CHAPTER 8 PRESENT SITUATIONS OF WATER AND SANITATION SECTOR AND OPERATION AND MANAGEMENT

8.1 Long Term Plan of Water and Sanitation Sector

The government prepared the Sector Investment Plan of the Water and Sanitation Sector, and the Strategic Investment Plan for the Water and Sanitation Sector was announced in September 2009. The salient features of the plan are presented below.

8.1.1 General

The Government of Uganda has undertaken to reform the water 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.

8.1.2 Water and Sanitation Sector and Its Sub-sectors

The water and environment sector is divided into two main parts: i) water and sanitation, and ii) environment. Within water and sanitation, the following components have been defined for the purposes of the Sector Investment Plan.

- Water Resources Management (WRM)
- Rural Water Supply (RWS)
- Urban Water Supply and Sewerage (UWSS)
- Water for Production (WfP)
- Sanitation
- Sector Coordination and Management (SC&M)

8.1.3 Sector Objectives

(1) Vision for the Ministry of Water and Environment:

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:

i) 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;
ii) 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
iii) To develop and efficiently use water supply for production (agriculture, irrigation, livestock watering, aquaculture, rural industries, hydropower, tourism).

(2) Sector Targets of Rural Water Services

The most important target of the sub-sector is the coverage of services. This target is a complex one that is dependent on its achievement on a number of factors including the existing coverage (data); the life span of the existing facilities and assumed future technology mix (technical variable) and, the functionality of the facilities (data/technical target). The departure point for the investment planning is the present coverage of around 63%. The official target is 77% coverage in rural areas by 2015 and a linear increase in coverage thereafter to reach full coverage by 2035.

Equity is also a target and achieving more uniform coverage rates in the sub-counties will imply higher per capita costs since the sub-counties with low present coverage typically are water scarce areas where expensive technologies are needed.

Functionality of rural water supply facilities is an important target that is included in the sector performance measurement system. Higher functionality implies greater coverage for the same level of sub-sector investment. The cost of achieving higher levels of functionality is in principle related to the investments made in community mobilization and the Community Based Management System (CBMS) as well as the investments in replacement of existing infrastructure. The departure point of functionality is the existing level of 82% and the target is eventually to achieve 95%.

(3) Sector Targets of Urban Water Services

The coverage target is officially 100% coverage in urban areas by 2015 and thereafter investments to cover population increases and replacement of existing infrastructure that outlives its lifespan.

This would imply very high investments in the short-term and the coverage targets suggested in the investment plan is full coverage to be achieved by 2035 and by 2015 80% for the large urban areas, and 65% by 2015 achieving full coverage in 2035 for the small towns, considering the present low rate of coverage in small towns of 43%.

Functionality of water supply facilities is an important target that in practice is set as a part of the measurement system of sector performance. Higher functionality implies less rehabilitation costs and greater coverage for the same level of sub-sector investment. The departure point is the existing level of 89% with a linear increase towards 95% towards 2015.

The main target in relation to sewerage in urban areas is coverage. The coverage targets of the Vision 2035 for sanitation aim at 95% access to improved sanitation. To achieve this in urban areas, centralized sewerage systems are likely to be an appropriate technology in the centers of urban areas notwithstanding the prospects of increasing the role of EcoSan technologies. Ten percentage of coverage with sewerage has been used as the target for both NWSC and small towns.

8.2 Present Situation of Water Supply

8.2.1 Drinking Water Supply

In Uganda, the drinking water supply is categorized into the rural and the urban 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 including rural growth centers.

(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 i) large urban towns: 23 towns gazetted for operation by National Water and Sewerage Corporation (NWSC) inclusive of 30 other satellite urban areas supplied by these 23 NWSC systems, and ii) 160 small towns of municipalities, town councils and town boards gazetted for the operation by the private operators contracted by Water Authority. In the Lake Kyoga Basin, there are the following large-scale piped water supply systems under the operation of NWSC.

Table 8-1 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)

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 Manutumba towns, respectively, and their system will be extended to Mayuga and Amuria as well in the future according to NWSC as shown in Figure 8-1.

Source: NWSC

Figure 8-1 Water Supply System of Large Town

As for the systems for small towns, the following systems are in operation in the Basin. As shown in Table 8-2, 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%.

Table 8-2 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)

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.

(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 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.

The total number of RGCs in the whole country was estimated to 844 by 2003, but the documents prepared in January 2009 by the Urban Water Supply and Sewerage Department (Status of Implementation of Urban Water and Sanitation Projects and Rural Growth Centers, January 2009) listed 621RGCs. Based on the results of the site reconnaissance carried out by the Study Team in some districts, the listed RGCs have to be replaced with the other growing villages since many RGCs have been developed into small towns, new villages have grown up to RGCs, and some districts have been split into several districts.

1) Water Sources and Type of Water Supply Facilities

a) Water Sources for Drinking Water Supply

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

Table 8-3 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.

The most predominant water sources are spring/stream flows with gravity flow systems in the districts located in the hilly areas near the Mt. Elgon (the districts shaded in the table). These facilities are regarded as the gravity flow schemes (GFSs), of which distribution pipes traverse several villages and communities from upstream to downstream with public taps managed by the tap water committees.

Table 8-4 Ratio of Water Sources for Each District

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

Data source: DWD

b) Water Supply Facilities

i) 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.

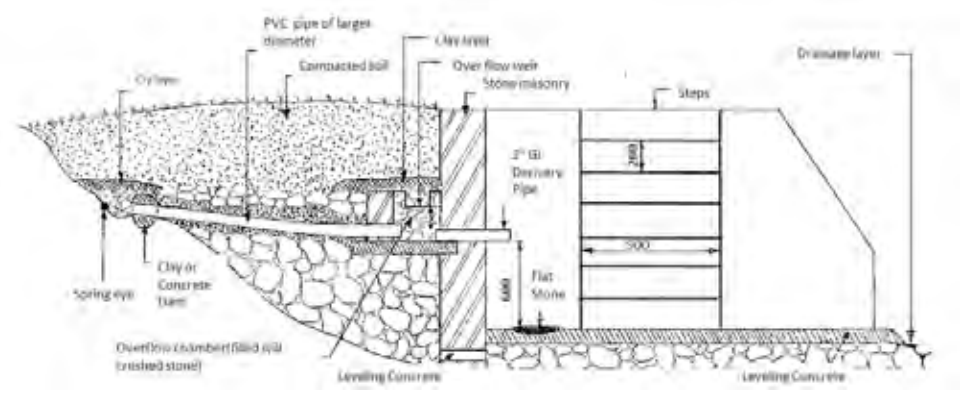


Figure 8-2 Typical Spring Water Supply Facility

ii) 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.

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. Spare parts for maintenance are easily procured because they are manufactured in Uganda, and the supply chains are also provided widely to cover district capitals. Hand pump platforms are constructed in accordance with the standard specification of DWD, and wooden fences are required to be constructed by the respective communities, but there are many wells operated without no such fences.

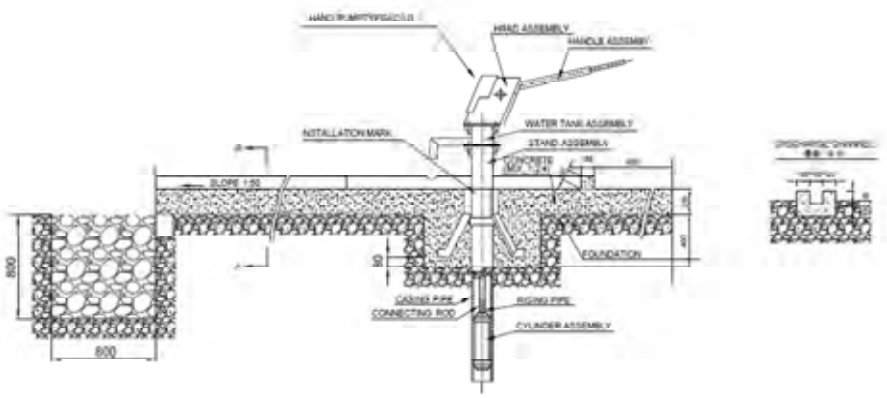


Figure 8-3 Typical Groundwater Supply Facility (Hand Pump)

Piped Water Supply Facility in Rural Are

The component of piped water supply facility, widely used in RGC, is shown below.

Water sources (Deep wells) → **Reservoir (Elevated tank)** → **Distribution pipe (HDPE)** → **Kiosk (3 taps)**

(Water Source Facility)

Most of water intakes use submersible motor pumps with protection fence and utilize commercial electricity of 415V, 3-phases, because RGC usually install electricity distribution systems. However, the electricity distribution system produces frequent electricity failure and voltage fluctuation of approximately 10 percent. Some of piped water supply facilities are not constant operated due to stoppage of electricity supply because of no electricity bills payment. In planning of piped water supply system, it should be into consideration whether the revenue from water sold is able to cover operation cost. In Long-term Strategy for Investment Planning, Implementation and Operation & Management of Water Supply and Sanitation in Rural Growth Centers, it is recommended to apply the most suitable power sources through the comparison among commercial electricity, diesel generation, solar power, and wind power considering the characteristics of the target water supply areas.

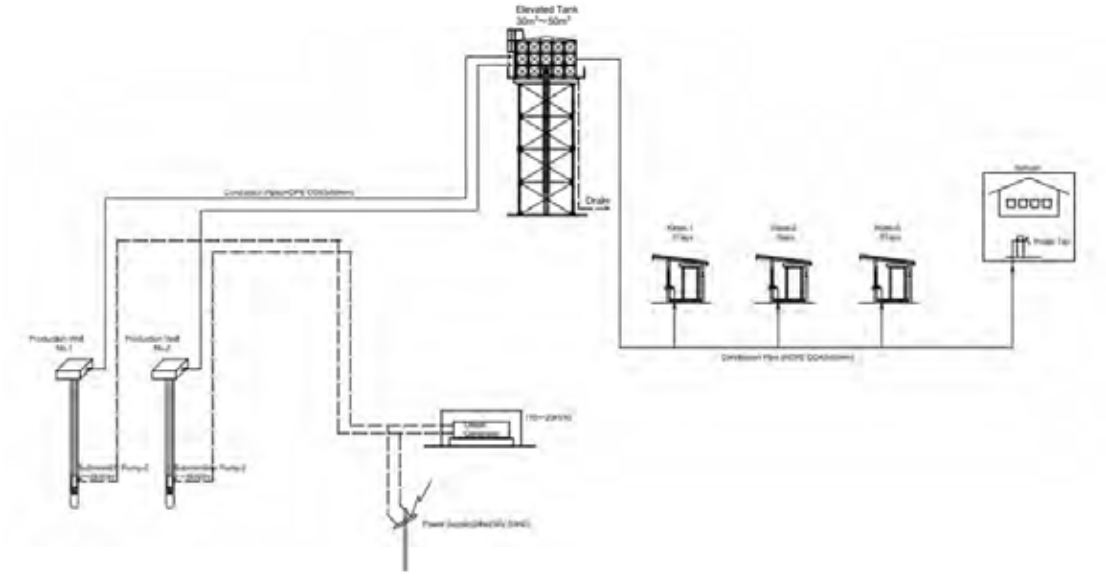


Figure 8-4 Typical Piped Water Supply Facility (Groundwater)

(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.

Most of distibuted and coveyannce pipes are made of uPVC or HDPE with size of 40-110mm in daiameter. The steel elevetaed tank is usually fabricated using domestic steels, but some of them are done using prefabricated steel panels imported from Nairobi in Kenya.

(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. The kiosk has usually 3 taps, and the water bill is collected on the basis of water supply amount. The yard tap and the kiosk install flow meters, with which the water supply amount is recorded.

iii) 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 not considered as stable seasonally.

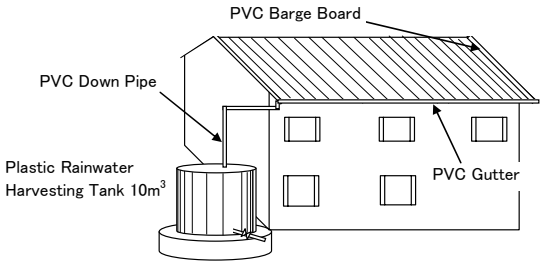


Figure 8-5 Rainwater Harvesting Facility

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 $500m^2$.

In case of primary schools, the facility collects the rainwater with $10m^2$ plastic tank, and then conveys and stocks it to the underground reservoir with capacity of $30m^2$ in the school ground. The underground reservoir installs the hand pump at the upper slab for use as needed.

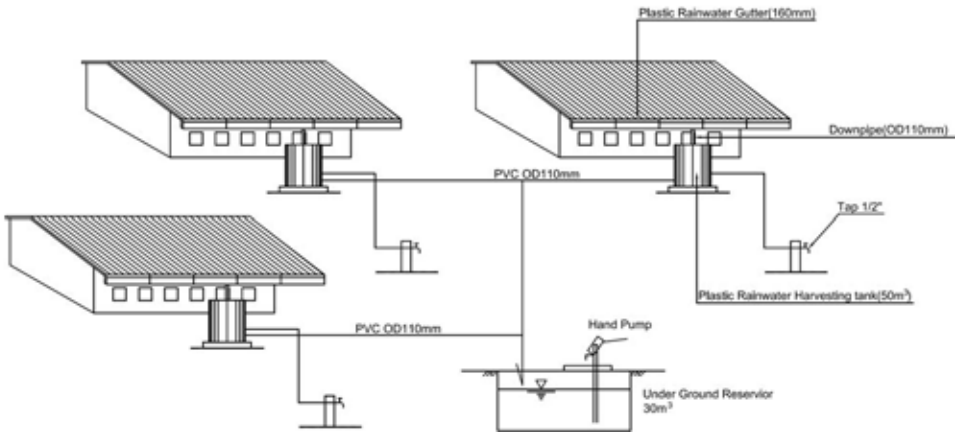


Figure 8-6 Typical Rain Water Harvesting Facility (Large Scale)


The photos show the rainwater supply facility of the primary school in Soroti area, which was constructed in the Amret Soroti Phase Project, but the facility does not work at present due to damaged connection pipe line fabricated with low-quality pipes. The rainwater collecting system comes to be utilized in many households because improved PVC collectors and plastic tanks are easily procured.

iv) Gravity Flow System Area (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. Since the level difference between water supply and water service facilities is approximately 500m in height, the water is depressurized by means of several concrete pressure-reduced tanks and distributed to each village with GI (galvanized iron) pipes of 50mm in diameter. The water service facilities with one public fountain are protected with the wooden fence for animals not to enter and to protect the public fountain.

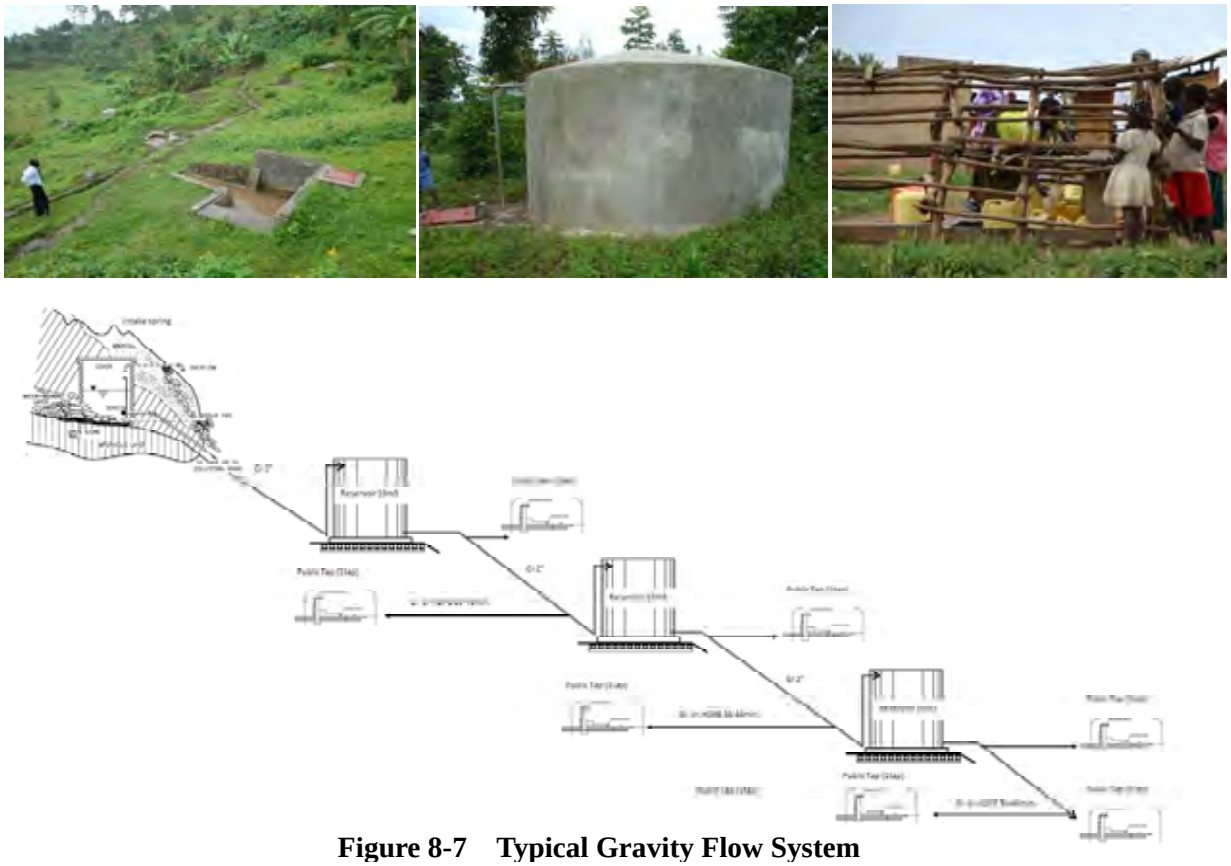


Figure 8-7 Typical Gravity Flow System

2) Water Consumption

In the rural water supply of the country, the daily water consumption per capita is set at 20 liter/day/capita. The maximum number of people served by one (1) borehole or standpipe/tap is 300. In case any institutional demand is considered in the piped supply systems for RGCs, the following consumptions are considered.

Table 8-5 Water Consumption for the Rural Water Supply

Demand	Water Consumption
Day school (student/day)	5
Residential school (litter/student/day)	25
Hospital (liter/bed/day)	100
Health center (liter/day)	100
Government office (liter/employee/day)	10
Hotel (liter/bed/day)	100
Camps (liter/person/day)	80

3) Coverage and Equity of Access to Safe Water

The rural population served and the coverage of rural water supply are shown in Table 8-6 for each district in the Basin. The coverage varies widely from 12 % of the Kaabong district of Northern region to 92 % of the Kaberamaido district of Eastern region averaging 57 % of whole of the Basin, which is lower than the national average of 63 %. The coverage of districts in the Northern region is generally rather lower.

Table 8-6 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 8-8 in the country. In the Basin, the indicator values of the Bugiri and the Kaabong districts are found to be high in comparison with other districts.

