower stations with less than 20MW capacity are categorized as small-scale hydropower scheme. Though none of small-scale hydropower stations exists in Lake Kyoga Basin, more than a dozen potential sites have been identified mainly around Mt. Elgon and feasibility study has been done for some sites.

3.4.4 Sanitation

(1) Sanitation in Urban Areas

The coverage of urban sewerage system in the urban areas controlled by NWSC is quite low as shown in Table 3-17.

Table 3-17 Present Situation of Sewerage System in Urban Areas of Lake Kyoga Basin

Name	Coverage (%)	Capacity of Treatment Plant (m3/day)	Capacity Utilization (%)
Jinja	6	16,000	10
Lira	2	900	27
Mbale	7	4.6	23
Soroti	4	3,000	8
Tororo	5	2,000	19

Sourdce:NWSC

The present capacity of treatment facility is enough, but the collection network is provided only in the core areas of town resulting in low utilization of the capacity. Peoples who do not connect to collection networks still uses the ordinary toilet as same as in the rural areas. It is necessary to provide the collection networks to increase the connection. In the small towns, there is no such urban sewerage system provided, since they have to concentrate the expansion of water supply system at present, and the people in the small town uses the ordinary toilet.

(2) Sanitation in Rural Areas

Most districts started a campaign to enforce the Public Health Act with emphasis on construction of latrines. As a result, the national latrine coverage reached to 62.4 % in 2008, and in the Basin 55.5 %. The coverage of household latrines is rather higher in the districts of the Eastern and the Central regions, and the coverage of some districts such as the Abim, Kaabong, Kotido and Nakapiripirit is as low as two (2) % as shown in Table 3-18.

[1] Uganda National Water Development Report 2005 (Chapter 8), 2006, World Water Assessment Programme

[2] The Renewable Energy Policy for Uganda 2007, Ministry of Energy and Mineral Development

Table 3-18 Latrine Coverage of Districts in Lake Kyoga Basin (2008)

District	Latrine Coverage (%)	District	Latrine Coverage (%)	District	Latrine Coverage (%)
Northern		Eastern		Manafuwa	62
Amolatar	49	Budaka	60	Mayuga	68
Apac	53	Bugiri	65	Mbale	65
Dokolo	49	Bukuwa	60	Namutunba	52
Lira	52	Bukudea	60	Pallisa	60
North-Eastern		Bududa	59	Sironko	57
Abim	2	Busia	82	Soroti	68
Amuria	24	Butaleja	89	Tororo	82
Kaabongo	2	Iganga	65	Central	
Katakwi	55	Jinja	71	Kayunga	59
Kotido	2	Kaberamaido	52	Luwero	73
Moroto	10	Kaliro	86	Mukono	81
Nakapiripirit	3	Kamuli	74	Nakasongola	71
		Kapchorwa	58	Wakiso	73
		Kumi	56		

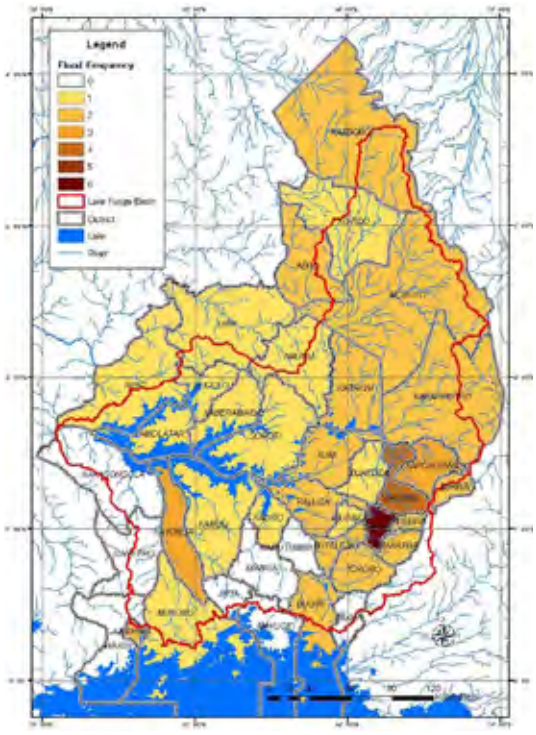
Source: Water and Sanitation Sector Performance Report September 2008

3.5 Flood, Sediment Disaster and Drought

Figure 3-23, 24 and 25 show frequency of water related disasters: flood, sediments disaster and drought in the Bain based on EM-DAT (Emergency Events Database). Since 2007 flood affected extremely wide area, most of districts in Lake Kyoga Basin have experienced flood damage. Highly frequent affected areas by flood are the north-eastern area of the Basin and surrounding area of Mt. Elgon. Droughts have occurred in Karamoja region in northern part of the Basin. Droughts have frequently occurred four times in recent ten years and affected hundreds of thousands of people. Landslide has been recorded only in Mbale district.

Source: EM-DAT

Figure 3-23 Sediments Disaster Frequency



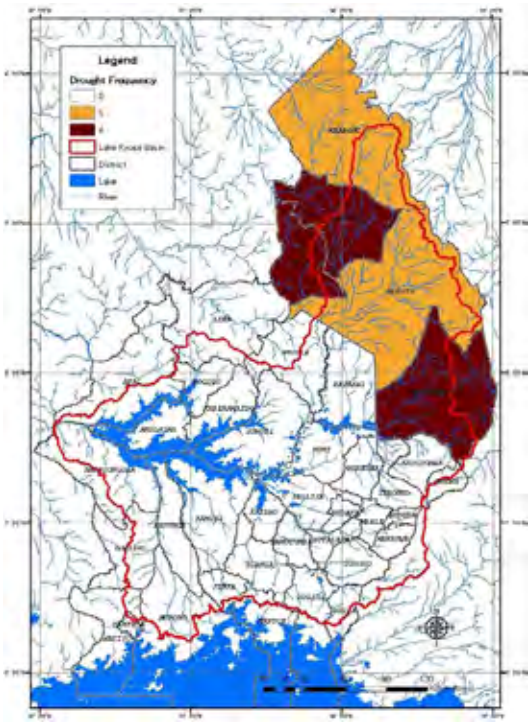
Source: EM-DAT

Figure 3-24 Flood Frequency

3.5.1 Present Condition on Deforestation and Forest Degradation

The survey results of the present condition on deforestation and forest degradation, which is one of the main triggers against flood and sediments disaster, in and around Mt. Elgon area are presented in Figure 3-26