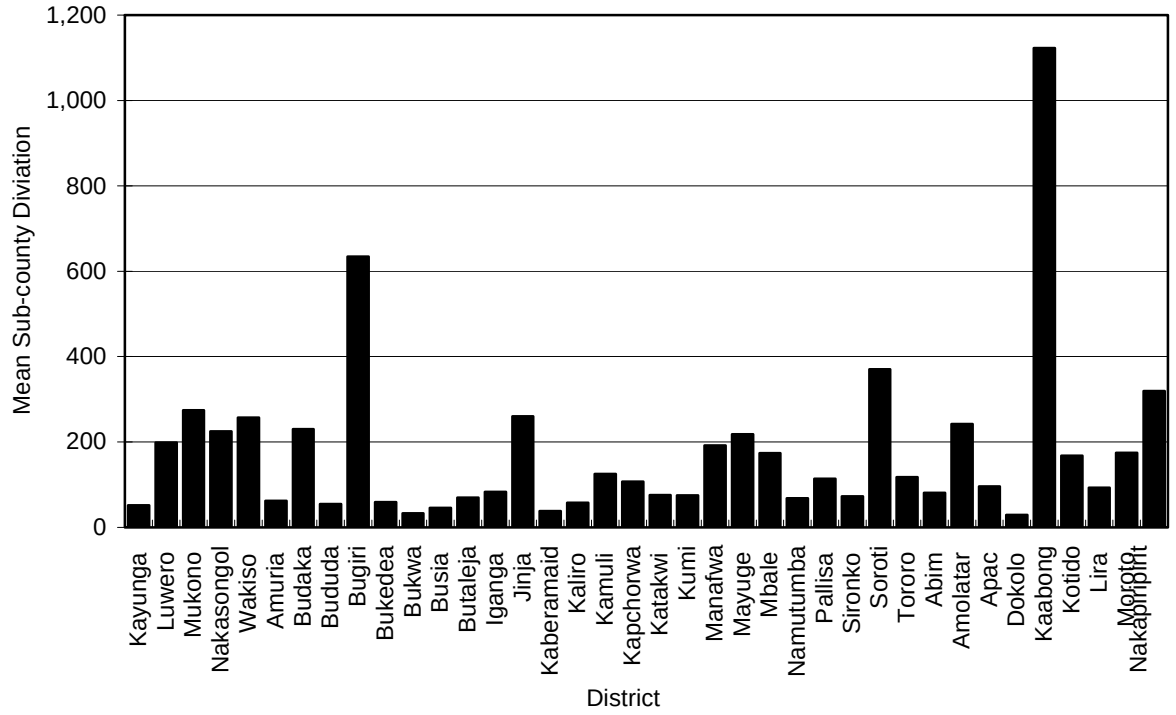


Figure 8-8 Equity of Access to Safe Water for Each District

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. The Technical Support Units (TSUs) are responsible for supporting such water user's groups in operation and maintenance of their water supply facilities. There are eight (8) TSUs in the country, and three (3) TSUs; TSUs 3, 4 and 5, are related to the communities in the basin.

Table 8-7 presents such number of the functional and the non-functional facilities for deep and shallow wells in each district of the Lake Kyoga 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 of 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 8-7 Functionality of Deep Tubewells and Shallow Wells

Districts	Deep Boreholes F*	Deep Boreholes NF*	Functionality (%)	Shallow Wells F*	Shallow Wells NF*	Functionality (%)	Districts	Deep Boreholes F*	Deep Boreholes NF*	Functionality (%)	Shallow Wells F*	Shallow Wells NF*	Functionality (%)
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: Non-Functional)

8.2.2 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 cultivated lands including commercial farmlands which amount for 50,006 km^2 as shown in Table 8-8 is almost half of them.

Table 8-8 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	7293.0	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	50.80	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.

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 favorable 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 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 the following table.

Table 8-9 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.

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 8-10.

Table 8-10 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)

(2) Livestock

In the Lake Kyoga basin, the livestock animals shown in Table 8-11 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.

Table 8-11 Livestock Production in Lake 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

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

Source: DWD

A index called Tropical Livestock Units (TLU) 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. The following table presents the carrying capacity of the available pasture lands in the districts of the Lake Kyoga basin estimated based on the UBOS statistics.

Table 8-12 Pasture Land and Carrying Capacity in Lake Kyoga Basin

District	Area of Natural Pasture (ha)	Carrying Capacity (ha/TLU)	Carrying Capacity (TLU)	District	Area of Natural Pasture (ha)	Carrying Capacity (ha/TLU)	Carrying Capacity (TLU)
Abim	368,414	1.55	237,686	Katakwi	158,226	0.98	161,455
Amolatar	118,595	0.80	148,244	Kayunga	96,951	0.72	134,655
Amuria	158,226	0.98	161,455	Kotido	491,219	1.55	316,915
Apac	158,127	0.80	197,659	Kumi	83,063	0.98	84,758
Budaka	32,525	0.98	33,188	Lira	288,079	0.80	360,099
Bududa	27,561	0.98	28,124	Luweero	264,703	0.72	367,642
Bugiri	55,238	0.86	64,606	Manafwa	38,347	0.89	43,330
Bukedea	83,063	0.98	84,758	Mayuge	77,870	0.86	91,076
Bukwa	39,068	0.86	45,694	Mbale	51,129	0.89	57,773
Busia	52,741	0.98	61,673	Moroto	789,810	1.55	509,555
Butaleja	37,191	0.86	43,499	Mukono	216,105	0.72	300,145
Dokolo	123,463	0.80	154,328	Nakapipirit	538,743	1.55	347,576
Iganga	80,788	0.72	112,206	Nakasongola	163,931	0.98	167,276
Jinja	45,918	0.72	63,776	Namutumba	55,238	0.86	64,606
Kaabong	368,414	1.55	237,686	Pallisa	48,340	0.86	56,538
Kaberamaido	82,667	0.98	84,354	Sironko	101,033	0.89	114,161
Kaliro	88,488	0.86	103,495	Soroti	167,669	0.98	171,091
Kampala	11,389	0.72	15,818	Tororo	86,780	0.86	101,497
Kamuli	247,760	0.86	289,778	Wakiso	115,700	0.72	160,694
Kapchorwa	113,782	0.89	128,567				

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

(3) Fishery

The fishery is also considered one of the important activities requiring the water resources in the basin. As shown in the Table 8-13, 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 3,281t in the basin.

Table 8-13 Fish Ponds and Production in Lake Kyoga Basin

Sub-basin	Area of Ponds (m^2)	Production of Talapia (t)	Production of Catfish (t)	Production of Carp (t)	Production of Nile Perch (t)	Production of Prawns (t)	Total Production (t)
(1) Okok	16,704	10.9	14.3	0.0	0.0	0.0	25.1
(2) Okere	65,490	20.1	30.2	0.2	0.0	0.0	50.5
(3) Awoja	160,488	72.9	118.3	7.3	0.0	0.0	198.5
(4) Lwere	51,271	27.9	59.1	1.4	0.0	0.0	88.3
(5) Akweng	161,651	67.6	81.9	2.8	0.0	0.0	152.3
(6) Abalan	111,833	124.5	158.5	0.8	0.0	0.0	283.8
(7) Kyoga	234,447	92.1	144.9	0.5	0.0	0.0	237.6
(8) Mpologoma	576,500	408.5	599.3	9.9	0.0	0.0	1,017.7

(9) Lumbuye	96,784	75.7	101.6	0.0	0.0	0.1	177.4
(10) Victoria Nile	475,840	202.3	287.4	0.6	0.0	1.3	491.6
(11) Sezibwa	529,515	238.3	317.7	1.5	0.4	0.0	557.9
Total	2,480,523	1,340.9	1,913.2	25.1	0.5	1.4	3,281.0

Source:

8.2.3 Industrial Water Supply

The extraction of water either groundwater or surface water has to be implemented subject to the permission by the DWRM. Tables 8-14 present the organizations which have been permitted by DWRM in the basin as of 2006. The permission for the industrial water is less.

Table 8-14 Permitted Water Abstraction as of 2006

District	Name	District	Name
1. Groundwater			
Apac	Pope Johns Hospital-Aber	Mukono	Namilyango College - ZAKALIA
	Loro Army Baracks		Bulamogi Sky Investments Ltd.
Bugiri	Bugiri Town Council		Seven Falls Beverages Limited
	Igloo Food Industries Ltd.		Rwenzori Beverages Co., Ltd.- Namanve
Iganga	Bukoona Mixed Farm		Rwanzori Beverages Co., Ltd.-Goma
	Haji Anuar Butt		Rwanzori Beverage Co., Ltd. - Natabulirwa
	Bank of Baroda		Namilyango College - LWEMBAWO
	Iganga Town Council		Mt. St. Marys Secondary School, Namagunga
	Iganga Town Council		Coffee Research Center, KITUZA
	Iganga Town Council		Nkokonjeru Town Council
	Iganga Town Council		Dott Services Ltd
Jinja	Jamia Mosque		Tembo Steels (U) Ltd.
	Marine & Agro Export Processing Ltd .	Soroti	Saimmco Ltd.
	Gomba Fishing Industries Ltd.	Tororo	Tororo Cement Industries Ltd. (CD 598)
	Seven Falls Beverages Company Limited		Tororo Cement Industries Ltd. (CD 592)
	Kengrow Industries Limited		Benedictine Monastry Tororo
	Nile Agro Industries Limited		Tororo Cement Industries Ltd. (CD 4198)
Kamuli	Balawoli Cotton Ginnery Ltd.		Benedictine Monastery, Tororo
	Marias Care	Wakiso	Muyomba Dairy Farm Lrd.
Kotido	Verona Fathers Loyoro Mission - Kotido Diocese		Kakiri Subcounty Local Council
	Uganda WildlifeAuthority, Kidepo V. National Park		Kakiri Subcounty Local Council
Kumi	Kumi Town Council		Kakiri Subcounty Local Council
	Kumi Town Council		Cementers Limited
	Kumi Town Council		Cementers Limited
	Kumi Hospital		Rafiki Foundation Uganda
Lira	Verona Fathers		All Nations Theological College (ANTC)
Mbale	Uganda Klere Industries Limited		Wagagai Limited
Moroto	Co-operation and Development Africa Mission		Wakiso Town Council 2
	St. Kizito Hospital Matany		Wakiso Town Council
2. Surface Water			
Busia	Igloo Food Industries Ltd.	Mukono	Van Zanten Uganda Limited
Jinja	Kakira Sugar Works (1 985) Limited		Sugar Corporation of Uganda Limited
	NWSC - Jinja		MERENA Estates Ltd (Jjaja Tereza Water Service)
	Steel Corporation of East Africa Limited		Merena Estates Limited
	AES Nile Power Limited		Eskom Uganda Ltd.
	Eskom Uganda Ltd.		Water, Environment & Geo Services Ltd.
	Gomba Fishing Industries Limited		Liao Ning China Middle East Paper Co. .(U) Ltd.
	Gomba Fishing Industries Limited		Sai Farms Limited
	BIDCO Uganda Limited, Plot 4B Mabua Road		Uganda Crop Industries Ltd
Kamuli	Kamuli Town Council	Sironko	MTL - Mam Traders Limlted
	Balawoli Cotton Ginnery Ltd.	Soroti	Soroti Municipal Council
Lira	NWSC - Lira	Tororo	NWSC - Tororo
Mbale	NWSC - Mbale	Wakiso	Kajjansi Roses Limited
	NWSC - Mbale		Ngege Ltd.
Mukono	Son Fish Farm		Melissa Flowers Ltd.
	Mount St. Mary's Secondary School, Namagunga		Wagagai Ltd.
	Makerere University, Mechanical Engineering Dept.		Imperial Resort Beach Limited
	Nile Breweries Limited		Uganda Wildlife Education Centre
	Nyiil Picfare Limited		Venos Farm Limited

Source: DWRM

8.3 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 the following table.

Table 8-15 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	4.600	23
Soroti	4	3,000	8
Tororo	5	2,000	19

Source: 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

The improvement of sanitation and hygiene conditions is important to reduce poverty and improve the quality of life in the rural areas. This will lead to a reduction in water and hygiene related diseases and contribute to a better health standard in the population. 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 8-8.

Table 8-16 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
Kaabong	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

8.4 Operation and Maintenance of Water Supply System

8.4.1 Water Supply System and O&M Organization

(1) Organization of Water and Environmental section in Uganda

Organization structure of National Level, District Level and Community Level for the water and environmental sector in Uganda is shown in Figure 8-1 in Chapter 8. The roles relating to the operation and maintenance of water supply system in each level are as follows.

- National Level

  The Ministry of Water and Environment (MWE) 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.

  The other ministries such as the Ministry of Health (MOH) and the Ministry of Education and Sports (MOES), etc., are engaged in the water and environment administration in their own fields.

- District Level

  Local Governments (Districts, Town Councils, sub-Counties) are empowered by the Local Governments Act (2000) to provide water services and manage the Environment and Natural Resource base. The District Water Offices manage water and sanitation development and oversee the operation and maintenance of existing water supplies in the District.

- Community Level

  Communities are responsible for operating and maintaining rural water supply and sanitation facilities. A water user committee (WUC) should ideally be established at each water point.

(2) Water Supply System and O&M Organization

Water supply system and O&M organization in each area are shown in Table 8-17. Water supply facilities in the rural area are mainly point water sources and operated and maintained by the communities, except those for RGCs with small scale of water supply system with pipeline and pumps. Water supply facilities in the small towns in urban area are mainly water supply system with pipeline and operated and maintained by the private operators, with some exceptions. In large towns NWSC operates and maintains the large scale of water supply systems.

Table 8-17 Water Supply System and O&M Organization

Area		Population	Type of Water Supply System	O&M Organization of the Facilities[*1]
Rural	Village	Less than1,500	Point Water Source ・Borehole with hand pump ・Shallow well ・Protected spring ・Gravity flow scheme Tap ・Rain water tank	Water User Community or Water User Group (WUC[*1]or WUG[*2]): The whale community served by the individual point water facility
				Water and Sanitation Committee (WSC[*3]): Acompetent WSC of about 6 people elected by the WUC
				Water User Association (WUA[*4]): In case of many WUC/WCG being served by one water source (like a GFS), the WSCs come together to form a WUA, who in turn can select/elect the Central Committee (like a WSC) to O&M the whole scheme.
	Rural Growth Center (RGC)	1,500～5,000	Point Water Source	Same the above
			Small scale of Water Supply System with pipeline and pumps.	Private Operator under the DWO[*5]and Sub-County Water Authority (Board)
Urban	Small Town	5,000～15,000	Water Supply System with pipeline and pumps	Town Board Water Supply Offce
				Private Operator under the Town Water Authority
	Large Town	More than 15,000	Large Scale Water Supply System	National Water and Sanitation Corporation (NWSC)

*1 Water User Community, *2 WUG: Water User Group, *3 WSC: Water and Sanitation Committee, *4 WUA: Water User Association, *5 DWO: District Water Office

8.4.2 O&M in Rural Water Supply System

The National Water Policy (1999) provides for user ownership and management of rural water and sanitation facilities as a sustainability strategy. This is promoted through the Community Based Maintenance System (CBMS) as the most appropriate management option where the users take full responsibility over management and maintenance of their facilities.

(1) Organizations related to CBMS

In the CBMS the Communities should take responsibility for O&M of their facilities as shown in Table 8-17. At the same time, organizations of the local governments and the central government in charge of rural water supply should undertake their duties to pursue a sustainability of the facilities and improvement of the water supply ratio.

Moreover, Development Partners, NGO・CBO and Private Sector are providing funds, technical assistance, training, supply of spare parts and repair etc. to support the smooth management of the rural water supply system. Table 8-18 shows the related organizations and their duties. Work items and relation of each organization are shown in Figure 8-9.

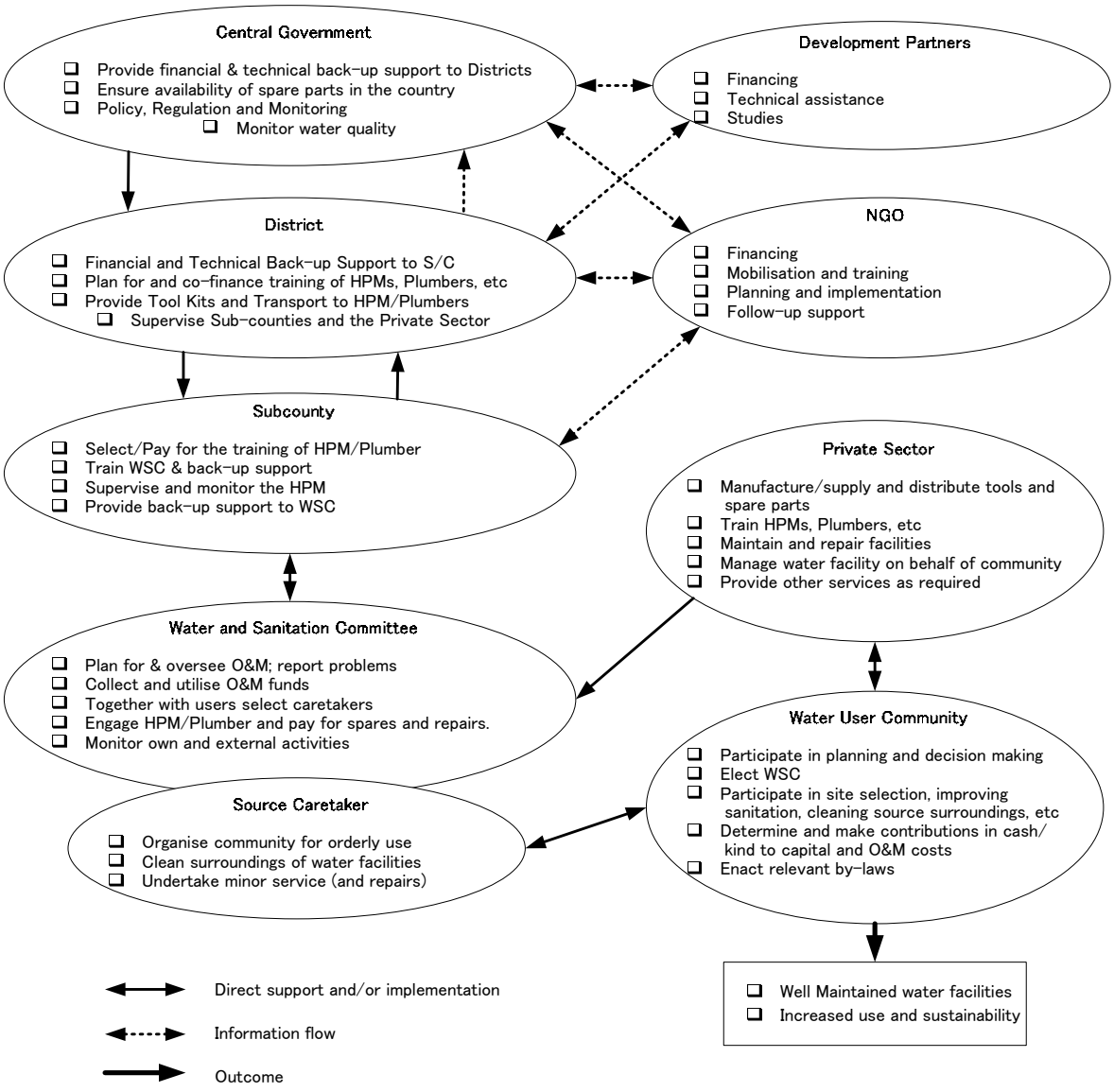


Figure 8-9 Work Items and Relation of each Organization

Table 8-18 Organizations in CBMS and their Duties

Organization	Duties
Central Government	Government prepares the overall policy framework, legislation and guidelines under which the sector operates. Central government here refers to the line Ministry (MWE/DWD) and other sector relevant Ministries responsible for Health, Gender, Agriculture, etc. The Central government coordinates funding, training, supply of inputs and implementation. It is responsible for ensuring that policies are followed, and approaches used contribute towards the attainment of sector objectives. It should therefore monitor the performance and functionality of the water facilities nationally, and take the necessary remedial action. MWE/DWD also contributes towards the costs of major repairs beyond community capacity.
District	The District provides back-up support and technical guidance to Sub-Counties in planning and budgeting, implementation and monitoring of their work plans. It should also budget for co-funding of major repairs as part of the planning process. Where the need for major repairs arises the District should provide the required guidance and supervision, and also play a key role in ensuring established standards for O&M are maintained. The District is also responsible for routine water quality monitoring (after construction) to assess its suitability for consumption. It is also responsible for monitoring the performance of O&M and taking relevant actions to address shortcomings with support from DWD.
Sub-County	The Sub-County is a body corporate, and has a mandate to plan and oversee implementation of development programs. Therefore they should prepare plans and budgets incorporating O&M aspects. The O&M budget should provide for follow-up support and co-financing of major repairs. They can also supervise the private sector carrying out training and monitoring of O&M.
Community	The community is responsible for management and maintenance of their water facilities.Preventive maintenance and repairs, and payment of required funds. Each community should select a competent WSC and Care-takers to guide their participation.The mode of community involvement is dictated by the type of community and the type of water supply system.
Development Partners	Development partners support the government in improving the safe water and sanitation coverage. They provide funding and technical assistance directly to government programs and through other agencies, and also offer support in studies to assess performance of different aspects of the sector, with a view to improvement. All support should be coordinated with government.
NGOs and CBOs	Several NGOs and CBOs are involved in the water and sanitation sector. They have useful roles to play as partners in mobilization, training, planning, follow-up support and other activities, being already established in communities.
Private Sector	The role of the private sector is to support the communities in carrying out any activities beyond their capability. HPMs, masons and plumbers carry out maintenance and repair work, and are paid by the communities. Private firms manufacture, supply and distribute inputs and spares, and undertake major repairs. PSOs can also undertake community mobilization and training. They can also manage point or small piped water supplies on behalf of the users, particularly in RGCs.

Source: ”A National Framework for Operation and Maintenance of Rural Water Supplies”

(2) Maintenance items

As shown in Table 8-19 maintenance of water supply facilities consists of daily inspection/ maintenance and repairs. Repairs are divided into minor and major repairs; minor repairs contains those of minor cracks and leaks etc. other than daily services, and major repairs include replacement of major components of the facilities. Communities are responsible for the daily inspection / maintenance and minor repair of their water facilities. With good routine maintenance the need for repair is normally minimal, and where it occurs the costs are relatively low.

Table 8-19 Maintenance Items for Each Water Supply System

Type of WSS	Daily inspection / Maintenance	Minor Repair	Major Repair
Borehole (with hand pump)	・ Clearing drains and surroundings ・ Maintaining fence. ・ Checking of handpump. ・ Periodical replacement of fast wearing parts (buckers, valves, etc)	・ Repair of damaged parts outside routine service. ・ Replacement of damaged slow wearing parts (handle, chain, few pipes and/or rods, cylinder). ・ Repair or cracks to platform or drain.	・ Fishing of dropped pipes and rods. ・ Desilting of borehole. ・ Repairs to borehole casing and screens. ・ Replacement of platform and drain. ・ Replacement of rising mains.
Protected Spring	・ Cleaning Intake area, drains and surroundings. ・ Maintaining fence.	・ Repair or cracks to retraining wall, platform or drain.	・ Re-protection (due to diversion or major failure)
Gravity Flow Scheme	・ Cleaning Intake area, drains and surroundings. ・ Maintaining fence(s). ・ Periodical checking of components for proper functioning. ・ Periodical replacement of fast wearing parts (taps, etc).	・ Repair of minor leaks in structures or components. ・ Repair of pipe bursts.	・ Rebuilding of intake works or other major structures. ・ Replacement of long pipeline sections damaged by landslides, etc.
Pumped and Piped Scheme	・ Cleaning intake area, drains, fence and surroundings. ・ Checking of pump.	・ Repair of minor leaks in structures or components. ・ Repair of pipe bursts.	・ Rebuilding of intake works or other major structures. ・ Replacement of long pipeline sections damaged by landslides, etc.

8.4.3 Constraints on O&M of Rural Water Supply

(1) Technical Capacity and Staff Deployment

Table 8-20 shows the present status and constraints of O&M organizations with regard to technical capacity and staff deployment, stated in the “Strategic Investment Plan for the Water and Sanitation Sub Sector (MWE, July 2009)”. During the site surveys in some Districts by the study Team, daily maintenance works by the staffs of WSCs at the Point Water Sources shown in the Table 8-19, such as Cleaning intake area and checking of pumps etc, were found to be inadequate. Training the staffs of WSCs and back up supports by Sub-counties and DWOs are required. Although not indicated in Table 8-20 it was found that in some DWOs staffs required had not been deployed yet and daily works could not been conducted sufficiently because of failure of necessary equipment such as computers etc. Capacity building and staff deployment including necessary equipment in other organizations engaged in O&M of water supply facilities are also considered to be required.

(2) Funding for O&M

At the point water sources, users usually take the water without tariff. And at the time of Minor Repair shown in Table 8-19, WSC collects the fee from users if required. Major repairs and extensions of the scheme are sometimes not affordable to the local community. Funding for them should come from outside, that is the local/central Government.

As for the water supply schemes with pipeline and pumps for RGCs. It was found in the field survey that the private operator is not able to supply the water to the users continuously but intermittently because they do not pay the electricity charge due to lack of operation fund, and the users are returning to the old point water sources they used previously.

Thus the O&M fund is inadequate in both point water sources and water supply schemes in RGCs. Therefore as measures to solve the O&M fund constraints, there are the following alternatives at present.

1) Umbrella Organizations (UOs)

Umbrella Organizations were constituted as regional organizations in three regions. “The South Western Umbrella of Water and Sanitation (SWUWS) was set up to give back-up support to water authorities and water supply boards for RGCs and small towns in operation and maintenance (O&M)”. It was constituted in 2002 as an association of the local Water Supply and Sanitation Boards, and currently provides support for piped water supply schemes in seven Districts. The SWUWS carries out the role for the member towns as follows:

- Water quality monitoring, supplying spare parts to members, locating spare-parts suppliers
- Providing technical backup support, regular monitoring inspections for the member schemes and reporting to DWD

However it requires a subsidy in the form of grant financing from the Austrian Development Cooperation (ADC) which is channeled through the Joint Partnership Fund in DWD. This implies that the SWUWS in its present form cannot exist without support from the ADC.

The other two Umbrella Organizations, the Eastern Region and Mid-Western Region have just been set up. The Study on these organizations will be required.

Table 8-20 Present Status of O&M Organization

Organization	Role	Present Status	Links	Staffing	Major Constraints
Technical Support Units (TSU)	Capacity building support to DWO for facilitating O/M of rural system	Inadequate resources to fully support the implementation of the CBMS	DWD Districts	Knowledge and skills adequate	Capacity to adequately cover the new districts
Districts (DWO)	Support to management of RGC system and village committees for point sources	Inadequate priority and resources for implementation of the CBMS	DWD Sub-counties Communities Private sector	Inadequate capacity at LG and community levels	Inadequate support to CBMS in both parishes and RGCs
Sub-counties/water Authorities	Supporting formation and functioning of Water and Sanitation Committees to solve management issues and problems. Function as Water Authorities for RGCs systems	Working but limited resources for facilitating the support to water committees and managing RGCs	Water & Sanitation Committees Districts Private Operators	Limited technical capacity	Inadequate support to parishes Technical capacity to manage RGCs
Communities (WSC)	Management, operation and maintenance of point sources and RGCs	Working but limited technical capacity for efficient O&M. Bottlenecks in spare-part supply chain	Parish/Sub-county Private Operators Water Users	Inadequate knowledge and skills in water, sanitation and hygiene	Limited technical capacity affect effective O&M
Private Sector	Operation of water supply schemes through contracts with Water Authorities	Work but some constrains by technical skills and inadequate financing due to delayed Water Authority payments and release of subsidy to nonviable schemes	Sub-counties Districts DWD Water Users	Limited planning and technical skills	Spare-parts and supplies in rural areas Limited planning and technical capacity of local private Operators
NGOs, CBOs	Training and support to communities in O&M	Need to harmonies approach of different NGOs in communities	Districts Sub-counties Communities		Need to anchor NGO activities in LG structures for sustainability

2) Town Cluster Operators

In the "Long-term strategy for Investment Planning, Implementation and Operation & Maintenance of Water Supply and Sanitation in Rural Growth Centres" (May 2005, DWD), the following recommendation is shown.

"The main approach will be that the WSC hires a Local Private Scheme Operator (SO) for the operation and maintenance of the scheme. The SO will do the day-to-day operation and maintenance. In the Small Town Strategy it is recommended that O&M for small town is contracted to private Town Cluster Operators. For RGCs it is recommended that O&M for RGCs that will develop into small towns in the near future are included in the clusters for small towns. The chosen technology for those RGCs will be more similar to small towns and the RGCs will benefic from the "economies of scale"

The concept of "CLUSTER" has just been started by IFC (International Finance Corporation) : this means that a few Towns join together to form the "CLUSTER" and one Private Operator is then allowed to bid for O&M for all these Towns under the "CLUSTER". There is a chance that the Private Operator can charge smaller fees for the Operation and Management and some balance remains for Maintenance (repairs, rehabilitations and replacements).

CHAPTER 9 WATERSHED MANAGEMENT AND FLOOD CONTROL

In this chapter, the first section describes general matters of existing conditions regarding watershed management and flood control in Lake Kyoga Basin, which includes conditions of past disasters, land cover and vegetation conditions, surface water use facilities, flood control facilities, and sharing of water resources with neighboring countries. Then, subsequent sections mention two topics considered to be particularly important for formulating the basic plan, which are runoff characteristic of the basin and characteristic of past flood, and deforestation condition and characteristic of disasters in hilly and mountainous area of the upstream of the basin.

9.1 Existing Conditions of the Basin

9.1.1 Water-Related Disasters

Table 9-1 shows the list of water-related disasters which occurred in Lake Kyoga Basin or included Lake Kyoga Basin in affected area. The table has been basically compiled from the data of EM-DAT: The OFDA/CRED International Disaster Database, and are added data of large-scale disaster in 2010 to. While this database contains the data of major disasters in the world since 1900, records of food and landslide disasters in Uganda are included in the database only since 1997.

Figure 9-1 to Figure 9-3 show location and frequency of flood, drought and landslide disaster by district. 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 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.

It is indicated that water related disasters in Uganda are relevant to El Nino and La Nina[1]. According to that, during an El Nino year chances of intense flood level rains are increased during the period October to December over most parts of the country. On the other hand during a La Nina year chances of drought conditions are increased. In recent years, El Nino occurred in 1997-1998, 2002-2003 and 2009-2010, and La Nina occurred in 1998-2000, 2005-2006 and 2007-2008. Although some floods such as 2007 severe flood have occurred independently of El Nino, El Nino and La Nina can be used as one of indication for disaster preparedness and response since floods or droughts has occurred with high probability during and around El Nino or La Nina year.

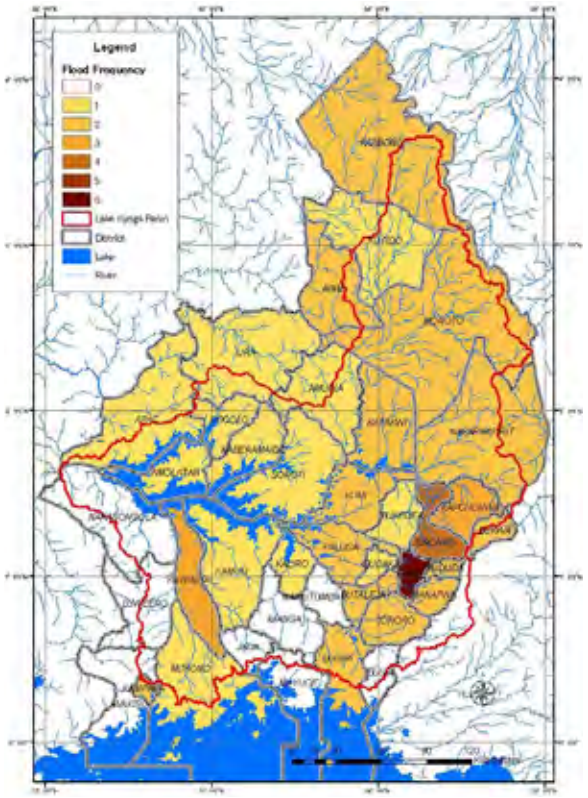
[1] Uganda National Water Development Report 2005 (Chapter 9), 2006, World Water Assessment Programme

Table 9-1 List of Water-Related Disasters Relevant to Lake Kyoga Basin

No.	Start Date	End Date	Location	Damages		
				No. of Killed Person	No. of Total Affected Person	Est. Damage (US$ Million)
Flood						
1	14/11/1997	28/11/1997	*Bundibugyo, Kabarole,* Tororo, Mbale, Pallissa, Bugiri *and Nebbi* Dist.	100	153,500	1
2	31/07/1998	31/07/1998	Lake Kyoga	0	15,200	-
3	30/03/2002	30/03/2002	Kangulumira (Kayunga district)	0	100	-
4	26/04/2002	28/05/2002	Mbale, Sironko, *Bundibugyo,* Kapchorwa, *Buhweju* districts	17	760	-
5	21/04/2003	04/06/2003	Mbale, Bugiri district	5	1,500	-
6	01/07/2003	03/07/2003	Mbale area	20	700	-
7	12/08/2006	21/08/2006	Bumufuni parish (Bunambutye sub-county, Sironko district), Kapkwot parish (Ngenge sub-county, Kapchorwa district)	3	1,680	-
8	23/10/2006	19/12/2006	Kumi, Kayunga, Mukono, *Kabale, Kisoro,* Butaleja, Kaliro, Kampala areas	0	4,000	-
9	15/08/2007	31/10/2007	Amuria, Bukedea, Kaberamoido, Katakwi, KUli, Soroti (Teso sub-region), *Amuru, Gulu, Kitgum, Paer (Acholi region),* Amolatar, Apac, Dokolo, Lirea, *Oyam* (Lango sub-region), Abim, Kaabong, Kotido, Moroto, Nakapiripirit (Karamoja region), Bududa, Bukwo, Kapchorwa, Mbale, Manafwa, Sironnko (Elgon region), *Adjumani, Arua, Moyo, Nebbi, Yumbe (West Nile region), Kiboga,* Kamuli (Centram Uganda)	29	718,045	0.071
10	15/11/2007	18/11/2007	Kampala city	4	3,000	-
11	17/11/2008	17/11/2008	*Adjumani, Moyo districts (West Nile region)*, Nakapiripirit, Moroto, Kaapong, Abim districts (Karamoja region), *Kiboga*, Kayunga districts (Central region), *Kasese (Western Uganda)*	49	30,040	-
12*	Feb./2010	Apr./2010	Bududa, Butaleja, Katakwi, Mbale, Manafwa, Sironko, Budaka, Pallisa, Bukwo, Tororo, *Bundibugyo, Kasese, Kabarole, Kisoro, Kabale*	-	over 33,000 households	-
Drought						
1	00/01/1967	00/00/1967	Karamoja	0	25,000	0.2
2	00/00/1979	00/00/1980	Karamoja	0	500,000	-
3	00/12/1987	00/00/1988	Karamoja, Northwestern	0	600,000	-
4	00/08/1999	00/00/2001	Northern Karamoja District	115	700,000	-
5	00/06/2002	00/00/2002	Karamoja region	79	655,000	-
6	00/03/2005	00/03/2006	Kalapata, Nyakwae (Kotido district), Rupa, Nadunget (Moroto district), Karamoja region	0	600,000	-
7	00/07/2008	00/11/2008	Nakapiripi, Kodito, Abim districts (Karamoja, North-East)	0	750,000	-
Landslide (Mass movement wet)						
1	23/11/1997	23/11/1997	Mbale Region	20		-
2*	01/03/2010	01/03/2010	Bukalasi and Bulucheke Sub-County (Bududa district)	about 350 incl. missing	about 4,000	-

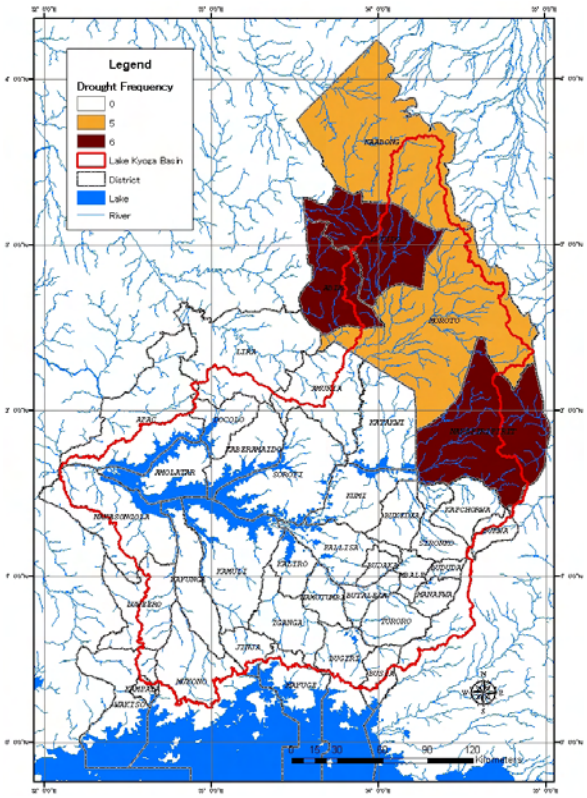
Source: EM-DAT: The OFDA/CRED International Disaster Database

* Floods Operation Update by Uganda Red Cross Society, Situation Report by UNOCHA,



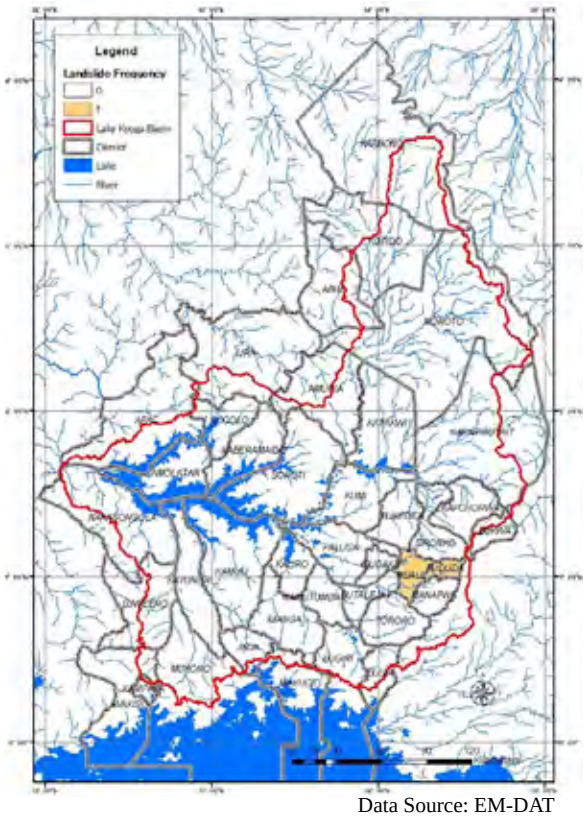
Data Source: EM-DAT

Figure 9-1 Flood Frequency



Data Source: EM-DAT

Figure 9-2 Drought Frequency



Data Source: EM-DAT

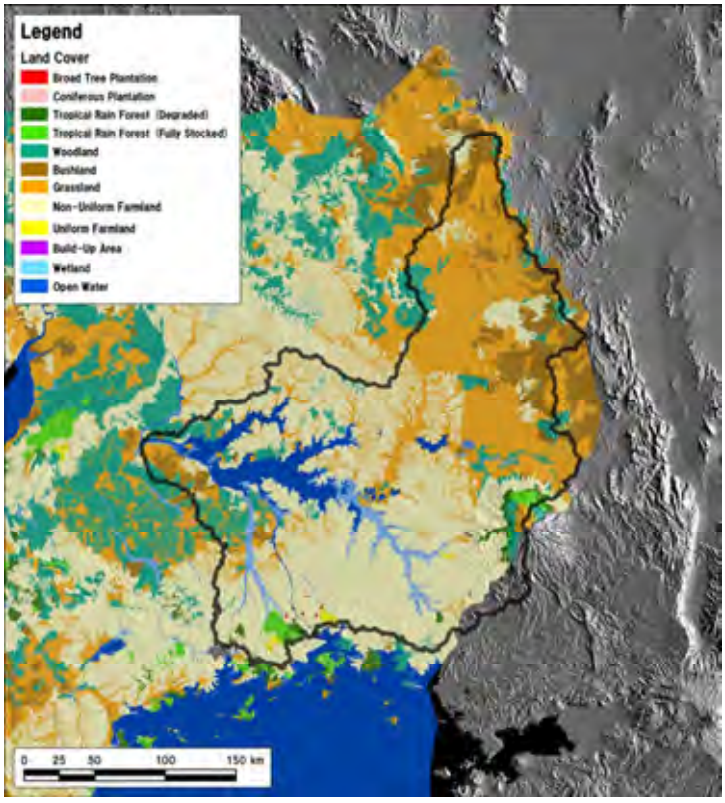
Figure 9-3 Landslide Frequency

9.1.2 Land Cover (Landuse) and Vegetation

(1) Land Cover/Use Conditions in Lake Kyoga Basin

The land area of Uganda excluding water is about 205 thousands km^2, out of which 49 thousands km^2 (about 24%) is covered by forests (plantations and tropical high forests) and woodland. 13 % of the land area (about 31 thousands km^2) is under protected areas owned and managed by the Forest Department (5%) and Uganda Wildlife Authority (8%), and the balance (87%) is under private ownership. In the protected areas mainly consisting of Forest Reserves, Game Reserves and National Parks, forestland comprising of plantations, tropical high forests and woodland is most extensive (47%), followed by grassland (37%)[2].