The persons in charge of DEOs have the same opinion about major factor of expansion of deforestation and forest degradation, and that opinion is "Deforestation is conducted and expanded for production of firewood and cultivation due to human activities to be expanded and needed by rapid population increase." Photo 3-1 is mountainous area in Bududa district. It clearly shows that forest was logged and cultivated even in such mountainous area. Such cultivated slopes were observed in every mountainous area around Mt. Elgon through the field reconnaissance.



Source: EM-DAT

Figure 3-25 Drought Frequency

Photo 3-1 Cultivation in Mountainous Area

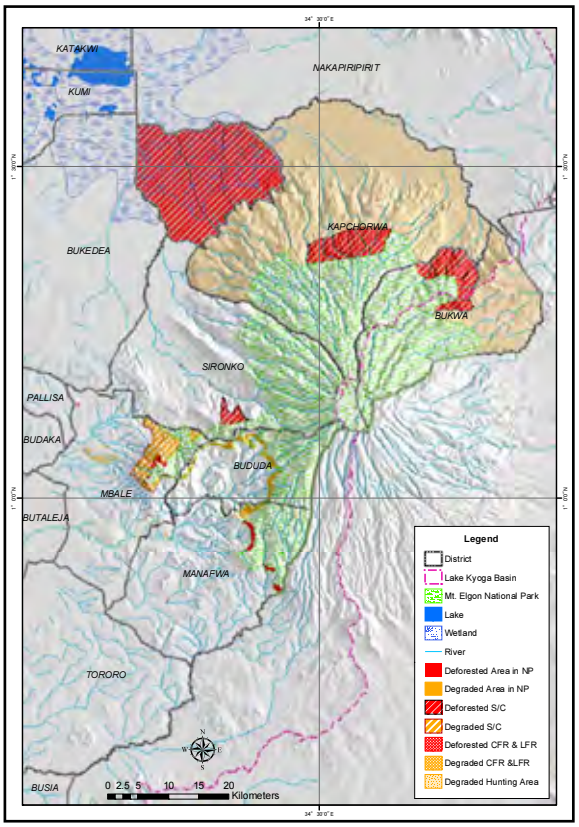


Figure 3-26 Heavily Deforested & Forest Degraded Area in and around Mt. Elgon

3.5.2 Present Condition on Flood and Sediment Disaster

The survey results of the present conditions on sediment disaster and flood in and around Mt. Elgon are presented in Figure 3-27. It reveals that past disaster occurrence area and disaster prone area of sediment disasters spread in mountainous area around National Park, and flood prone area locates at downstream of sediment disasters prone area.

(1) Flood Disaster

Flood damage in the survey area is mainly caused by inundated type of flood in middle and downstream part since disasters of mountainous area are recognized as sediment disasters. It is frequently heard that flood is caused by riverbed rising due to sediment deposition produced in high volume in the upstream area, but quantitative data cannot be acquired.

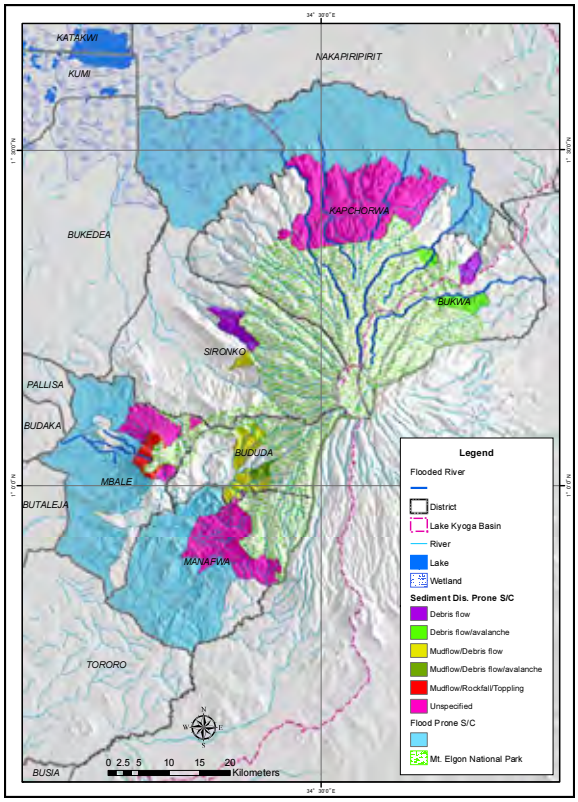


Figure 3-27 Flood and Sediments Disaster Prone Area in and around Mt. Elgon

Although condition in flood could not be observed, it is considered that sediment transportation as bed load is not much since alluvial cone is hardly seen in the survey area. Therefore, it is difficult to consider that riverbed rising which may cause flood has occurred due to sediment deposition. In the survey area, mountainous land features quickly change to plain field with very gentle slope, therefore, it may be considered that the root cause of flood is an increase of runoff ratio due to deterioration of upstream area if flood frequency becomes higher in recent years.