Land cover in Lake Kyoga Basin is shown in Figure 9-4 and Table 9-2. Sum of forests and woodland is 8.5% as one third of the value of Whole Uganda, and glassland and small-scale farmland are 28.5% and 45.8% respectively, which are about 8% higher than the values of Whole Uganda. As shown in Figure 9-4, central part of the Lake Kyoga Basin is widely covered by small-scale farmland and most part of Karamoja region is covered by glassland. Forests spread only in some parts of vicinity of the Basin boundary of northern, eastern and southern parts, and around Lake Kyoga in western part of the Basin.



Source: GIS data of National Biomass Study (1996), Forest Department

Figure 9-4 Land Cover in Lake Kyoga Basin

[2] National Biomass Study Technical Report, November 2003, Forest Department, Ministry of Water Lands and Environment

Table 9-2 Land Cover in Whole of Uganda and Lake Kyoga Basin

No.	Land Cover	Uganda [i)]		Lake Kyoga Basin [ii)]	
		Area (km^2)	Percentage	Area (km^2)	Percentage
1	Broadleaved Tree Plantation or Woodlot	35.2	0.0	28.7	0.1
2	Coniferous Plantation	162.2	0.1	24.0	0.0
3	Tropical High Forest (Fully Stocked)	7,263.7	3.0	497.3	0.9
4	Tropical High Forest (Degraded / Encroached)	2,239.1	0.9	435.7	0.8
5	Woodland	38,417.2	15.9	3,817.6	6.7
6	Bushland	12,550.6	5.2	4,263.4	7.5
7	Grassland	49,455.8	20.5	16,293.7	28.5
8	Wetland	3,866.7	1.6	2,126.1	3.7
9	Small-Scale (Non-Uniform) Farmland	89,495.0	37.0	26,161.6	45.8
10	Uniform or Large-Scale Farmland	346.6	0.1	179.6	0.3
11	Build-Up Area	262.2	0.1	56.2	0.1
12	Open Water	37,503.7	15.5	3,220.4	5.6
	Total	241,598.3	100.0	57,104.5	100.0

Source: i) GIS data of National Biomass Study (1996), Forest Department, ii) JICA Study Team

(2) Conditions of Deforestation and Degradation of Forestry

In Uganda, 26.3% of forest cover has disappeared between 1990 and 2005, which is worst seventh in the World[3]. Although about 12 thousands km^2 of the land is stipulated as Forest Reserves, forests have been deforested and degraded even in Forest Reserves. Deforestation is more in Local Forest Reserve than in Central Forest Reserves[4].

Table 9-3 summarizes conditions of deforested and degraded area in Forest Reserves of which whole or part are included in Lake Kyoga Basin. 8.0% and 4.5% of forests has been deforested and degraded in Central Forest Reserves in the Basin though the ratio of deforestation and degradation in Forest Reserves in the Basin is lower than the ratio of whole Uganda.

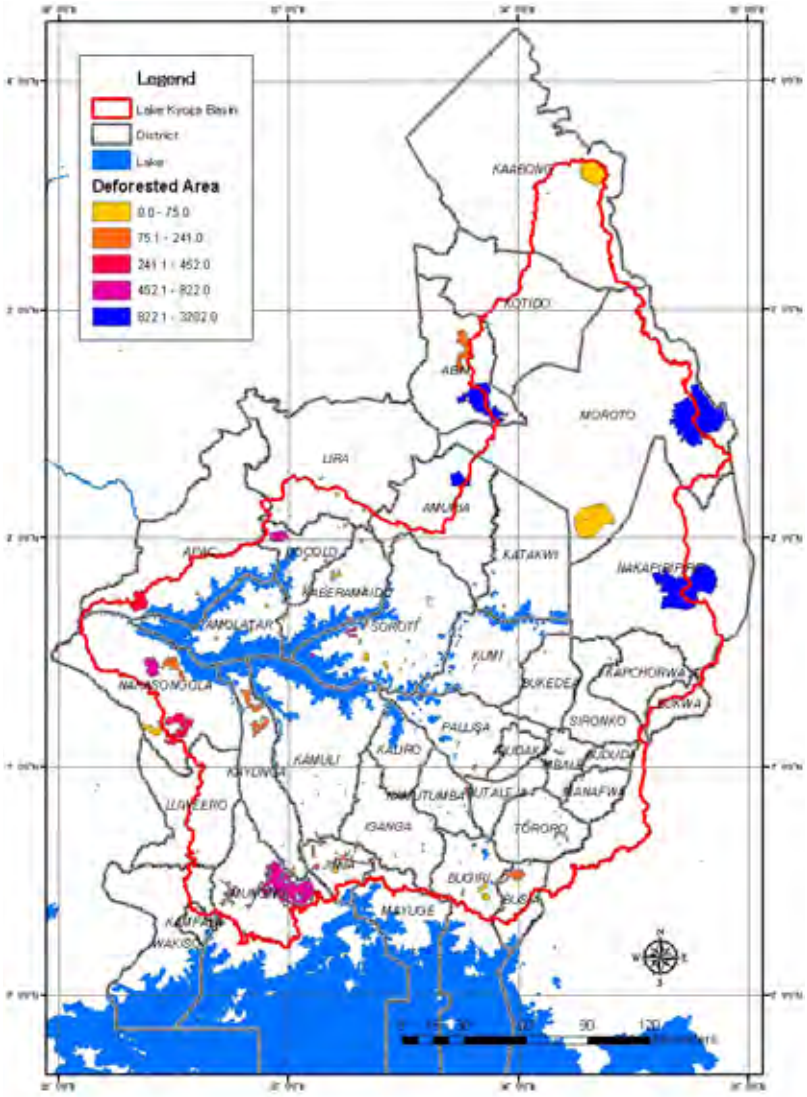
Table 9-3 Deforested and Degraded Area in Forest Reserves

	Total Area (km^2)	Deforested Area (km^2)	Deforested Ratio (%)	Degraded Area (km^2)	Degraded Ratio (%)
Central Forest Reserve (Uganda) [i)]	11,737.5	1,050.5	8.9	578.9	4.9
Central Forest Reserve (Lake Kyoga Basin) [ii)]	2,581.6	207.6	8.0	116.4	4.5
Local Forest Reserve (Uganda) [i)]	49.6	21.5	43.3	2.4	4.8
Local Forest Reserve (Lake Kyoga Basin) [ii)]	18.4	7.1	38.6	0	0

Source: i) National Biomass Study Technical Report, November 2003, ii) JICA Study Team

The area of deforestation in Forest Reserves in the Basin is shown in Figure 9-5. Large deforested area in northern part and eastern part of the Basin (in Abim, Moroto and Nakapiripirit districts), which are indicated in blue color, are located in mountain area.

[3] The New Vision, Friday, May 6, 2009
[4] National Biomass Study Technical Report, November 2003, Forest Department, Ministry of Water Lands and Environment



Data Source: National Biomass Study Technical Report, November 2003

Figure 9-5 Deforestation Conditions of Forest Reserve

9.1.3 Surface Water Use Facilities

(1) Earth Dam and Valley Tank

There are many small earth dams and valley tanks mainly for livestock and domestic use in Lake Kyoga Basin.

Their design capacities have very wide range. Capacities of small earth dams are from 1,300m^3 to 2,090,910 m^3, and those of valley tank are from 600 m^3 to 90,000 m^3. 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. For example, among ten (9) small earth dams in Kumi district, of which detailed information was obtained from district water officer, two (2) of them have entirely lost their function by silting and eight (8) of them have only partially functioned.

Small earth dams and valley tanks have not only water supply function but also flood control function, therefore, their capacities shall be enhanced by new construction and/or rehabilitation of exiting facilities.

(2) 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 generated in these two stations[5,6]. 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. The table below shows the list of potential sites and Figure 9-6 shows locations of identified sites and districts where potential sites exist.

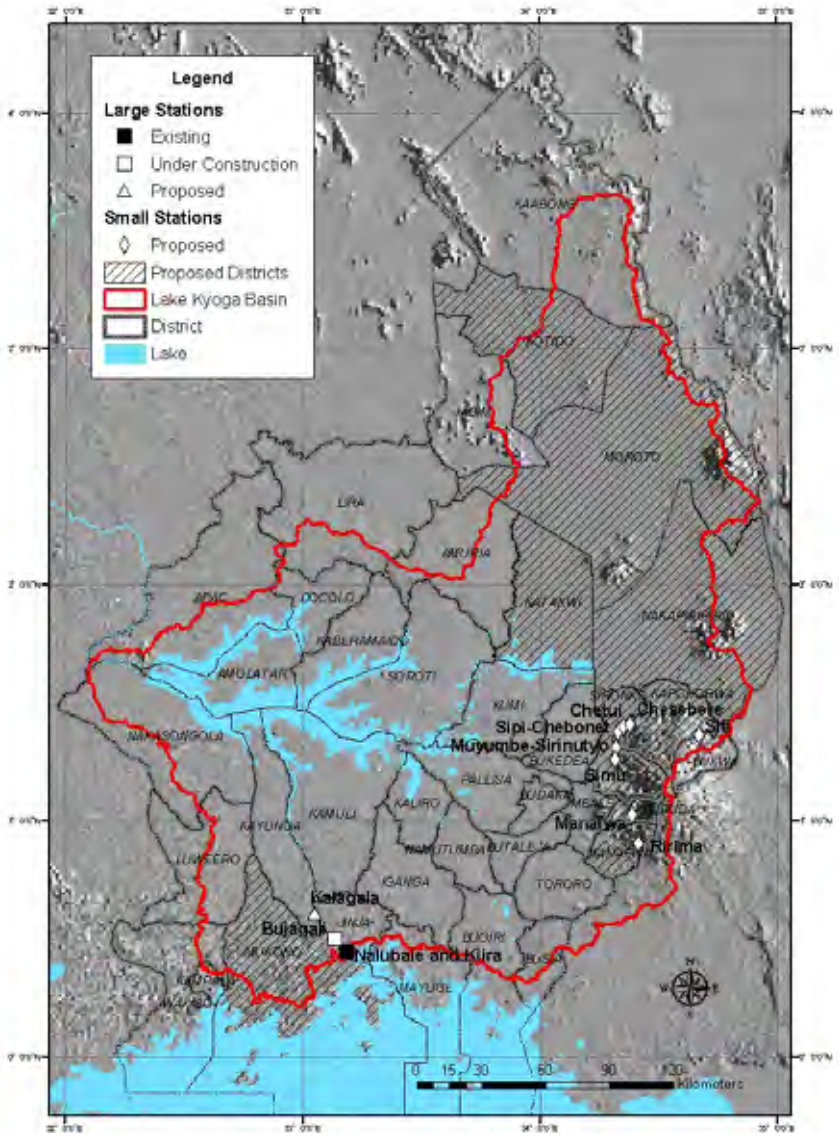


Figure 9-6 Locations of Existing and Planned Hydropower Stations

[5] Uganda National Water Development Report 2005 (Chapter 8), 2006, World Water Assessment Programme
[6] The Renewable Energy Policy for Uganda 2007, Ministry of Energy and Mineral Development

Table 9-4 Proposed Sites of Small Hydropower Stations in Lake Kyoga Basin

No.	Site	District	Capacity / Potential (Mw)	Remarks
Study has been undertaken				
1	Dirigana	Sironko	0.35-0.45	Feasibility study has been undertaken
2	Muyembe-Sirinutyo	Sironko	2.6	Project has been stalled. Permit is expired.
3	Sipi-Chebonet	Kapchorwa	2.5	Pre-feasibility study has been done. Permit is expired.
4	Siti	Kapchorwa	3.3	Pre-feasibility study has been done. Permit is expired.
5	Ririma	Manafwa	1.2	Permit is expired.
6	Sezibwa	Mukono	0.5	-
Site is uncommitted / Developers are undecided				
7	Simu	Sironko	0.5	-
8	Chesebere	Kapchorwa	1.1	-
9	Chetui	Kapchorwa	1.1	-
10	Manafwa	Bududa	0.75	-
11	From Mt. Kadama	Nakapiripirit	-	-
12	Kanyagareng	Nakapiripirit	-	-
13	From Nangeya Mountains	Kotido	0.225	-
14	Kalere	Kotido	0.44	-
15	From Mt. Moroto	Moroto	0.65	-
16	Okok	Katakwi	0.5	-

Source: 1) Annual Rural Electrification Report for the period July 2006 to June 2007, The Rural Electrification Agency (REA),
2) The Renewable Energy Policy for Uganda 2007, Ministry of Energy and Mineral Development

9.1.4 Present Conditions of Flood Control Facilities

There are no large scale flood control facilities in Lake Kyoga Basin except small earth dams and valley tanks mainly for livestock and domestic use. Regarding rainfall observation system, twenty-four hour rainfall data from 14 climate stations around the country (among them, four (4) are in or adjacent to Lake Kyoga Basin: Jinja, Soroti, Lira and Tororo) are reported daily by voice radio and telephone, and weather radar at Entebbe Airport has a range of 384km and covers the entire country although the radar has not been functioning as of July 2009. However, a quantitative weather forecasting model is still preparing, and flood forecasting and warning system including real-time reporting and analyzing water level and discharge data is not developed at all.

As for project relevant to flood, the works funded by Egypt has been implemented for removing floating weeds and floating vegetated islands in outlet of Lake Kyoga. Also, works for heightening of roads and installation works of cross drainages have been implemented in main road such as Kumi-Soroti road since cutoff of transportation network particularly road network was a severe problem in 2007 flood. The works will contribute to securing evacuation place, evacuation route and transportation means for commodities in emergencies.

9.1.5 Transboundary Setting of Uganda's Water Resources related to Lake Kyoga Basin

Lake Kyoga Basin is a part of River Nile Basin, then its management and development shall be

restrained by legal framework of River Nile Basin.

(1) Legal Framework for the Sustainable Management of the Nile Waters

Treaties regarding the management of the waters of the Nile Basin date back to 1929 when Great Britain and Egypt signed an agreement under which no irrigation, power works or other measures were to be constructed or taken on the Nile and its branches or on lakes from which it flows in the Sudan or in countries under British administration except with the previous agreement of the Egyptian government. The Agreement was followed by the 1959 Agreement on the Full Utilization of the Nile Waters, which was signed between Egypt and Sudan. The 1959 Agreement apportions the waters of the Nile between the two signatory states.

Given the new political dispensation in the Nile basin, the Nile Basin countries, in 1995, embarked on the process of negotiating and developing a new Nile Basin Cooperative Framework Agreement for the sustainable management and development of the shared Nile water resources. This process is still ongoing and it is envisaged that once these negotiations are successfully concluded, the resulting agreement will supersede all the existing Nile water agreements.[7]

(2) Agreed Curve

Before the construction of the Nalubale (Owen Falls) dam, which began in 1951, the outflows from Lake Victoria were controlled naturally by the Ripon Falls some 3 km upstream of the dam site. It was agreed between the UK government, acting on behalf of Uganda as the ruling power, and the Egyptian government, that the dam would be operated on a run-of-river basis, so that the flows of the White Nile would not be affected by the project. After study of the discharge measurements which had been made at Namasagali, some 80 km downstream of the lake outfall, since 1923, an Agreed Curve was established which described the natural relation between lake levels measured at the Jinja gauge and simultaneous measured outflows from the lake.[8]

Since 1954 (when the Nalubale dam was completed), water flow from the Lake has been constrained to mimic the natural outflows from the lake using a rating curve of “Agreed Curve” that correlates the flow of the Nile at the source with Lake Victoria to the water level in the Lake.[9]

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[7] Uganda National Water Development Report 2005 (Chapter 10), 2006, World Water Assessment Programme

[8] Consultancy on the Development of a new Lake Victoria Water Release Policy Final Report, October 2008, Lake Victoria Basin Commission East African Community

[9] Bujagali Energy Limited, Bujagali Hydropower Project Social and Environmental Assessment - Main Report, December, 2006

9.2 Characteristics of Basins/Rivers in Lake Kyoga Basin and Recent Maximum Flood

In this Section, characteristics of rivers and sub-basins in Lake Kyoga basin as well as characteristic of 2007 flood of recent maximum flood are investigated and analyzed as a basis on considering watershed management and flood control plan.

9.2.1 Runoff Characteristic of Sub-Basins

(1) Longitudinal Profile of the Rivers

Figure 9-7 to 9-11 show longitudinal profiles of the representative rivers among the main rivers flow into Lake Kyoga. The longitudinal profiles were made by DEM generated SRTM (Shuttle Radar Topography Mission) data. Figure 9-12 shows locations of the representative rivers, water level and discharge stations and wetland in the figures of longitudinal profiles.

The rivers run from northern part and eastern part of the Basin such as Awoja, Okok and Mpologoma rivers have mountainous area in the upstream and their gradients change to steep slope quickly in the upstream, especially in Awoja and Mpologoma rivers of which gradients in the upstream are more than 1/20. Their rivers' sections until upstream border of wetland have gentle slope of about 1/4,000 to 1/2,500.

As for the river such as Sezibwa River, which is located in south side of Lake Kyoga and runs from Lake Victoria side, the gradient in the upstream from wetland is about 1/600 and gradient in the downstream from upstream border of wetland is gentle as about 1/3,500.

In the river such as Akweng river located in north-west part of the Basin, average gradient of the river is about 1/900, and gradients of sections until and from upstream border of wetland are about 1/1,800 and 1/500 respectively.

All rivers have quite gentle slope around Lake Kyoga.