(2) Sediment Disaster

Sediments disaster does not caused by flash flood but mud flow or debris flow. This seems to be strongly related to the topographical and geological conditions of Mt. Elgon. (refer to 2.3.3)

Although sediment disasters have frequently occurred, there are not so many disasters cause heavy damage until now. However, heavy damage can be occurred in the case that a disaster happens in densely-populated area, for example, about 350 persons were dead or missing by sediment disaster in Bududa district in March 2010. This implies that a potential of such disaster occurrence in the area becomes high.

3.6 Environmental and Social Considerations

3.6.1 Legal System Concerning Environment and Social Consideration

In 1995, Uganda enacted "National Environment Statue" calling for Environmental Impact Assessment (EIA) for all development activities likely to negatively impact on the environment before they are implemented. National Environment Management Authority (NEMA) has been created and dated to operation and implement this request.

The statute also designates environmental inspectors who can enter on any premises or vehicle for environmental audit. In the environmental act, environment is defined as 'the physical factors of the surroundings of the human beings', 'the biological factors of animals and plants and the social factors'. According to this definition, all EIAs are expected to carry out assessments embracing the ecological, social and socio-economic aspects of the environment. It is for this reason that the practice so far has been not to separate Environmental Impact Assessment from social or health impact assessment as is the case in other jurisdictions.

Table 3-19 lists up related statutes, regulations and guidelines on EIA and water resources.

Table 3-19 Statue, Regulation and Guideline on EIA and Water Resources

Statute	Constitution of the Republic of Uganda, 1995
	The National Environmental Statute, 1995
	The Water Statute, 1995
Statutory Instrument、Regulations	The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999
	The Environmental Impact Assessment Regulations, 1998
	The National Environment (Waste Management) Regulations, 1998
	The National Environment (Waste Discharge) Regulations, 1998
	The Sewerage Regulations, 1999
	The Water Supply Regulations, 1999
	The National Environment (Designation of Environmental Inspector) Notice, 2001
	The National Environment (Conduct and Certification of Environment Practitioners) Regulation, 2003
Guideline and Guideline Note	Guideline for Environmental Impact Assessment in Uganda, 1997
	Environmental Standards and Preliminary Environmental Impact Assessment for Water Quality and Discharge of Effluent into Water and Land in Uganda
	Operational Guidelines for Environmental Inspectors, 1999
	Environmental Audit Guidelines for Uganda,1999
	Environmental Inspection Report (Form)

3.6.2 EIA Scheme

EIA framework is shown in Figure 3-28. It consists of three stages as follows.

- Stage-I : Screening

  Development of particular project (Guideline Annex 3) has to submit a project brief to the Authority (NEMA: The National Environment Management Authority) for screening. Therefore,

Developer will as well to check up the project plan according to the checklist (Guideline Annex 4, 5), and if it necessary, review mitigation plan during the early stage of the project planning cycle. According to the checklist, the proposed action is checked on the subject of socio-economical, aesthetic, cultural, biological, physical environment, about each stages of project (site selection, construction and implementation). Phase-I is divided in 3steps. First step, the project is judged if it exempt from EIA. And next step it is judged if it's required mandatory EIA. In the third step, it is confirmed if it undertakes appropriate mitigation measures. If after screening it is determined that a detailed Environmental Impact Study (EI Study) is required, the developer shall then initiate the necessary steps to get the EI Study done (Phase-II).

- Stage-II：Environmental Impact Study

The initial step in the EI Study is to determine the scope of works to be undertaken in assessing the likely environmental impacts of proposal project. Usually this includes meetings with relevant agencies and stakeholders to obtain their comments on what should be included in the study and what alternatives should be considered. The developer shall undertake to prepare a scooping report which summarizes the results of scooping, and which shall also constitute part of Terms of Reference for the study. The Terms of Reference shall be reviewed by the Authority, in consultation with the responsible Lead Agencies before an Environmental Impact Study is conducted. Based on the information from the scooping exercise as contained in the Terms of Reference, an Environmental Impact Study shall be conducted and Environmental Impact Statement (EIS) will be prepared. The developer shall submit ten copies of the EIS to the Authority.

- Stage-III：Decision Making

Either on the basis of a finding that a project is exempt, appropriate mitigation measures have been incorporated for identified potential environmental impacts, or disapproves the environmental aspects of proposal project. If approved, the developer will be licensed or permitted to implement the project in accordance with the mitigation measures stipulated in the Environmental Impact Statement. If it is denied, the developer may, if such denial is based on environmental considerations that can further be improved, be urged to revise the proposed action to eliminate adverse impact.

During 1996 to 2003, over 950 projects have been subjected to EIA, out of which no less than 800 have been approved for implementation, while up-to 20 have not been approved. Like this, EIA system in Uganda seems to be established itself.

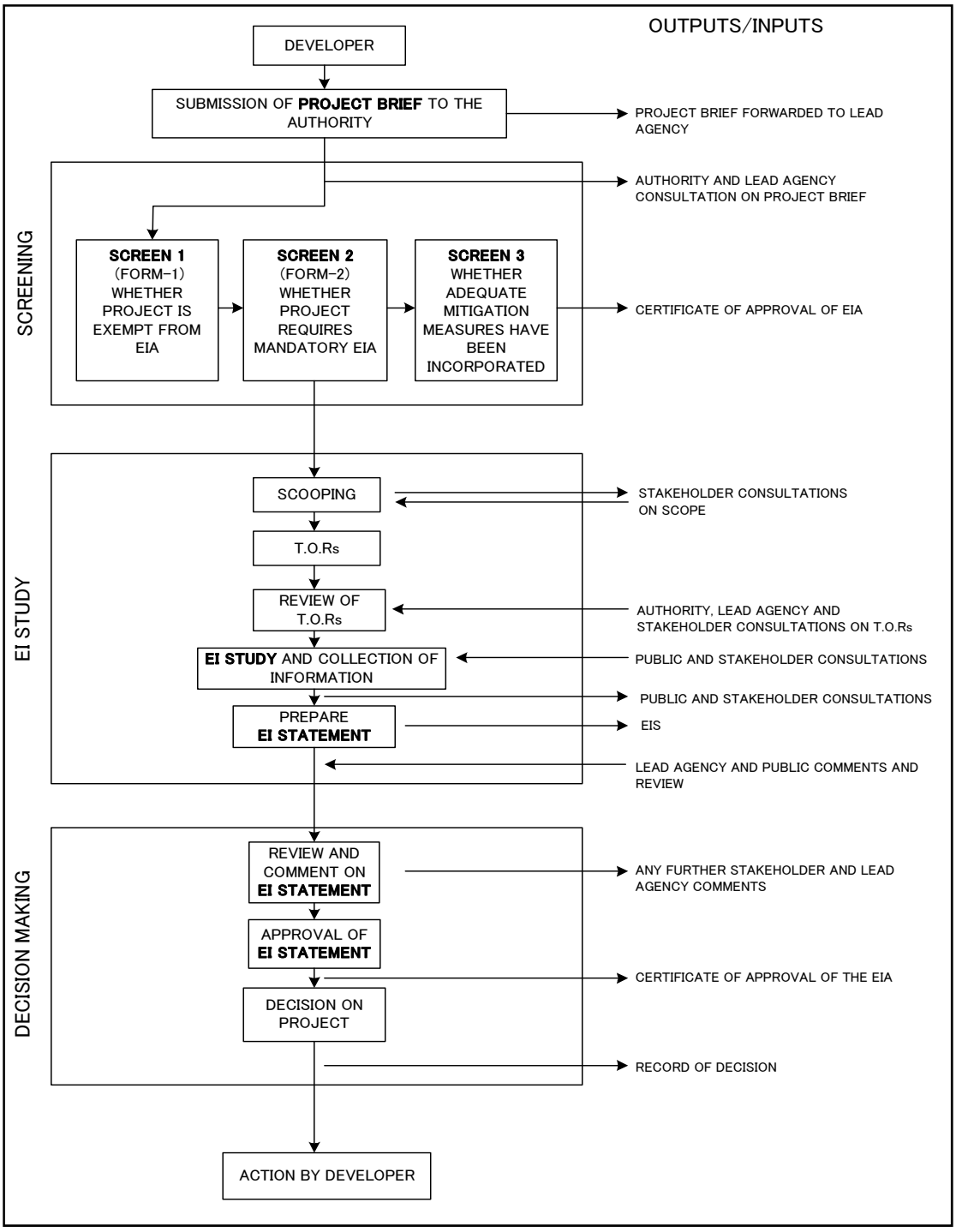


Figure 3-28 EIA Process Flow in Uganda

Chapter 4
Water Resources Potential Evaluation

CHAPTER 4 WATER RESOURCES POTENTIAL EVALUATION

4.1 Water Balance Analysis for Water Resource Evaluation

A water balance is a numeric accounting of inputs, outputs, and storages of water and it can be used to manage water resources, to monitor and predict water shortage, to prevent flooding, and so on. The water balance of study area is expressed simply by the following equation.

$$P = E + R + I$$

P: precipitation, *E*: evapotranspiration, *R*: runoff, *I*: infiltration.

Table 4-1 List of Used Monitoring Data

Observation Items	Frequency of Observation	Number of Stations	
		Uganda	Kenya
Precipitation	Daily and Monthly	271	4*
Maximum Temperature	Daily	36	3*
Minimum Temperature	Daily	36	3*
Average Temperature	Monthly	1*	1*
Sunshine Hours	Daily	6	2*
Evaporation	Daily	9	-
River Water Flow	Daily	11	-

Source: Department of Meteorology, DWRM and WMO*

The list of used monitoring data for this analysis is shown in Table 4-1. However, the monitoring data in the northern part of the study area is not sufficient because of the security reasons. in order to estimate meteorological data covering the whole study area. To supplement the lack of monitoring data, the additional meteorological data observed in Kenya were utilized for the interpolation of some items.

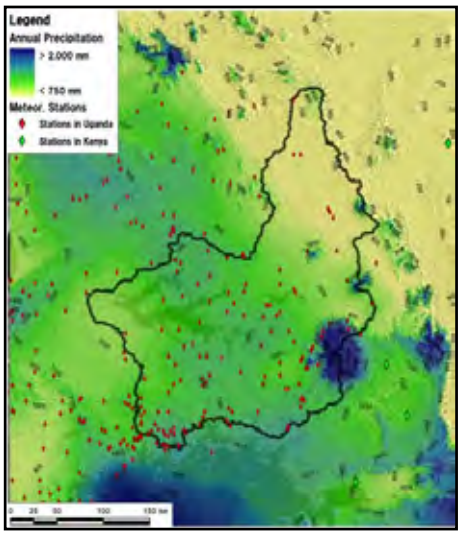


Figure 4-1 Estimated Annual Precipitation

4.1.1 Estimation of Precipitation

The annual and monthly precipitation maps of the study area and its surroundings were created by the precipitation data of meteorological stations. The precipitation values of unmeasured area (unmeasured grid) were estimated by Kriging method as an interpolation using measured precipitation values. The estimated annual precipitation map is shown in Figure 4-1. The annual precipitation of the plain and gently hilly terrain, where the most of study area belong to, is 1,000 to 1,300 mm. However, the annual precipitation in the plain of northern part, Kaabong, Kotido and Moroto Districts, is less than 1,000 mm. On the other hand, the annual precipitation of mountainous area is estimated to be over 2,000 mm.