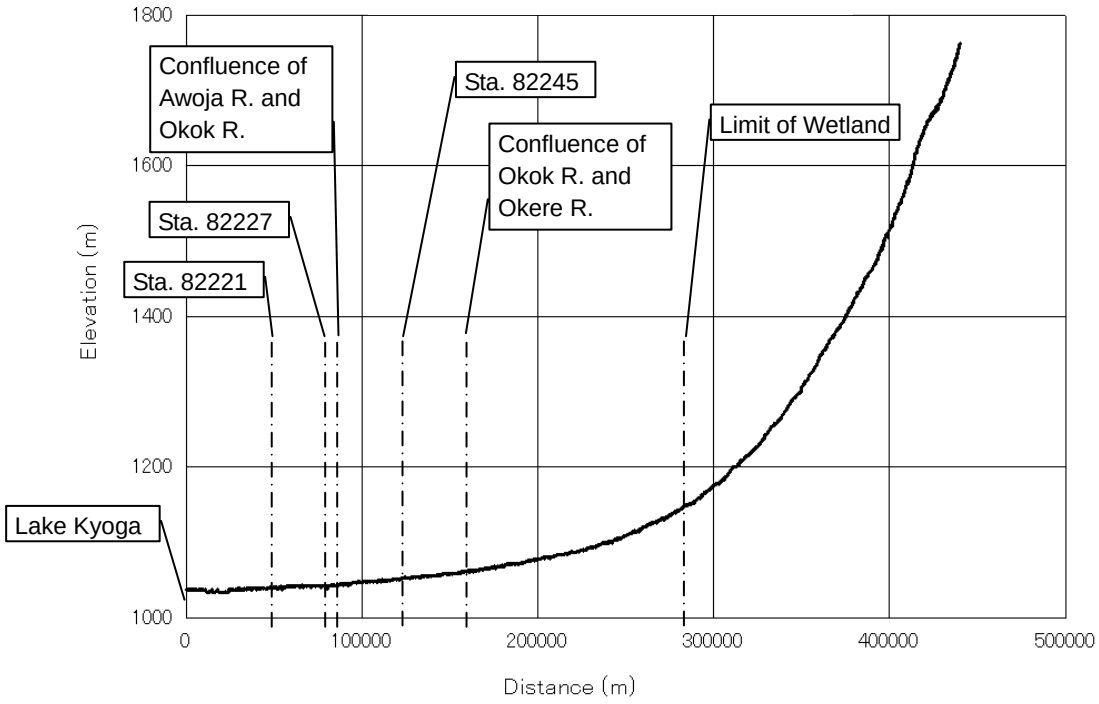


Figure 9-7 Longitudinal Profile of Awoja and Okok River (from Lake Kyoga to Confluence of Awoja and Okok River, and to Uppermost Stream of Okok River)

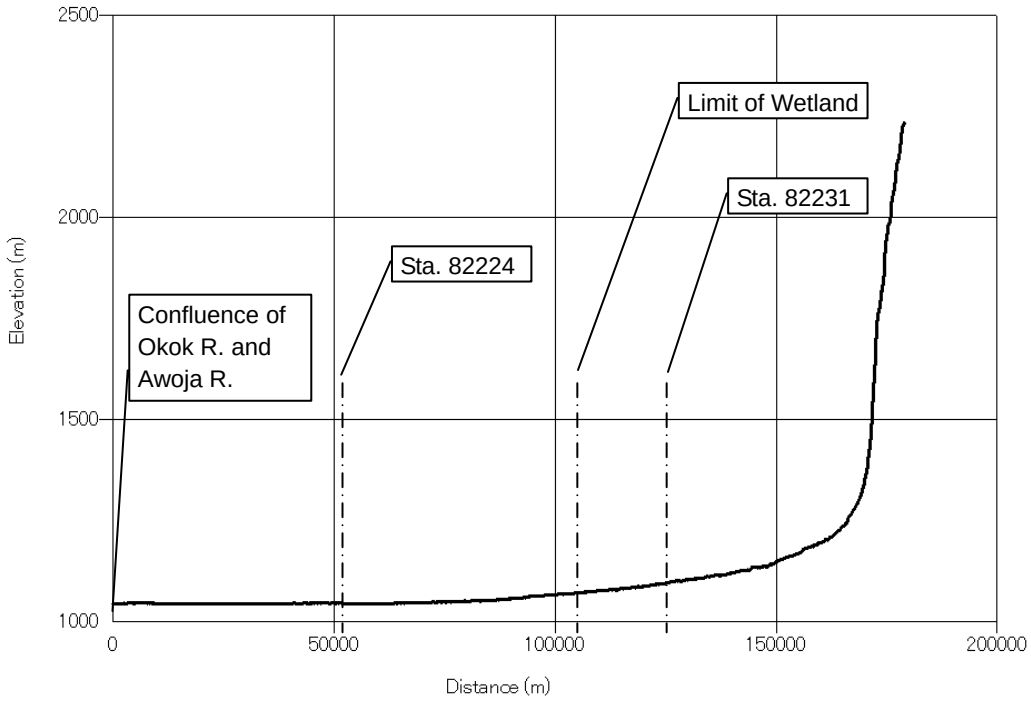


Figure 9-8 Longitudinal Profile of Awoja River (from Confluence of Okok River to Uppermost Stream of Awoja River)

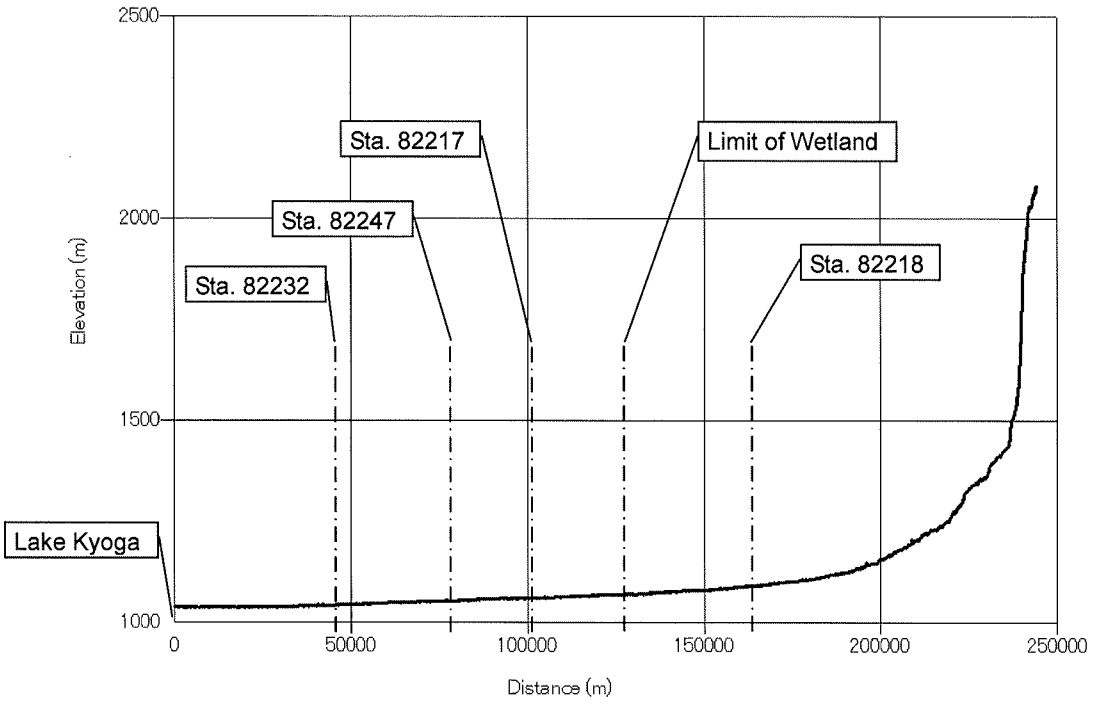


Figure 9-9 Longitudinal Profile of Mpologoma River (from Lake Kyoga to Uppermost Stream of Mpologoma River)

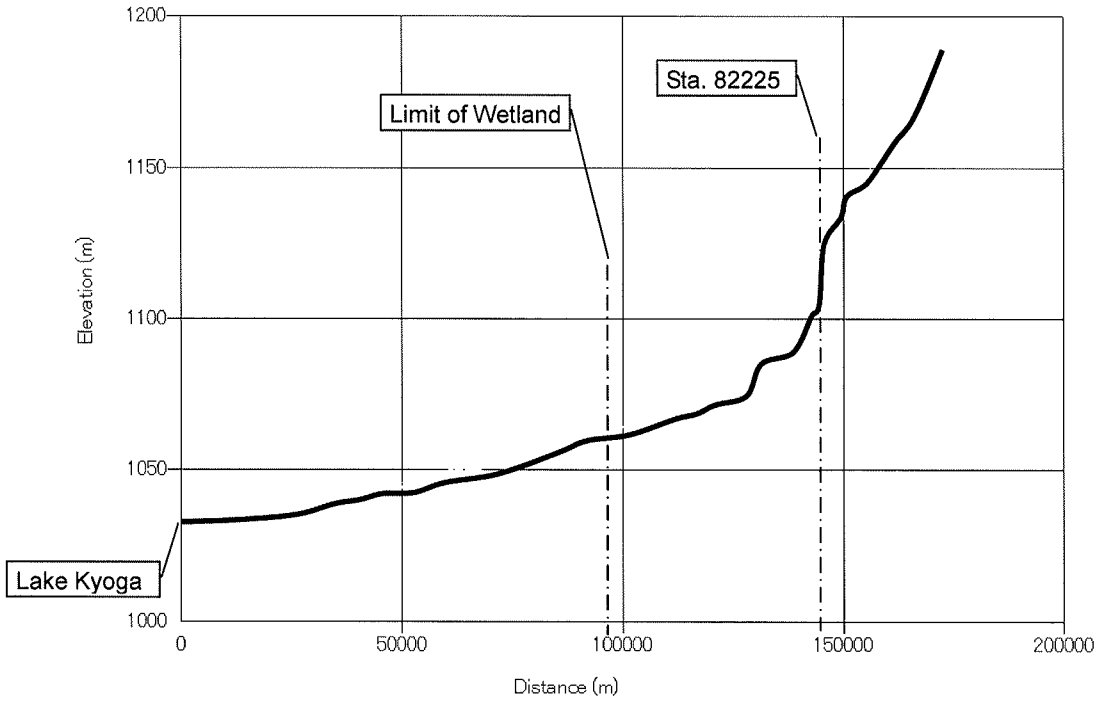


Figure 9-10 Longitudinal Profile of Sezibwa River (from Lake Kyoga to Uppermost Stream of Sezibwa River)

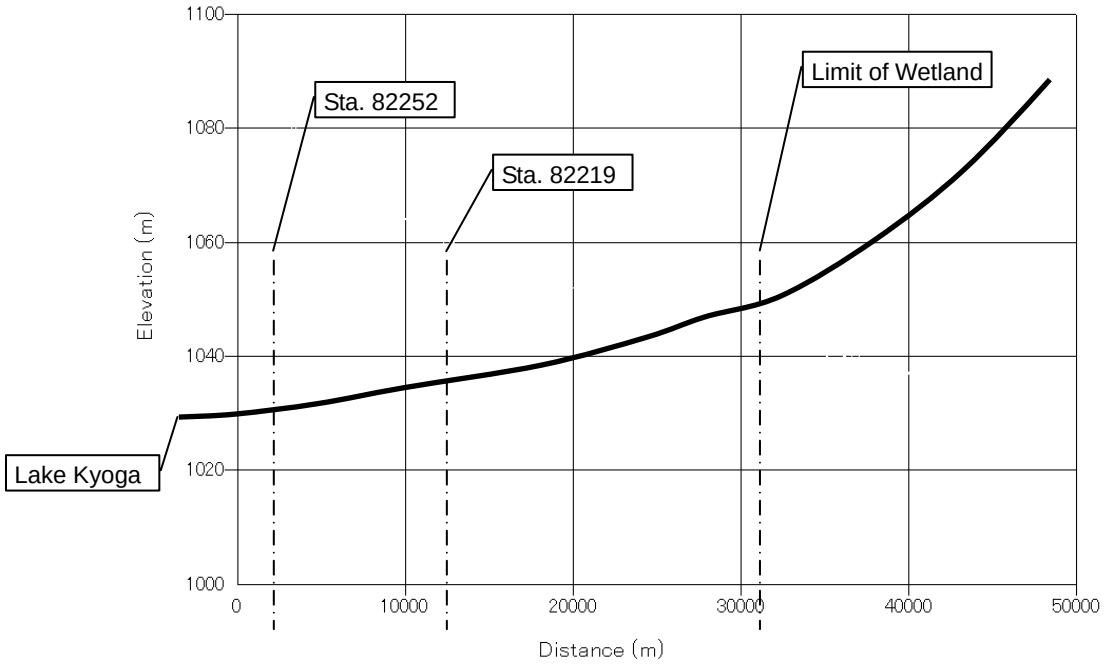


Figure 9-11 Longitudinal Profile of Akweng River (from Lake Kyoga to Uppermost Stream of Akweng River)

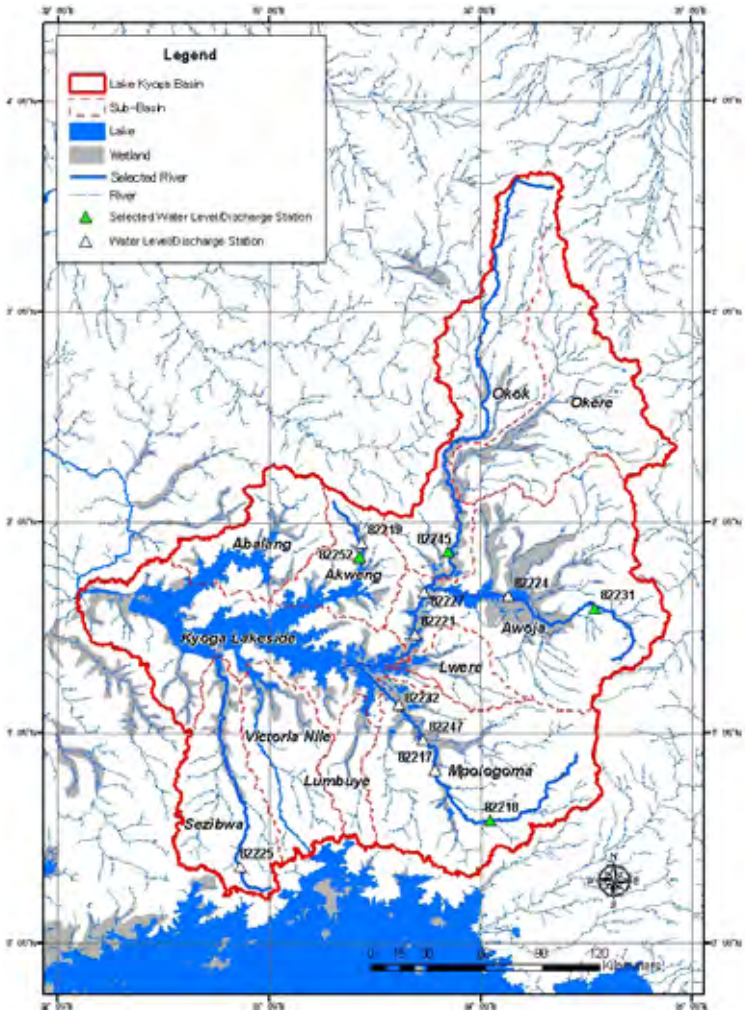


Figure 9-12 Location of Selected Rivers

(2) Runoff Characteristic of Sub-Basins

Figure 9-13 and 9-14 show 1) long term mean of monthly rainfall for catchment area of each station ("Monthly Rainfall"), 2) converted value from discharge to rainfall by dividing long term mean of monthly total discharge by catchment area ("Monthly Runoff") and 3) runoff ratio calculated by dividing Monthly Runoff by Monthly Rainfall, at four (4) water level and discharge stations shown as "Selected Station" in Figure 9-12. Right figures show Monthly Rainfall and Monthly Runoff and left figures show Monthly Rainfall and runoff ratio. In addition, "Area" in the title of each figure is catchment area of each station.

Both Station 82252 and 82245 are located in downstream part of each sub-basin as well as in wetland, while their catchment areas are quite different. Station 82231 and 82218 are located in middle part of the rivers that have mountainous area in the upstream.

The following can be said as characteristics of sub-Basins in Lake Kyoga Basin from the investigation results of these figures although it has been done by a few stations' data due to limited reliable discharge data.

- Runoff ratio tends to increase gradually from February-March to December-January. In other words, runoff ratio is low in early part of the year (except January).
- The peak of Monthly Runoff appears lately than the peak of Monthly Rainfall. It is noticeable in the stations (82252 and 82245) located in downstream part of the rivers. Time lag of the peaks becomes large when catchment area is large. Time lag of Station 82252 with catchment area of 700.7km^2 is about one month but time lag of Station 82245 with catchment area of 12,653.0 km^2 is about three months. It is considered that wetland highly influences the time lag of the peaks which become noticeable in downstream part.
- Regardless of catchment area, both Monthly Runoff and runoff ratio of middle part of the rivers with mountainous area in the upstream are higher than those of downstream.
- Monthly Runoff and runoff ratio of stations located in downstream part have no big differences in case that their catchment areas are quite different.

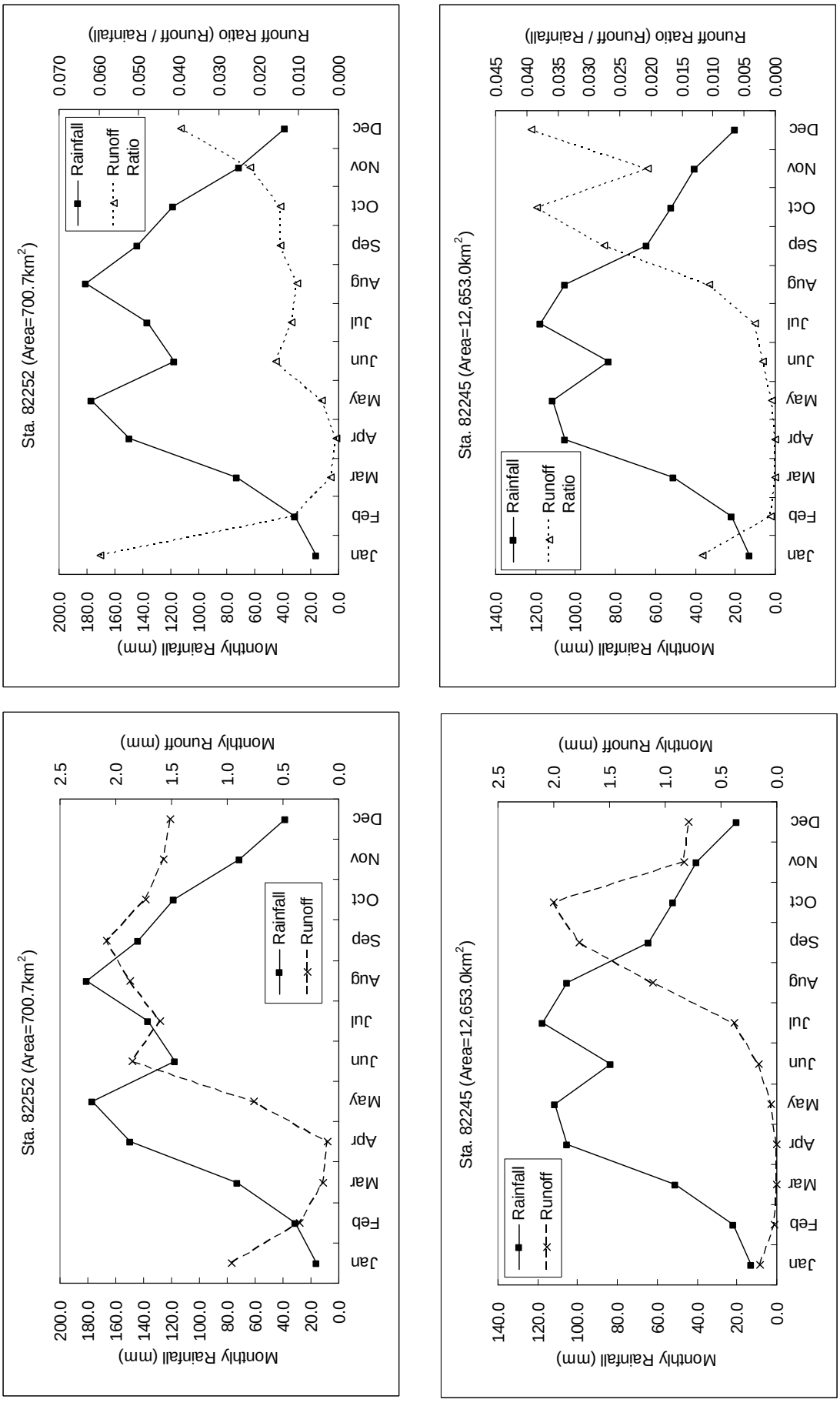


Figure 9-13 Rainfall, Runoff and Runoff Ratio of Selected Stations (1/2)