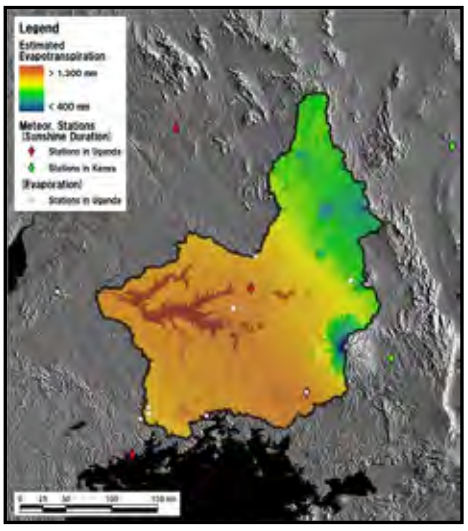


Figure 4-2 Estimated Evapotranspiration

4.1.2 Estimation of Evapotranspiration

The evapotranspiration of study area was estimated by

Makkink equation in consideration with Albedo (Nagai, 1993). The equation is defined as follows:

$$ET_{mak} = \alpha\left((a + 0.06 - A)\frac{\Delta}{\Delta + \gamma}\frac{Rs}{\lambda} + b\right)$$

ET_{mak} (mm/day): evapotranspiration

α: conversion value from potential to actual evapotranspiration value

Δ (hPa/°C): slope of saturation vapor pressure curve

γ (hPa/°C) : psychrometric constant

Rs (MJ/m^2/day) :total solar radiation

λ (MJ/kg): latent heat

a, b: regional constant values

A: albedo value of each land cover class.

The annual evapotranspiration map is shown in Figure 4-2.

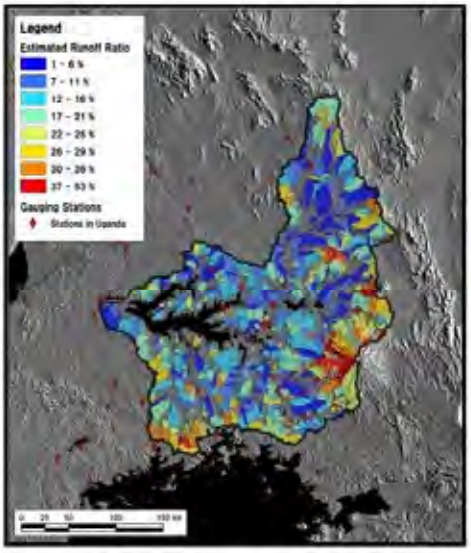


Figure 4-3 Estimated Runoff Ratio

4.1.3 Estimation of Runoff Ratio

The river discharge of the basin was estimated by each runoff ratio of 571 small catchments by the techniques of geomorphometry and statistical analysis (Principle Component Analysis; PCA). Figure 4-3 presents the distribution of runoff ratio. Higher runoff ratio having reddish color in the figure is obtained from the slope of mountainous and hilly terrain. On the other hand, lower runoff ratio having bluish color is obtained from plain areas.

4.1.4 Estimation of Infiltration (Groundwater Recharge)

Based on the estimated precipitation, evapotranspiration and runoff ratio, the infiltration reflecting the groundwater recharge volume can be estimate by the following equation.

$$I_{est} = P_{est} - AET_{mak} - P_{est} \times R_{ratio}$$

I_{est} (mm): amount of infiltration

P_{est} (mm): precipitation

AET_{mak} (mm): evapotranspiration value

R_{ratio}: runoff ratio from the runoff index.

Distribution of the annual infiltration in the Basin on a grid basis is shown in Figure 4-4. High values were generally obtained for mountainous area in the eastern part, because

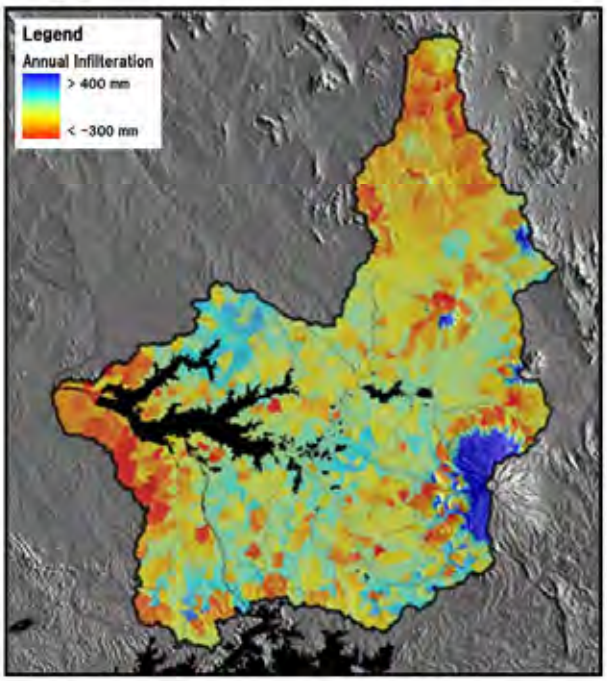


Figure 4-4 Estimated Annual Infiltration

precipitation is higher in the high altitude area than in the plain area. The infiltration of plain area with low precipitation, especially the northern part and the outlet area of the Lake Kyoga are very low. As for the central plain in the basin, the infiltration varies a great deal depending on its surface conditions.

4.2 Potential Evaluation of Surface Water Resources

Estimation of surface water resource of each sub-basin was conducted using the study results obtained in the course of the Study and the simulation software: Mike Basin. The simulation model constructed in the Study was used for water balance analysis in the future drought year.

Simulation was carried out in two steps as follows

Building up simulation model

- Data preparation (rainfall, evapotranspiration, river discharge and water usage.
- To setup catchment parameter (rainfall, evapotranspiration, run-off ratio and so on)
- Calibration (adjusts run-off analysis and observed river discharge)
- To simulate an initial condition of water resources during 1950 to 1979

Simulating future conditions in a specific drought year under future water demand

- To prepare the future water demand in 2035
- To prepare drought rainfall
- To simulate surface water conditions in future drought year
- To evaluate future condition of water resources

4.2.1 Building up Simulation Model

The rainfall data and river gauging station data are dramatically decreased since civil war had started at 1981. After the civil war, many of the stations are broken and observation has not been held until now. These data are stored in Hydata which is a database of hydrological information. For the calibration, both of rainfall data and river gauging data in the same period are necessary. Therefore, calibration period shall be selected according to the data availability and coverage in each sub-catchment. For the calibration, data which were observed in 1950 to 1979 shall be selected because of following two reasons.

- Data availability in Hydata
- Less water demand than the present

Each parameter of small-catchment is calibrated according to the comparison between the results of runoff analyses conducted adjusting parameters' values and the discharge measurement time series data as shown in Figure 4-5.

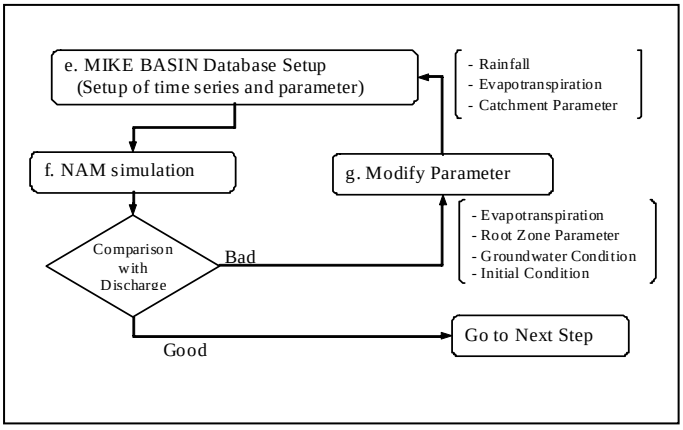


Figure 4-5 Flow Chart of Calibration Work

4.2.2 Simulation Results

Simulation for grasping basic runoff characteristic of each sub-basin under future water demand in 2035 was carried out by the formulated simulation model.

(1) Runoff Characteristic of Each Sub-Basin

Simulation was conducted in the following condition to analyze runoff characteristics of each sub-basin in Lake Kyoga Basin.

- Simulation period: From 1950 to 1979
- Water demand: Nothing
- Rainfall condition: Same rainfall time series as using in calibration work

Table 4-2 shows average, low water and drought water discharge of each sub-basin, which are calculated as basic runoff characteristic of each sub-basin and surface water potential.

Table 4-2 Runoff Characteristic of Each Sub-Basin

Unit: (m^3/s)

	(1) Okok			(2) Okere			(3) Awoja			(4) Lwere			(5) Akweng		
	Average Water	Low Water	Drought Water	Average Water	Low Water	Drought Water	Average Water	Low Water	Drought Water	Average Water	Low Water	Drought Water	Average Water	Low Water	Drought Water
1950	0.857	0.000	0.000	5.519	0.417	0.000	16.663	0.936	0.000	6.307	0.244	0.000	13.349	1.363	0.000
1951	3.333	1.069	0.006	7.786	2.003	0.122	20.953	7.644	0.748	8.366	2.817	0.227	11.370	4.087	0.601
1952	2.899	0.689	0.173	5.838	1.378	0.486	18.773	6.557	2.036	6.968	2.982	0.689	8.410	3.912	1.467
1953	4.495	0.245	0.024	5.238	0.634	0.050	12.698	1.779	0.578	3.541	0.418	0.050	7.453	1.463	0.163
1954	7.343	0.386	0.044	11.875	1.168	0.227	21.893	2.513	0.863	5.542	0.441	0.121	6.075	1.568	0.379
1955	5.684	0.482	0.079	7.243	1.312	0.185	12.235	5.360	1.590	4.073	1.418	0.192	7.812	0.572	0.051
1956	2.202	0.816	0.302	5.379	0.716	0.192	16.591	6.243	2.080	3.816	1.395	0.585	8.641	2.757	0.947
1957	3.739	0.291	0.044	3.293	0.580	0.235	16.528	4.146	1.735	4.848	0.561	0.182	8.653	2.129	0.868
1958	4.954	0.270	0.050	5.554	0.765	0.070	13.461	4.028	0.921	4.686	0.888	0.128	8.935	0.982	0.334
1959	3.165	0.557	0.071	4.764	0.356	0.046	10.683	6.489	3.137	4.116	1.127	0.487	8.766	3.982	1.346
1960	2.116	0.578	0.165	5.674	1.756	0.511	15.124	4.953	2.617	5.907	1.130	0.364	8.053	3.507	0.855
1961	11.049	0.102	0.011	11.917	0.395	0.070	35.903	4.159	0.648	10.633	1.972	0.059	15.548	3.353	0.602
1962	7.917	1.200	0.461	6.792	2.416	0.543	25.581	13.874	6.509	7.783	4.253	1.772	13.955	6.035	2.256
1963	1.885	0.399	0.181	6.887	1.097	0.234	27.310	7.890	3.473	9.184	2.158	0.778	9.595	3.021	0.794
1964	0.685	0.160	0.059	6.236	2.056	0.413	18.227	7.577	3.784	5.265	2.274	1.134	6.628	2.901	0.982
1965	1.176	0.085	0.004	1.951	0.703	0.166	10.319	4.761	0.824	3.334	1.328	0.185	6.420	1.609	0.066
1966	2.203	0.435	0.055	5.941	1.040	0.084	16.616	8.181	3.915	6.919	2.946	0.607	10.873	4.028	1.892
1967	2.129	0.197	0.033	10.795	1.926	0.188	24.308	5.002	1.342	6.247	1.537	0.223	15.563	1.598	0.387
1968	1.918	0.483	0.075	6.249	1.589	0.760	23.054	9.024	3.971	8.291	3.154	1.811	15.499	5.163	3.017
1969	1.358	0.426	0.016	3.144	0.928	0.099	19.019	10.644	3.468	6.836	3.565	1.709	10.136	4.017	1.640
1970	3.167	0.383	0.034	5.245	1.421	0.495	27.218	10.130	3.488	11.045	3.663	1.489	16.570	6.649	3.101
1971	2.836	0.302	0.034	2.869	0.551	0.084	16.591	4.661	1.233	3.836	0.897	0.091	10.449	1.784	0.184
1972	2.672	0.331	0.053	3.012	0.805	0.147	13.236	3.454	1.471	5.129	0.968	0.375	11.299	3.596	0.767
1973	0.913	0.135	0.035	0.462	0.136	0.000	10.717	3.924	0.837	4.737	1.850	0.424	7.755	2.182	0.368
1974	1.784	0.214	0.029	1.929	0.070	0.000	14.732	3.148	0.964	3.680	0.424	0.145	8.119	2.427	0.651
1975	5.190	0.218	0.040	8.028	1.224	0.006	31.724	5.325	0.806	9.222	1.350	0.025	18.077	2.649	0.321
1976	2.630	0.385	0.076	2.796	0.443	0.086	16.844	3.163	0.746	4.257	0.958	0.130	8.581	1.550	0.275
1977	2.628	0.459	0.028	3.235	0.550	0.066	25.308	10.574	2.679	7.756	2.613	0.373	12.288	3.566	0.823
1978	7.125	1.130	0.368	5.137	0.825	0.070	47.864	11.777	4.156	8.024	2.353	0.633	10.245	4.994	1.911
1979	1.148	0.183	0.051	0.764	0.193	0.057	7.549	4.285	2.041	2.074	0.589	0.175	7.481	3.649	1.828
Average	**3.373**	**0.420**	**0.087**	**5.385**	**0.982**	**0.185**	**19.591**	**6.073**	**2.089**	**6.081**	**1.742**	**0.505**	**10.420**	**3.036**	**0.962**