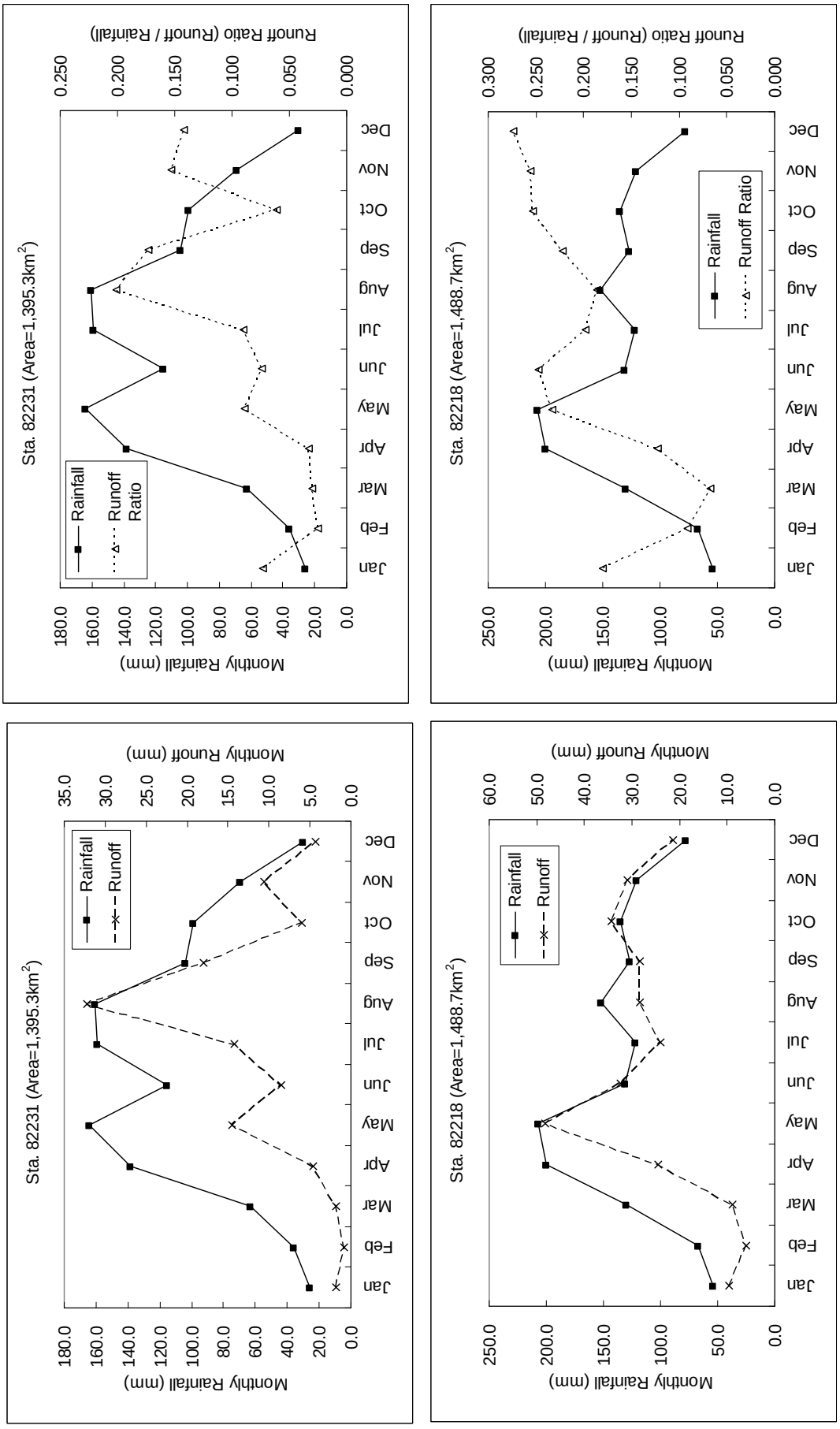


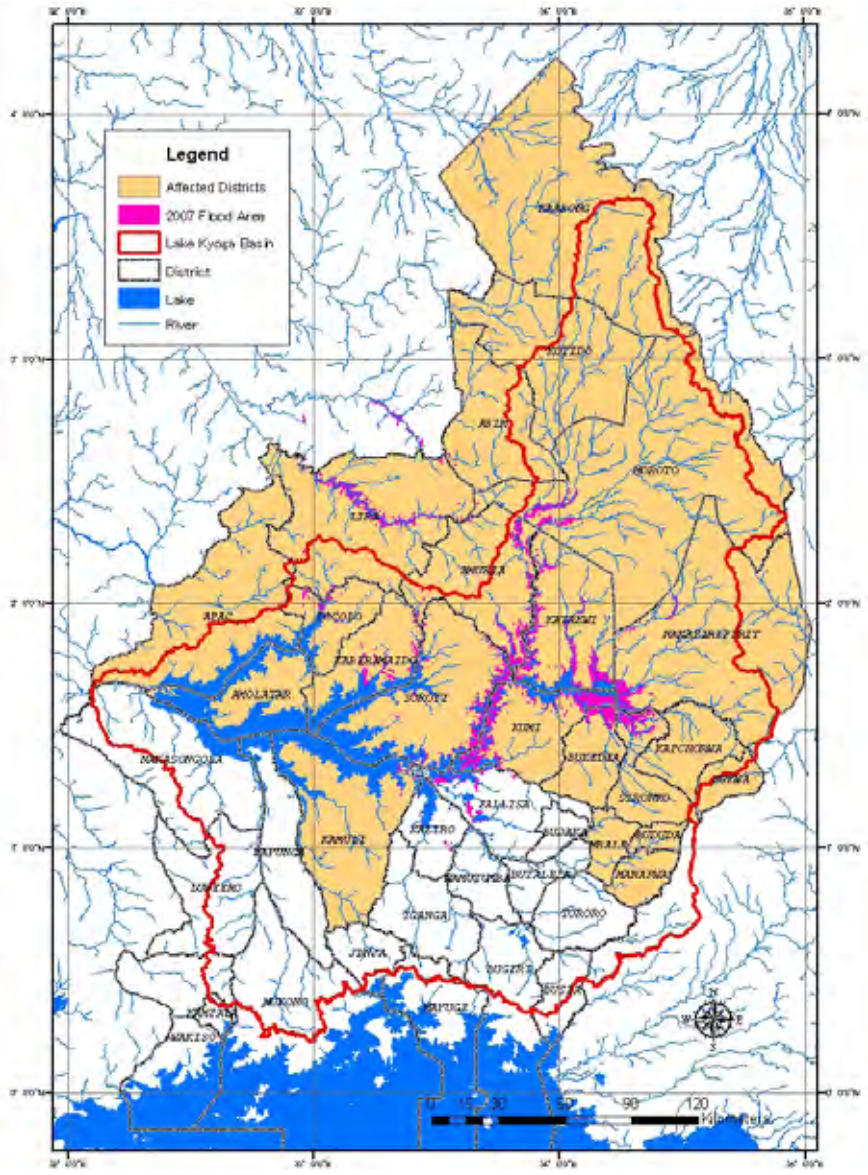
Figure 9-14 Rainfall, Runoff and Runoff Ratio of Selected Stations (2/2)

9.2.2 Damages by 2007 Flood

(1) Flooding Area and Affected Districts

Figure 9-15 shows flooding area and districts affected by 2007 flood. Flood-affected districts are identified by the data of CRED and UNOCHA. Flooding area is based on the flood-affected area map prepared by UNOSAT. UNOSAT detected flooding area using satellite data (MODIS TERRA) on July 21, 2007 (pre-flood) and September 16, 2007 (during flood).

Flood-affected districts spread to whole northern area of Lake Kyoga, and flooding area extends from east part of Lake Kyoga to middle parts of northern and eastern rivers such as Awoja and Okok rivers. Most of flooding area is included within wetland area.



Data Source: UNOSAT, UNOCHA & EM-DAT

Figure 9-15 Flood-Affected Districts and Flooding Area (as of September 19, 2007)

(2) Time Series of 2007 Flood

Major events of 2007 flood, particularly from emergency response aspect, are extracted from "Floods Response Timeilne" of "Uganda Floods Lessons Learnt Workshop Final Report, January 2008, OCHA Uganda", as follows:

- July 2007: Unusually heavy rainfall begins
- Week 3 of August: Initial joint assessment is undertaken in flooded areas
- Week 2 of September: Working figures of 300,000 affected are agreed by all clusters
- Week 3 of September: Main road from Soroti to Kampara is cut
- Week 4 of September: Government of Uganda declares 30 districts are now affected
- Week 2 of October: Physical access remains a major constraint for the response
  Most roads only open to 4x4 or 6x6 vehicles
- Week 3 of October: Rains begin to subside slightly
  Access remains a major issue
- Week 4 of October: Dry weather over the previous two weeks has begun to improve physical access in the affected area.
- Week 1 of November: Access remains a challenge, but improving
- Week 2 of November: Dry weather continues
- Week 4 of November: Clusters declare that Phase I of the response is over.
- Week 1 of December: Road access is restored, although some bridges are still out

(3) Affected Persons and Damages

There was extensive damage of vital infrastructure particularly roads, bridges and civilian infrastructures as well as of the core livelihood activities by 2007 flood.[10] Damages in several sectors are summarized below. Damage data covers all the country and are not limited in Lake Kyoga Basin. Since damage amount differs among reports, all the data is shown with its data source.

1) Affected Population

- 323,000 people were directly-affected by the sustained heavy rainfall, floods and general water-logging across Uganda. 100% of this population remains at risk of food insecurity and disease.[11]

2) Infrastructure Damage (Transportation)

- Bridges have been washed out and roads have become impassable in major roads as well as village roads. As of end of November 2007, although road access has been re-established as consequence of the decreased water level and emergency repairs by the Ministry of Works, the

[10] Uganda Floods Lessons Learnt Workshop Final Report, January 2008, OCHA Uganda
[11] Uganda Flash Appeal Floods 2007: Progress Update – 24 October 2007, United Nations

District Department of Works and partners, substantial damage to road and bridge infrastructure continues to pose a challenge to the passage of heavy trucks.[12]

3) Water Pollution

- Over 253,000 people have no access to safe water.[13]
- Hundreds of water sources were completely inundated by flood waters while others were polluted through leaching from soils contaminated by collapsed and/or overflowing latrines. Regular assessments and water quality testing conducted in Teso and Bugisu show that more than 57 per cent of the water sources continue to present dangerous levels of contamination by coliforms and colibacteria (as of 25 November). Before the floods approximately 20 per cent of the water sources could have presented some level of contamination.[14]

4) Crop Damage

- Total area lost to floods in Amuria district was 263.8km^2 out of 2007 total planted area of 595.8km^2, and Total area lost to floods in Katakwi district was 222.1km^2 out of 2007 total planted area of 519.5km^2.[15]
- Crop losses in terms of land area were 40km^2 in Soroti and 64km^2 in Kumi districts.[16]

[12] Uganda Flash Appeal Floods 2007: Progress Update – 30 November 2007, United Nations
[13] Uganda Flash Appeal Floods 2007: Progress Update – 24 October 2007, United Nations
[14] Uganda Flash Appeal Floods 2007: Progress Update – 30 November 2007, United Nations
[15] Special Report, FAO/WFP Assessment of the Impact of 2007 Floods on Food and Agriculture in Eastern and Northern Uganda, 18 January 2008, Food and Agriculture Organization of the United Nations & World Food Programme
[16] SWRMD-II, Visit Report No 57, TA on Flood Management, January 2008

9.2.3 Characteristic and Causal Analysis of 2007 Flood

(1) Stations selected for Analysis

Figure 9-16 shows stations using the analysis, which were selected in consideration of data availability.

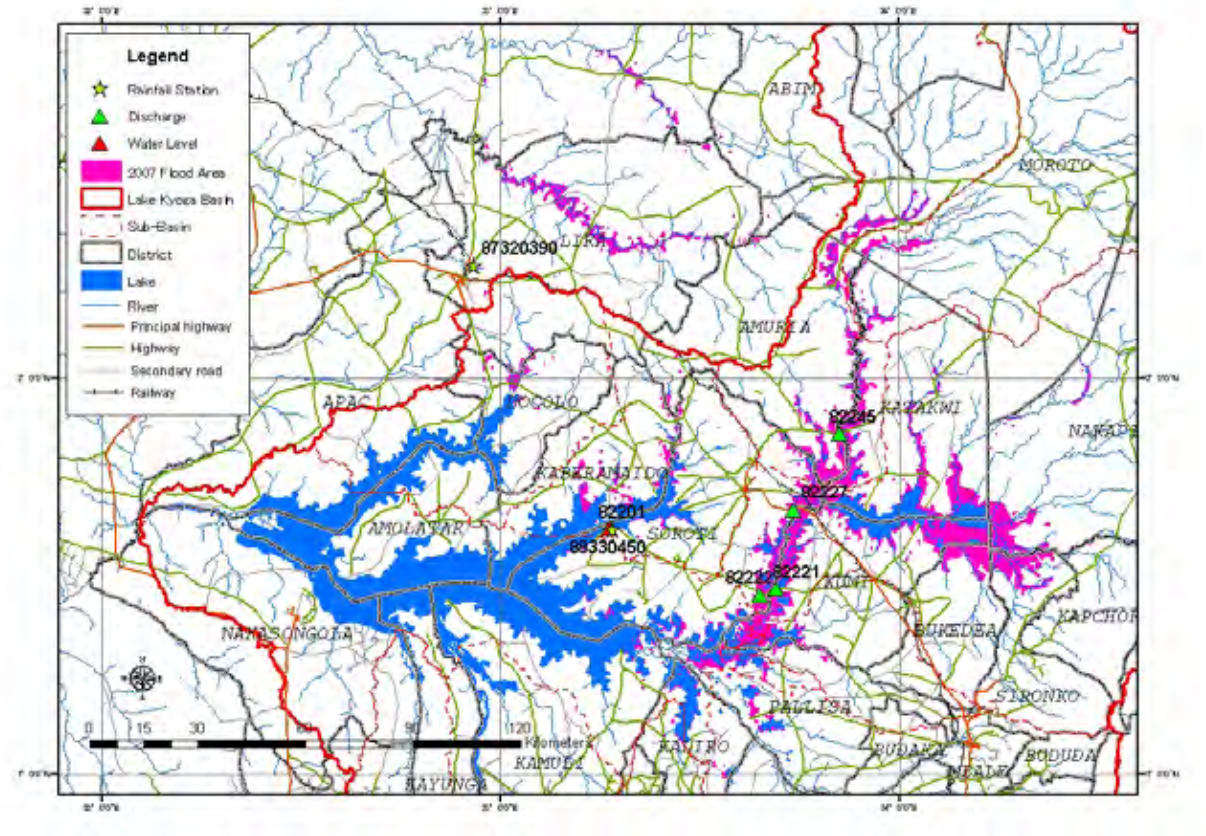


Figure 9-16 Meteorological and Hydrological Stations for Flood Analysis

(2) Discharge

Figure 9-17 shows time series variation of discharges and water level of Lake Kyoga at five (5) water level and discharge stations along Awoja-Okok river. Stations line 82245, 82227, 82221 and 82222, and 82201 in turn from the upstream, while 82221 and 82222 stations are considered that they are installed in parallel and observe discharge of one forked river (swamp) by these two stations. The peak of discharge at Station 82245 located in uppermost stream among five stations is considered on about September 20th from the figure though data of late September is missed in Station 82245. The distance between 82245 and 82221 is about 70km, but time lag of their peaks is about two (2) weeks from about September 20th to October 5th. It means transmission time of flood peak is quite slow.

Table 9-5 shows result of probability analysis for 2007 flood and it can be said that frequency of occurrence of 2007 flood is about once in 30-50 years.

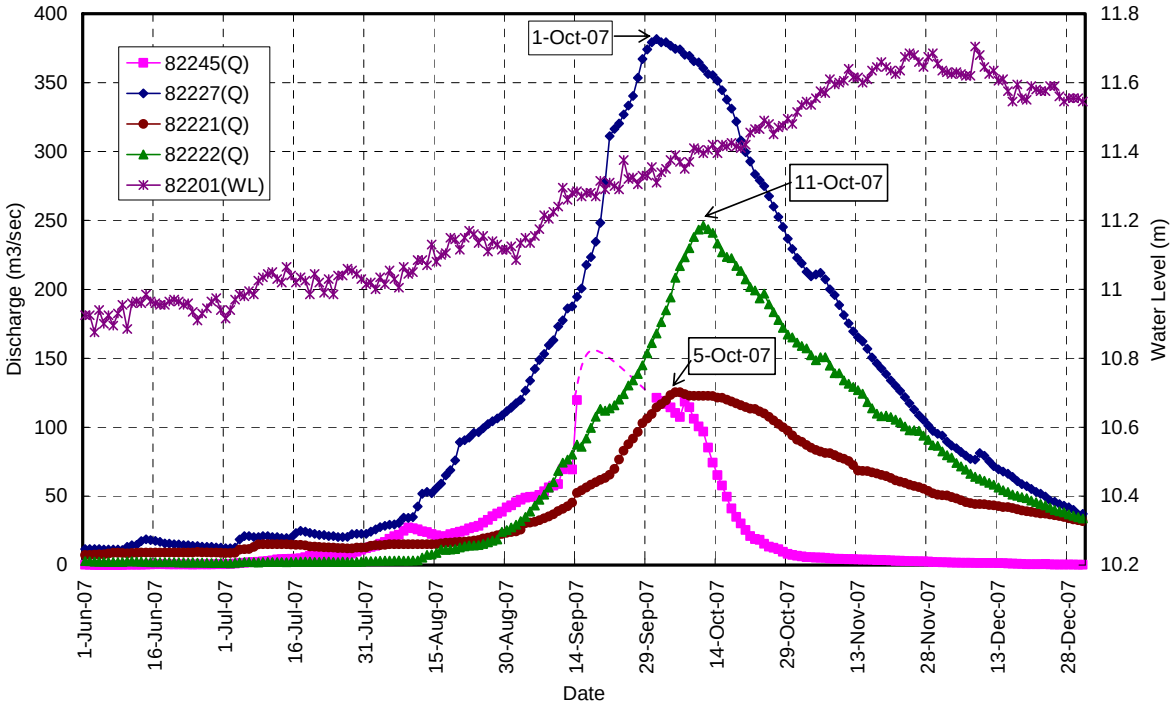


Figure 9-17 Comparison of Peak Discharge

Table 9-5 Frequency of Occurrence of 2007 Flood

Station No.	Location	2007 Maximum Water Level (m)	Previous Maximum Water Level (m)	No of Years	Water Level Return Period
82245	Akokorio	4.74	3.57	19	50
82227	Kapiri	12.10	11.04	14	30
82221	Agu	7.40	6.20	insufficient records	
82222	Abuket	4.66	3.25	14	30

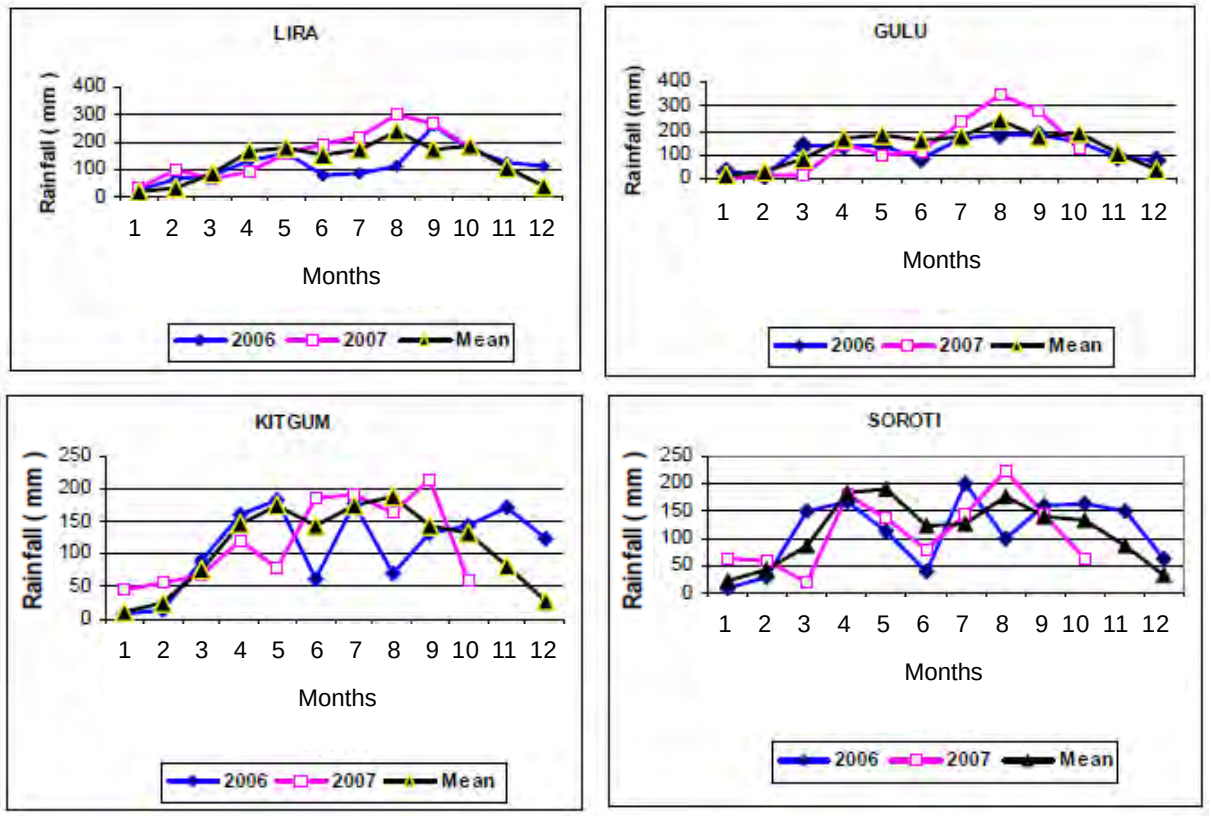
Source: SWRMD-II, Visit Report No 57, TA on Flood Management, January 2008

(3) Rainfall

Figure 9-18 shows comparison of monthly rainfall in 2006, 2007 and long term mean at a station (Soroti Station) within Lake Kyoga Basin and three (3) stations on the north side of Lake Kyoga outside Lake Kyoga Basin. The following common features are found particularly in three (3) stations on the north side:

- Rainfall of late 2006 is comparatively high
- Rainfall of June and July 2007 are higher than long term mean
- Rainfall of June and July 2007 are higher than long term mean

Besides, annual rainfall of 2007 in Lira Station is 1,672mm with about 5-10 return period.



Source: Special Report, FAO/WFP Assessment of the Impact of 2007 Floods on Food and Agriculture in Eastern and Northern Uganda, 18 January 2008, Food and Agriculture Organization of the United Nations & World Food Programme

Figure 9-18 Monthly Rainfall in Selected Areas in 2007 Compared with 2006 and Long Term Mean

(4) Rainfall and Discharge

Figure 9-19 shows monthly rainfall in two (2) stations and mean monthly discharge at a station in the downstream of Okok river. There is no available rainfall data in Okok sub-basin, then data of two (2) stations shown in the figure is used as rainfall stations nearby.

From the figure below, it can be said that there is time lag of peaks of rainfall and discharge as is the case with characteristic of long term mean of rainfall and runoff in sub-basins, and the time lag was about one month in 2007 flood.

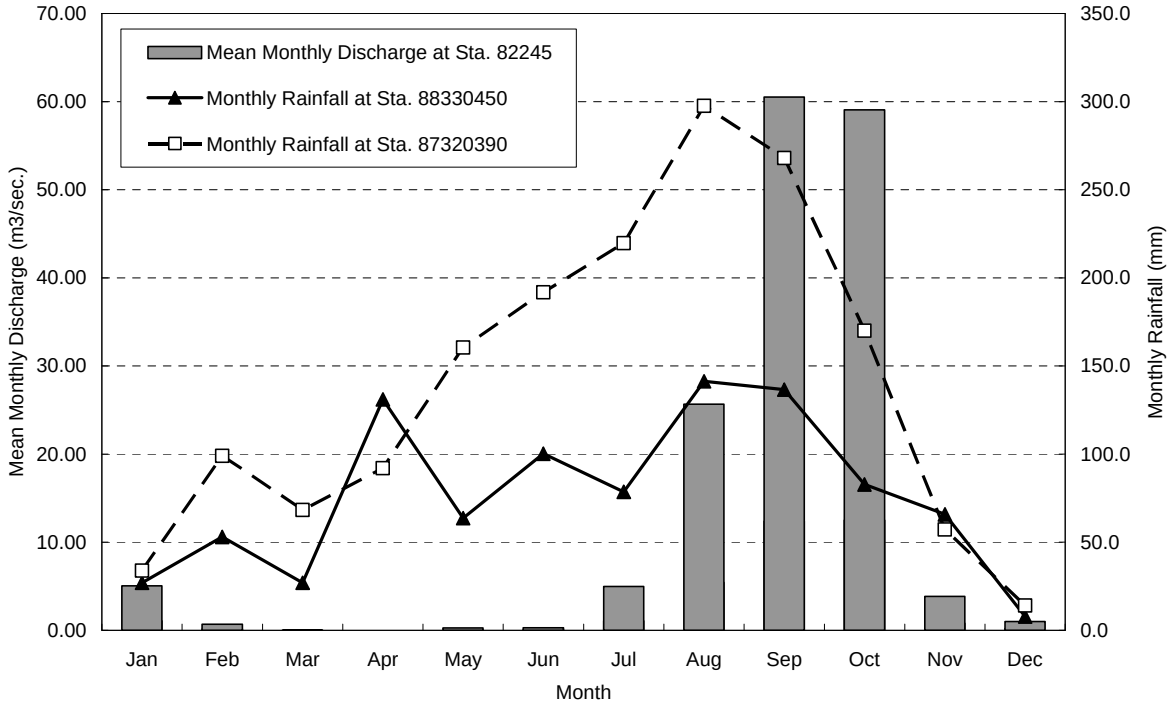
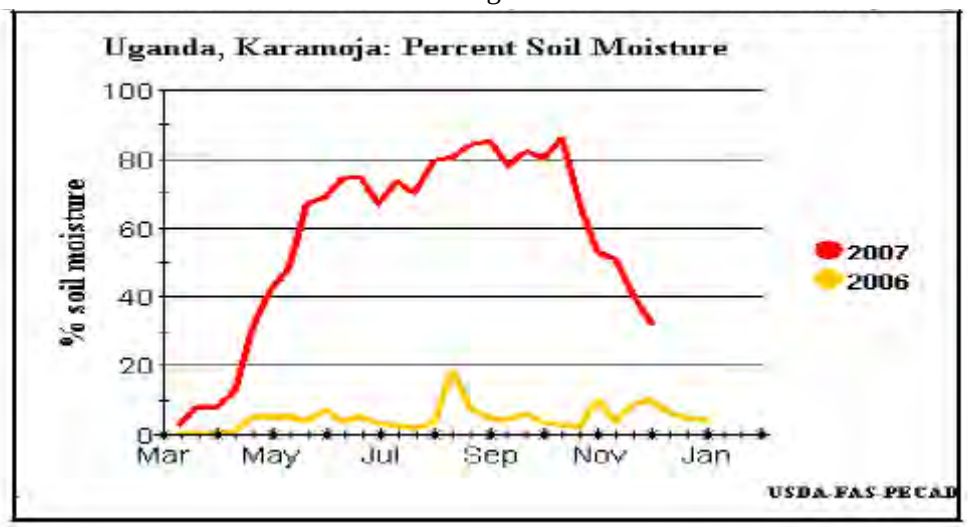


Figure 9-19 Monthly Rainfall and Mean Monthly Discharge in 2007

(5) Soil Conditions

Figure 9-20 shows soil moisture content in 2006 and 2007 in Karamoja region. It is revealed that the soil moisture content of 2007 is much higher than 2006.



Source: Special Report, FAO/WFP Assessment of the Impact of 2007 Floods on Food and Agriculture in Eastern and Northern Uganda, 18 January 2008, Food and Agriculture Organization of the United Nations & World Food Programme

Figure 9-20 Soil Moisture in 2007 Compared to 2006 in Karamoja Region

(6) Findings

Based on the investigation described above, characteristics of 2007 food are summarized below.

- While monthly rainfall of August and September and annual rainfall of 2007 are higher than their long term means, their return periods of 15 year are smaller than the flood magnitude with 30-50 year return period.
- Factors that flood magnitude became large compared to rainfall amount are considered as follows:
  1) Comparatively high rainfall from late 2006 to early 2007 compared to normal year
  2) Comparatively high rainfall of June and July when rainfall are low in normal year
  3) Increase of soil moisture by the above rain, and increase of runoff ratio
  4) Continuous heavy rainfall in August and September in the condition of high runoff ratio which may be higher than normal year, while runoff ratio tends to increase in late half of the year even in normal year
  5) Continuous rainfall in September when rainfall tends to start reducing in normal year
- The above prospect may indicate the possibility that flood may occur in no much rainfall by the effect of antecedent rainfall as well as the possibility that floods may be predicted by observation, collection and analysis of proper data such as rainfall and soil moisture.
- As described above, since the peak of discharge lately appear than the peak of rainfall, it is considered as available to forecast floods by proper monitoring of relevant data and to start disaster preparedness activities in advance especially in downstream area, namely, non-structural measures can be one of effective measures in Lake Kyoga Basin.

9.3 Deforestation, Forest Degradation and Disaster Survey

A survey in and around Mt. Elgon area was conducted aiming at confirming and investigating condition of deforestation and forest degradation, condition of flood and sediment disasters, relationship of forest condition and disasters, present condition and/or output of past and ongoing projects related to them, as well as considering proper measures in the basic plan. The survey consisted of field survey and literature research. The field survey included interview survey with district officers (district environmental officer (DEO) or district forest officer (DFO)) in and around Mt. Elgon area and officers of Mt. Elgon Conservation Area of Uganda Wildlife Authority (UWA), data collection and observation of existing condition through field reconnaissance. The survey results are shown below.

9.3.1 Present Condition on Deforestation and Forest Degradation

Present condition on deforestation and forest degradation in and around Mt. Elgon area was surveyed by interview survey, field reconnaissance and literacy research. Interview survey targeted at DEO and/or DFO of districts located in and around Mt. Elgon, which are Kapchorwa, Sironko, Bukwa (Bukwo), Mbale, Bududa and Manafwa districts, and officers of Mt. Elgon Conservation Area of UWA, which manages Mt. Elgon National Park.

Table 9-6 and 9-7 and Figure 9-21 summarize heavily deforested and heavily forest-degraded areas based on interview survey results and data collected from the officers. Among the results shown in Figure 9-21, the deforested and forest-degraded areas within National Park are concrete areas made by figure data provided from UWA, and the areas are as of 2007 and recent years. On the other hand, since the data of concrete deforested and forest-degraded areas outside National Park could not acquire, the area such as administrative boundary are indicated based on the names of sub-county, parish or specified area that is heavily deforested or forest-degraded, which were obtained from district officers and UWA. The deforested or forest-degraded areas outside National Park show not only recent deforested and forest-degraded areas but also past about 20 years' conditions of deforestation and forest degradation. In addition, as for Central Forest Reserve (CFR) and Local Forest Reserve (LFR), "degraded CFR & LFR" in Figure 9-21 shows forest reserves of which forest are completely degraded based on the results of interview survey, and "deforested CFR & LFR" shows forest reserves of which more than 75% of each total area were already deforested according to the data of National Biomass Study (2003)[17].

[17] National Biomass Study Technical Report, November 2003, Forest Department, Ministry of Water Lands and Environment

Table 9-6 Heavily Deforested Area in and around Mt. Elgon Area

District	Sub-County	Parish	Remarks
Kapchorwa	Benet	-	-
	Northern Area of Mt. Elgon		6,000ha
Sironko	Bunambutye	-	-
	Busulani	Bumumulo	-
Bukwa	Chesower	Nyalit	-
		Tulel	-
		Kamet	-
	Kabei	Mutushet	-
		Kortek	-
Mbale	Wanale	-	331ha, Encroachment to National Park (NP)
	Busano	-	49ha, Encroachment to NP
Bududa	-	-	-
Manafwa	Buwabwala	-	340ha, Encroachment to NP
	Bumbo		270ha, Encroachment to NP
	Everywhere of District		-

Table 9-7 Heavily Forest Degraded Area in and around Mt. Elgon Area

District	Sub-County	Parish	Remarks
Kapchorwa	*Hunting Area*		-
Sironko	*Northern Area of District*		Gradually from 20 years ago
Bukwa	-	-	-
Mbale	Bufumbo	-	-
	Wanale	-	-
	Central Forest Reserve (CFR) near Mbale Town		-
	Local Forest Reserve (LFR) in Kolonyi		-
Bududa	Bubita	-	684ha, Encroachment to NP
	Bulucheke	-	305ha, Encroachment to NP
	Bumayoka	-	316ha, Encroachment to NP
	Bushika	-	392ha, Encroachment to NP
	Bududa	-	
Manafwa	*All LFR*		-
	Everywhere of District		-

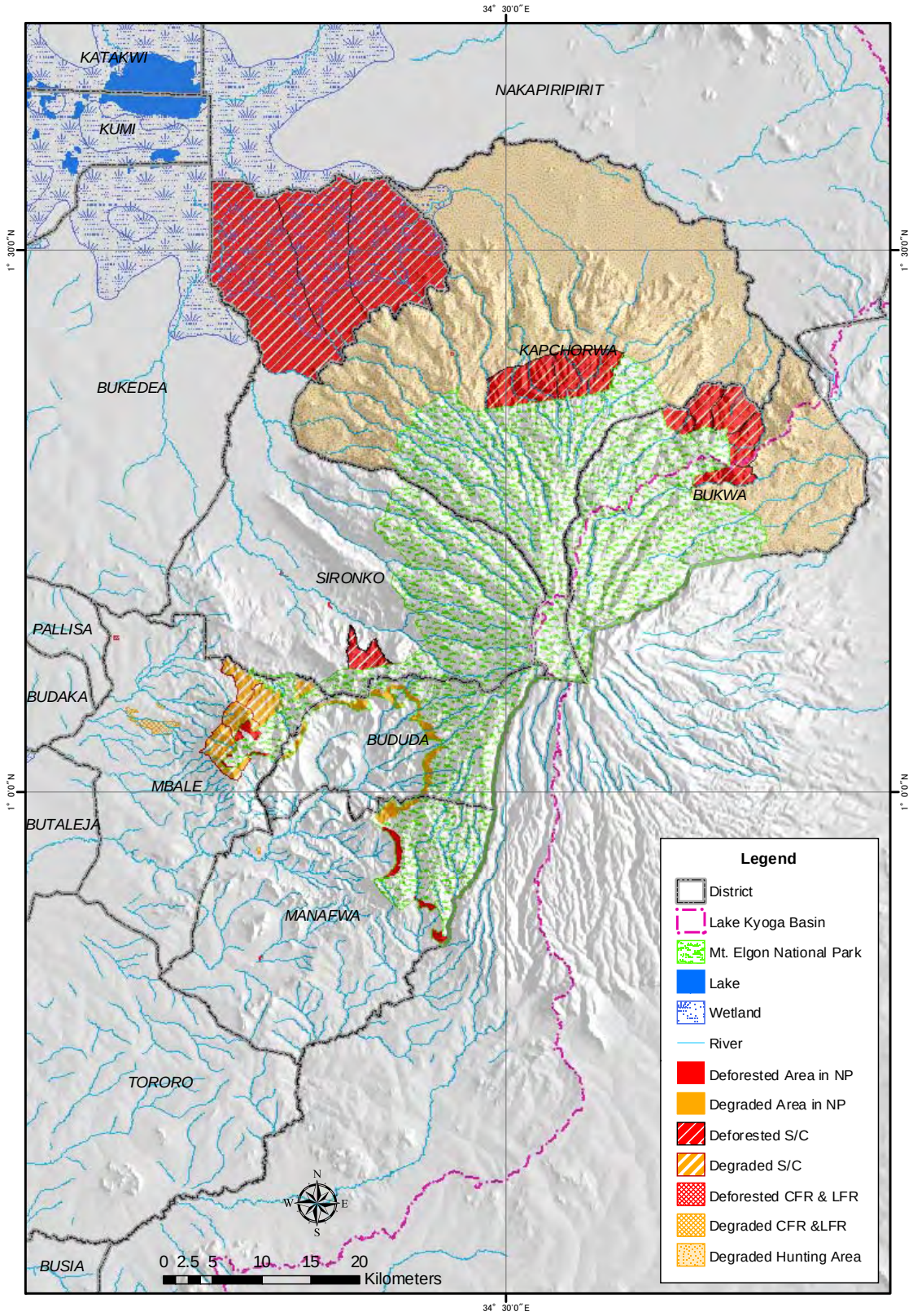


Figure 9-21 Heavily Deforested & Forest Degraded Area in and around Mt. Elgon Area

(1) General Trend

Regarding general trend of deforestation and forest degradation, the following comments were obtained through the interview survey, "Forest has dramatically decreased comparing to childhood. Deforestation and forest degradation are worsening in everywhere of district" from DEO in Manafwa district, "Forest still existed before 20 years even in northern part of district, but deforestation has been progressed and forest has disappeared at present." from DEO in Sironko district, "Although afforestation projects have been conducted, deforestation and forest degradation tends to expand generally" from DFO in Kapchorwa district. As seen in their comments, deforestation and forest degradation seems to have become pronounced several decades ago and have expanded across the years. All district officers 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 9-1 is mountainous area from Bududa district to Mbale district and mountainous area in Bukwa 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 and most slopes were cultivated up to very narrow boundary with National Park.

Photo 9-1 Cultivation in Mountainous Area (Right: Bududa District, Left: Bukwa District)

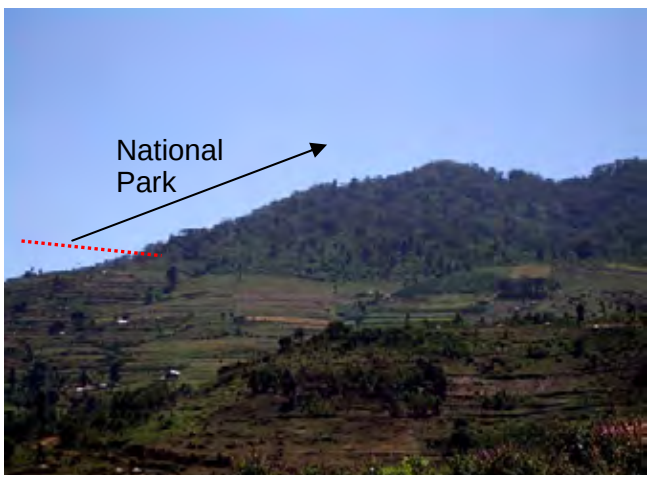


Photo 9-2 Boundary of Cultivation Land in Mountainous Area and National Park (Bukwa District)

(2) Deforestation and Forest Degradation within National Park

Deforestation, forest degradation and encroachment in National Park occur in Mbale, Bududa and Manafwa districts located in southern side of Mt. Elgon as shown in Figure 9-21. These districts have particularly high population density in Lake Kyoga Basin. Ranking of population density of Mbale, Bududa and Manafwa districts is top 1, 5 and 4 with 642, 449 and 452 persons/ km^2 respectively, when comparing each districts' population density in the area including Lake Kyoga Basin.

According to UWA, although deforestation and activities for acquiring forest resources within National Park are completely prohibited, encroachment, deforestation and forest degradation as well as afforestation to such area are a continuous affair in the area along the National Park. Also, according to officials of each district, deforestation and illegal activities for acquiring forest resources are frequently seen also in northern districts though the concrete area is not indicated in the figure.

However, it is considered that it proves the common opinion of officials of each district, which human activities are major cause of deforestation, that deforestation and encroachment are a remarkable matter in aforementioned three districts which have higher population density in the Basin.

(3) Deforestation and Forest Degradation outside National Park

1) Southern Part of Mt. Elgon (Mbale, Bududa and Manafwa districts)

Figure 9-22 shows a landuse map in and around Mt. Elgon area prepared using 1996 GIS data of Biomass Study. Almost all area of Mbale, Bududa and Manafwa districts except National Park area is categorised as farmland in the figure. Accordingly, hilly and mountain areas were already deforested and cultivated very widely as of 1996. In this interview survey, district officers answered deforestation and cultivation has progressed even in recent years. It is considered that it means that forest and trees remaining in farms are being logged further.