	(6) Abalang			(7) Kyoga Lakeside Zone			(8) Mpologoma			(9) Lumbuye			(10) Victoria Nile			(11) Sezibwa		
	Average Water	Low Water	Drought Water	Average Water	Low Water	Drought Water	Average Water	Low Water	Drought Water	Average Water	Low Water	Drought Water	Average Water	Low Water	Drought Water	Average Water	Low Water	Drought Water
1950	14.01	1.53	0.00	8.36	0.69	0.00	19.91	4.54	0.00	1.49	0.25	0.00	10.76	2.83	0.00	4.79	1.45	0.00
1951	13.42	4.42	0.53	15.42	2.37	0.07	32.75	12.22	2.18	6.82	2.22	0.11	19.22	6.00	0.79	11.77	2.87	0.93
1952	7.14	3.35	1.61	6.40	1.32	0.34	27.49	14.50	3.07	3.89	0.93	0.17	12.85	4.14	1.45	12.16	5.52	2.89
1953	6.91	2.22	0.24	1.07	0.18	0.04	10.25	2.46	0.42	1.02	0.21	0.04	8.77	2.31	0.42	7.29	3.06	0.51
1954	7.86	2.62	0.51	1.91	0.37	0.05	19.61	4.17	0.99	2.26	0.73	0.23	9.83	4.13	1.73	9.65	6.04	3.39
1955	10.29	2.78	0.55	3.46	0.47	0.03	16.23	8.90	2.64	2.65	1.14	0.43	12.28	4.85	2.88	9.40	5.42	3.08
1956	10.64	1.76	0.42	4.36	0.79	0.18	17.75	8.63	3.95	1.52	0.75	0.39	8.03	4.35	1.67	12.64	7.56	4.08
1957	9.99	2.60	1.19	5.32	0.30	0.02	18.07	4.23	1.77	3.67	0.89	0.22	14.03	4.25	1.65	13.88	3.76	1.60
1958	7.51	1.81	0.63	2.93	0.20	0.00	16.05	3.52	1.52	2.31	0.63	0.28	8.54	2.39	1.06	9.05	2.75	1.14
1959	11.34	4.70	0.92	4.19	0.85	0.24	18.05	9.57	1.60	3.13	1.36	0.47	6.37	2.89	1.17	8.81	3.94	2.60
1960	10.47	4.13	1.47	3.88	1.23	0.34	22.46	6.64	1.81	4.29	0.92	0.19	15.86	4.66	2.21	16.39	5.79	1.93
1961	18.93	4.47	0.97	15.83	1.17	0.08	52.97	17.67	0.65	10.14	1.69	0.05	24.72	6.46	0.58	17.18	4.58	0.67
1962	17.66	8.31	3.84	15.01	5.75	2.34	30.43	17.13	11.46	5.04	2.37	0.79	19.13	9.43	3.64	18.77	10.66	4.78
1963	14.75	6.40	4.20	26.92	4.60	1.80	51.05	17.50	11.29	9.60	2.94	1.48	22.09	7.74	3.13	16.45	8.35	4.77
1964	16.77	7.68	3.04	19.43	7.40	3.51	31.92	18.97	8.43	7.74	3.25	1.57	25.56	12.85	6.87	16.98	9.77	6.76
1965	7.98	2.52	0.53	5.43	0.60	0.10	19.02	8.35	1.47	2.46	1.41	0.41	8.16	3.80	2.09	11.82	3.04	1.17
1966	15.65	6.07	3.29	11.10	2.73	1.53	26.95	11.76	7.47	3.61	1.58	0.78	12.26	5.12	1.82	9.51	5.06	2.52
1967	19.82	2.62	0.78	5.72	0.92	0.16	27.56	12.62	3.67	5.61	1.06	0.40	19.05	4.25	1.87	11.35	4.33	0.51
1968	16.08	5.92	3.51	10.77	1.20	0.41	41.21	19.78	9.55	3.09	1.06	0.59	15.91	6.04	3.46	21.16	7.68	2.85
1969	10.80	4.53	2.19	5.83	2.15	0.62	28.58	19.66	11.91	3.05	1.53	0.67	12.39	6.82	3.00	19.06	9.72	3.71
1970	14.68	5.24	1.83	3.14	0.39	0.07	33.09	16.92	6.63	3.30	1.56	0.53	21.75	8.53	2.63	39.53	12.59	4.29
1971	11.65	2.30	0.27	1.04	0.14	0.03	19.70	5.68	1.51	4.64	0.58	0.04	14.38	5.07	0.48	13.03	6.86	3.38
1972	13.17	4.09	0.89	12.13	0.06	0.00	27.26	12.25	4.85	2.45	0.89	0.28	13.59	4.44	1.22	13.21	7.58	4.57
1973	12.85	3.54	0.40	8.08	2.39	0.66	17.67	9.58	2.54	1.58	0.64	0.15	4.41	2.34	0.59	2.57	1.46	0.66
1974	10.16	4.34	1.38	4.07	0.72	0.21	16.06	5.37	2.31	1.55	0.49	0.17	5.25	1.23	0.19	3.34	0.88	0.33
1975	21.85	1.81	0.24	0.57	0.14	0.05	23.57	7.21	0.88	3.38	0.96	0.07	12.85	4.11	0.05	7.95	1.64	0.23
1976	12.42	1.71	0.37	3.16	0.15	0.01	12.76	3.74	1.65	1.58	0.42	0.18	5.65	1.77	0.66	10.37	4.91	0.97
1977	15.45	2.05	0.54	4.58	0.69	0.05	21.53	6.48	1.42	1.85	0.53	0.15	4.17	1.67	0.19	9.19	3.45	1.22
1978	12.15	6.31	1.93	1.56	0.41	0.11	16.43	8.51	3.01	2.78	0.72	0.21	12.26	4.81	1.58	13.81	6.72	2.51
1979	7.03	3.53	1.95	0.19	0.01	0.00	12.34	4.49	1.68	1.73	0.95	0.34	3.80	1.58	0.52	2.39	0.57	0.21
Average	**12.65**	**3.85**	**1.34**	**7.06**	**1.35**	**0.43**	**24.29**	**10.10**	**3.74**	**3.61**	**1.16**	**0.38**	**12.80**	**4.70**	**1.65**	**12.45**	**5.27**	**2.28**

(2) Simulation on Surface Water Resources under Future Water Demand

Simulation was conducted in the following conditions aiming at contributing to water allocation investigation by grasping monthly tendency of entire Lake Kyoga Basin on future water demand and confirming utilization manner of this simulation model.

- Simulation period: One year (From January to December)
- Water demand: Future water demand in 2035
- Rainfall condition: Rainfall time series in 1/10 drought year

Simulation results are shown in Table 4-3and Figure Figure 4-6. The negative values in the table and figure mean that monthly runoff amount is not enough against water demand even if water is properly allocated within a sub-basin. From the simulation result, the following characteristics of Lake Kyoga Basin can be pointed out although the simulation was conducted under regulated conditions.

- In the case of drought year with 10 year return period under future water demand in 2035, water deficit occurs in almost all sub-catchments.
- Sub-basins where water deficit frequently occur are Okok, Okere, Lwere, Kyoga Lakeside Zone and Mpologoma. Especially, Okok and Okere sub-basin are severer.
- The seasons when water deficit frequently occurs are January to April and November to December.

Table 4-3 Water Resources of each Sub-basin in 1/10 Drought Year

Unit: million m^3 per month

Sub-basin Name / Month	(1) Okok	(2) Okere	(3) Awoja	(4) Lwere	(5) Akweng	(6) Abalang	(7) Kyoga Lakeside Zone	(8) Mpologoma	(9) Lumbuye	(10) Victoria Nile	(11) Sezibwa
January	-2.17	-2.75	3.43	0.10	5.87	8.70	-1.54	0.11	2.47	13.30	0.82
February	-1.93	-2.67	-0.43	-1.42	1.72	2.39	-3.23	-3.52	0.09	2.41	-0.27
March	-0.93	-2.47	4.40	-0.17	3.10	8.79	-3.83	-4.20	-0.40	-0.35	0.97
April	2.07	-0.21	13.02	10.31	17.51	34.38	6.69	49.71	8.07	35.10	21.31
May	8.74	4.48	31.46	8.32	22.20	26.13	3.38	49.63	6.21	20.48	12.32
June	2.82	1.57	49.92	13.96	20.03	26.60	-1.23	52.24	2.06	18.16	10.52
July	10.90	27.19	128.61	33.51	41.72	48.05	19.51	90.62	7.23	27.66	14.99
August	4.95	10.72	61.74	11.87	22.49	24.28	15.99	43.75	2.46	7.60	7.51
September	4.44	2.23	75.74	13.92	38.61	30.27	26.06	44.57	5.34	10.20	10.32
October	4.55	0.08	37.27	4.48	43.62	47.34	11.89	26.04	2.77	2.25	4.16
November	-0.20	-1.42	15.85	-0.17	13.62	16.43	2.71	11.27	1.14	0.04	1.66
December	-1.61	-2.42	4.03	-1.57	3.35	2.82	-3.07	-2.96	-0.20	-1.78	-0.47