2) Northern Part of Mt. Elgon (Sironko, Kapchorwa and Bukwa districts)

Deforested area located in northern side of National Park in central part of Kapchorwa district is also categorized as farmland in 1996 data. According to DFO in Kapchorwa district, this area was designated as forest reserve in 1939 and has been protected since 1939, but deforestation has started from 1983 when this area was excluded from forest reserve, and then deforestation area ran up to 6,000ha. After that, 1,500ha of the past-excluded area was designated again to National Park in 1993 when UWA started to manage National Park. However, since people already immigrated and lives in that area, the environmental condition seems to be difficult to recover even though afforestation projects have been implemented.

Figure 9-23 compares forest condition around Mt. Elgon using LANDSAT Satellite imageries in January 1986 and January 2003. The area with dark color in the figure shows tropical forests. The forest still remained in that area as of 1986, therefore deforestation may have progressed after 1986.

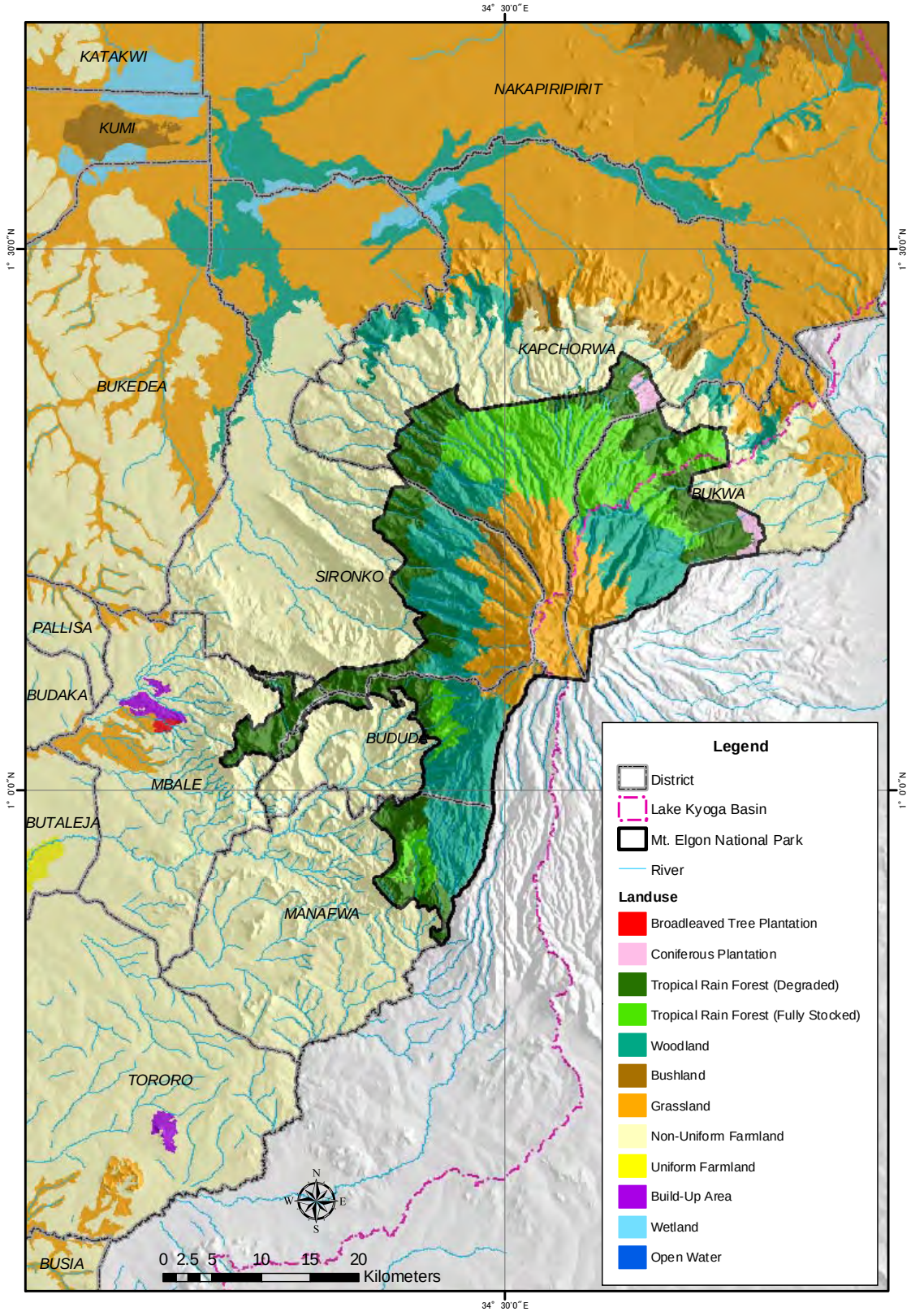
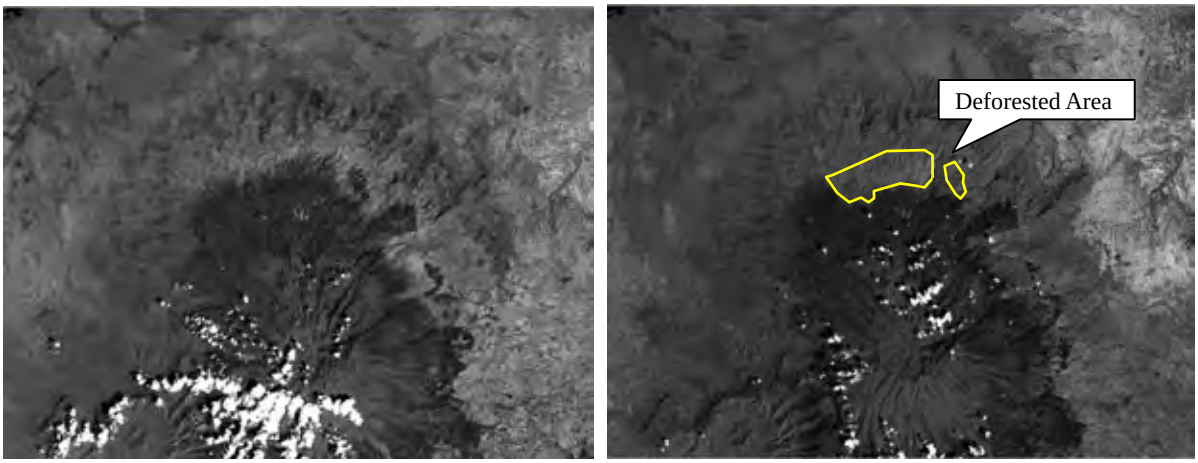


Figure 9-22 Landuse (Land Cover) in and around Mt. Elgon Area



1986/01 (Albedo Image) 2003/01 (Albedo Image)

Figure 9-23 Deforestation Condition in Northern Part of Mt. Elgon

In addition, northern area of Sironko district and bordering area between Kapchorwa and Bukwa districts, which are indicated as heavily deforested area in Figure 9-21, and Hunting area indicated as heavily degraded area in Figure 9-21, are areas where "woodland" still remains in Figure 9-23. Accordingly, deforestation has steadily progressed in the area where forest still remained as of 1996.

3) Forest Reserve

According to DEO in Mbale district, forests have completely disappeared in CFR and LFR of Mbale district. Since trees could confirm to exist in CFR through the field reconnaissance even though they are very sparse, however, it is considered that disappearance means forest degradation not deforestation. In the result of Biomass Study in 2003, ratios of deforestation and forest degradation area of this CFR are 11.7% and 0% respectively. When "Complete disappearance" is translated into "Complete forest degradation", it means forest degradation area of this CFR is 100% of the area of this CFR. Therefore, it can be said that forest degradation has progressed very rapidly in recent years in this CFR. In Manafwa district, all LFR has completely degraded according to DEO. In Bubolo LFR of one of two LFRs in Manafwa district, ratios of deforestation and forest degradation in Biomass Study are 9.5% and 0% respectively. Therefore, it can be also said that degradation has rapidly progressed in recent years in this LFR.

Almost all of forest reserves of six (6) districts in and around Mt. Elgon area are under heavily deforested or heavily forest-degraded condition. Deforested or forest-degraded area runs up to 6.4km^2 that is 86% of 7.4km^2 of total area of forest reserves of six (6) districts.

9.3.2 Present Condition on Sediment Disaster and Flood

(1) Interview Survey and Field Reconnaissance

Present condition on sediment disaster and flood in and around Mt. Elgon area was surveyed by interview survey and field reconnaissance. The interview survey targeted at the same persons as deforestation and forest degradation survey.

Table 9-8 summarizes past disaster occurrence area and disaster prone area of sediment disasters based on interview survey result, Table 9-9 summarizes those of flood and Figure 9-24 shows the area summarized in both tables. Since answers in the interview survey were obtained by name of sub-county or parish except some river names, disaster occurrence and prone areas are shown by administrative boundary in Figure 9-24. Meanwhile, information of sediment disaster in Bududa district in 2010 in the table is not from the interview survey result but from newspapers and internet.

Figure 9-24 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.

Questioning about disasters to have occurred in mountainous area in the interview survey, most of answers were mud flow or debris flow, and flash flood was a very rare answer. It is considered that those answers indicate an easiness of sediment runoff, deterioration of upstream area and/or progression of deforestation and forest degradation.

Besides, although “disasters occur frequently” was frequently heard in the interview survey, actual damage data such as death toll was very few or limited. It seems that there are not many disasters with deaths or heavy damage even if undeveloped system of data collection and arrangement may have an influence on that. It can be seen that land development and cultivation are progressing but densely-populated areas are not so many and locate in comparatively low disaster potential area.

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. Most rivers observed through field reconnaissance such as Atari River in Kapchorwa district, which was introduced as the river that flood occurs due to sediment deposition, have high turbidity in June when rainfall is comparatively small in rainy season and in the end of November when rainfall amount is falling down. However, most of transported sediment seems to be suspended load. 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.

At least, it seems there are not many inundated type of floods with heavy damage looking at interview survey and field reconnaissance, even if undeveloped system of collection and arrangement of damage data may have an influence on that.

Table 9-8 Sediment Disaster Prone Area in and around Mt. Elgon Area

District	Sub-County	Parish	Past Disaster Record		
			Type	Time	Damage
Kapchorwa	Benet	-	-	-	-
	Kwosir	-	-	-	-
	Kaptanya Upper	-	-	-	-
	Binyingi	-	-	-	-
	Kaproron	-	-	-	-
Sironko	Zesui	Bukahengere	Mudflow/Debris flow	Rainy season	Houses and crops were destructed.
	Bulago	-	Debris flow	2008 rainy season	-
	Hilly Area		-	-	-
Bukwa	Chesower	Nyalit	Debris flow/avalanche	2007 rainy season (May-Sep.)	One vehicle collapsed.
	Kabei	Mutushet	Debris flow	2006 May	One person died and one vehicle collapsed.
	Bukwo	-	Debris flow/avalanche	2008 July	Two persons died.
Mbale	Busano	*Upstream Area*	-	1996	Three persons died.
	Wanale	*In steep slope of Wanale ridge*	Mudflow/Rockfall /Toppling	2007 Sep.	-
	Nyondo	-	Excessive soil erosion	-	-
	Bukonde	-	Excessive soil erosion	-	-
	Bufumbo	-	Excessive soil erosion	-	-
Bududa	Bulucheke	Bugorero	Mudflow/Debris flow due to rainfall	1997 Nov.	Some people died.
	Bubita	-	Mudflow/Debris flow due to rainfall	2006 Mar.	House collapsed but no people died.
	Bukalasi	(Nametsi, Kubehwo and Namangasa Vil.)	Debris avalanche	2010 Mar.	About 350 persons died/missing.
Manafwa	Bumbo	-	-	1967 and 1999 (March-June)	-
	Bupoto	-	-	2003 and 2004	-
	Buwabwala	-	-	March to June	-
	Tsekululu	-	-	March to June	-
	Mukoto	-	-	March to June	-
	Kaato	-	-	March to June	-

Table 9-9 Flood Prone Area in and around Mt. Elgon Area

District	Sub-County	Parish	Past Disaster Record		
			Type	Time	Damage
Kapchorwa	*Ngenge River*		-	-	-
	Atari River		-	-	-
	Sundet River		-	-	-
Sironko	Bunambutye	*Especially in downstream area of Tabakonyi River*	-	April to June and November to January	-
Bukwa	*Bukwo River*		-	-	-
	Siti River		-	-	-
	Nyalut River		-	-	-
Mbale	Busiu	*In low laying areas*	-	-	-
	Busoba		-	-	-
	Lower Bungokho		-	-	-
	Bukasakya		-	-	-
	Nakaloke		-	-	-
	Lower Bushiende		-	-	-
	Namanyonyi		-	-	-
	Industrial Borough	*Downstream Area of Nashibiso and*	-	-	-
	Bungoko-Mutoto		-	-	-
	Nashibiso, Napwodi, Namatsyo River		-	-	-
Bududa	-	-	-	-	-
Manafwa	Sibanga	-	-	March to June	-
	Bugobero	-	-	March to June	-
	Buwagogo	-	-	March to June	-
	Bubutu	-	-	March to June	-
	Butiru	-	-	March to June	-

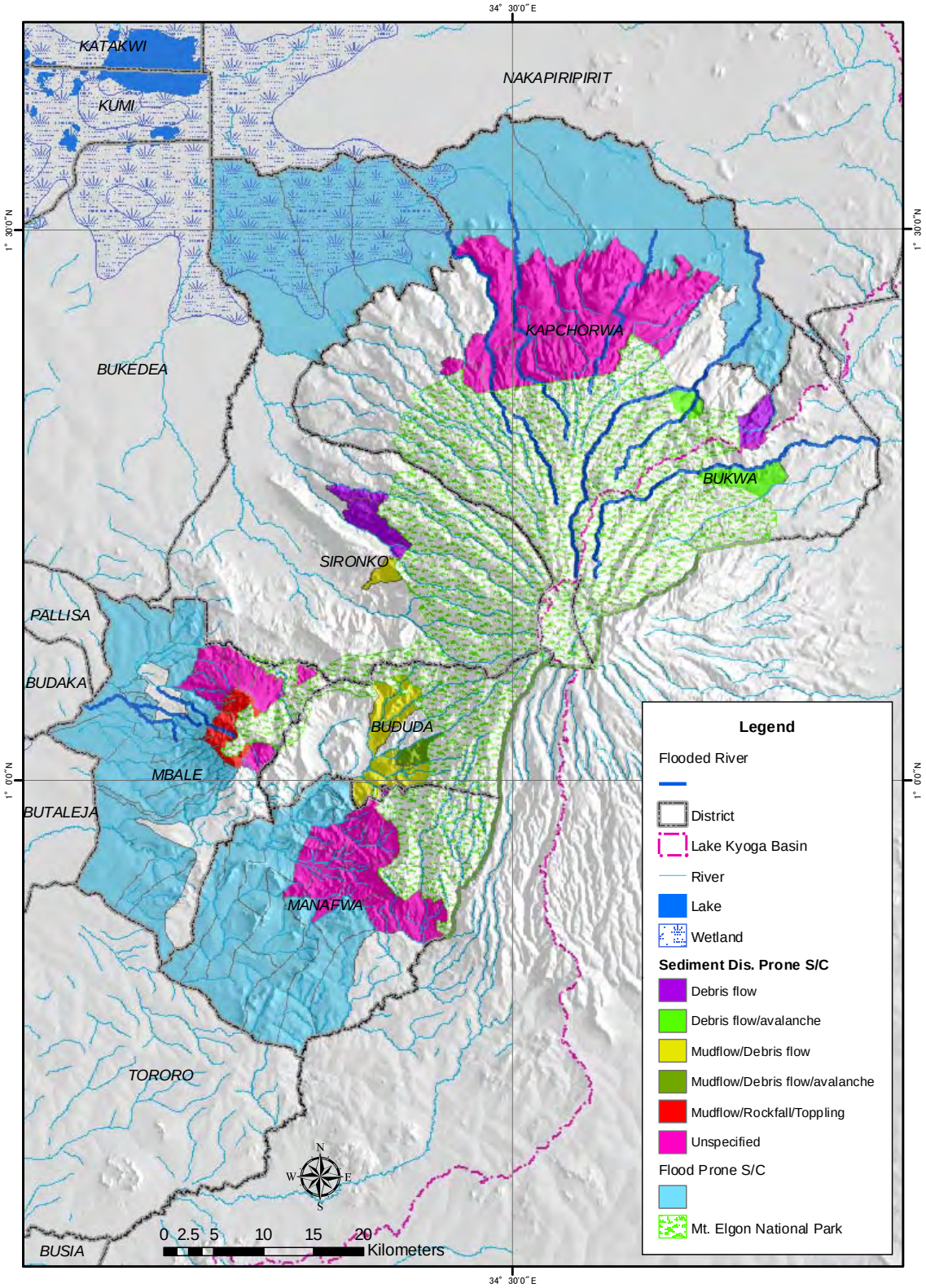


Figure 9-24 Sediment Disaster & Flood Prone Area in and around Mt. Elgon Area

(2) Pattern of Sediment Disasters around Mt. Elgon Area

1) Topographic and Geological Conditions around Foot of Mt. Elgon

Mt. Elgon is above sea level 4,310m and is considered as a composite volcano in Cenozoic, of which original magma is lava by alkali basalt. The mountain body has a sandwich structure that lava and tuff made by pyroclastic flow and volcanic ash alternately repeat. The tuff occupies thickness about 5-10 time to Lava=1 (Photo 9-3)).

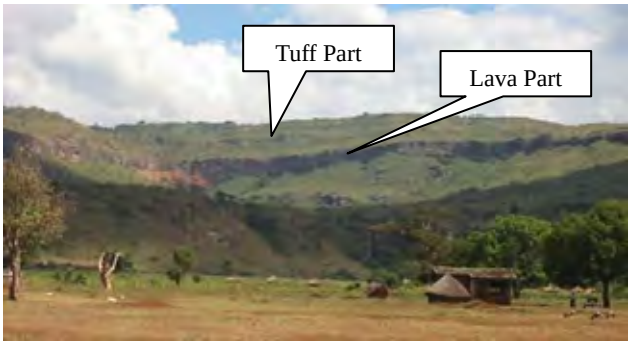


Photo 9-3 Sandwich Structure of Lava and Tuff

Since the lava is strong in weathering because it is dense and rigid but the tuff is weak to weathering and erosion, the lava protects progression of weathering of the tuff in the lower part of the lava in the place where lava remains, and terraced geographical features are formed in the upper part of the lava as shown in Figure 9-25. On the other hand, the tuff which is early to weathering is exposed and remarkably eroded in the place where the lava collapsed, and a terrace low by one step is formed.

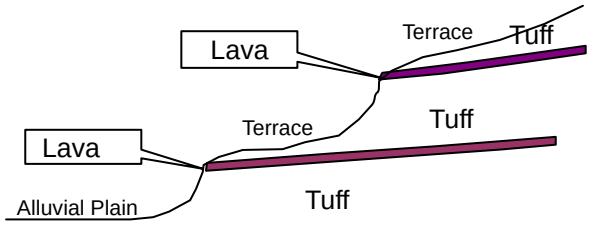


Figure 9-25 Geological Structure around Foot of Mt. Elgon

2) Collapse Pattern of Slope

Collapse of rock slope is controlled in collapse pattern by topple that foreface of slope unsticks by vertical crack and corrupts like falling as shown in Figure 9-26. Lava is strong in weathering of the rock itself, however, the lava unsticks, falls and corrupts from the foreface by erosion of lower tuff since the lava has developed vertical cracks due to fast cooling in the process of flowing on the surface. Slopes formed by this phenomenon have been observed through the field reconnaissance, lava part exposes near-vertical sheer surface (Photo 9-3).

Source：USGS HP

Figure 9-26 Topple

Even in tuff part, collapse has occurred by topple in the part with steep slope.

The slope of Mbale city side in Ngokonjeru located in about 6km south-east of Mbale city has sheer cliff and topple-type collapse has occurred (Photo 9-4). Colluvial deposits are accumulated in the cliff foot and there are unstable soil masses in places. These soil masses may corrupt by a heavy rainfall or a change in terrain in future. When this slope corrupted by

heavy rainfall on September 2007, rock collapse as well as collapse of unsteady talus cone deposited below the rock have occurred and have caused damage to houses and roads by mountain.

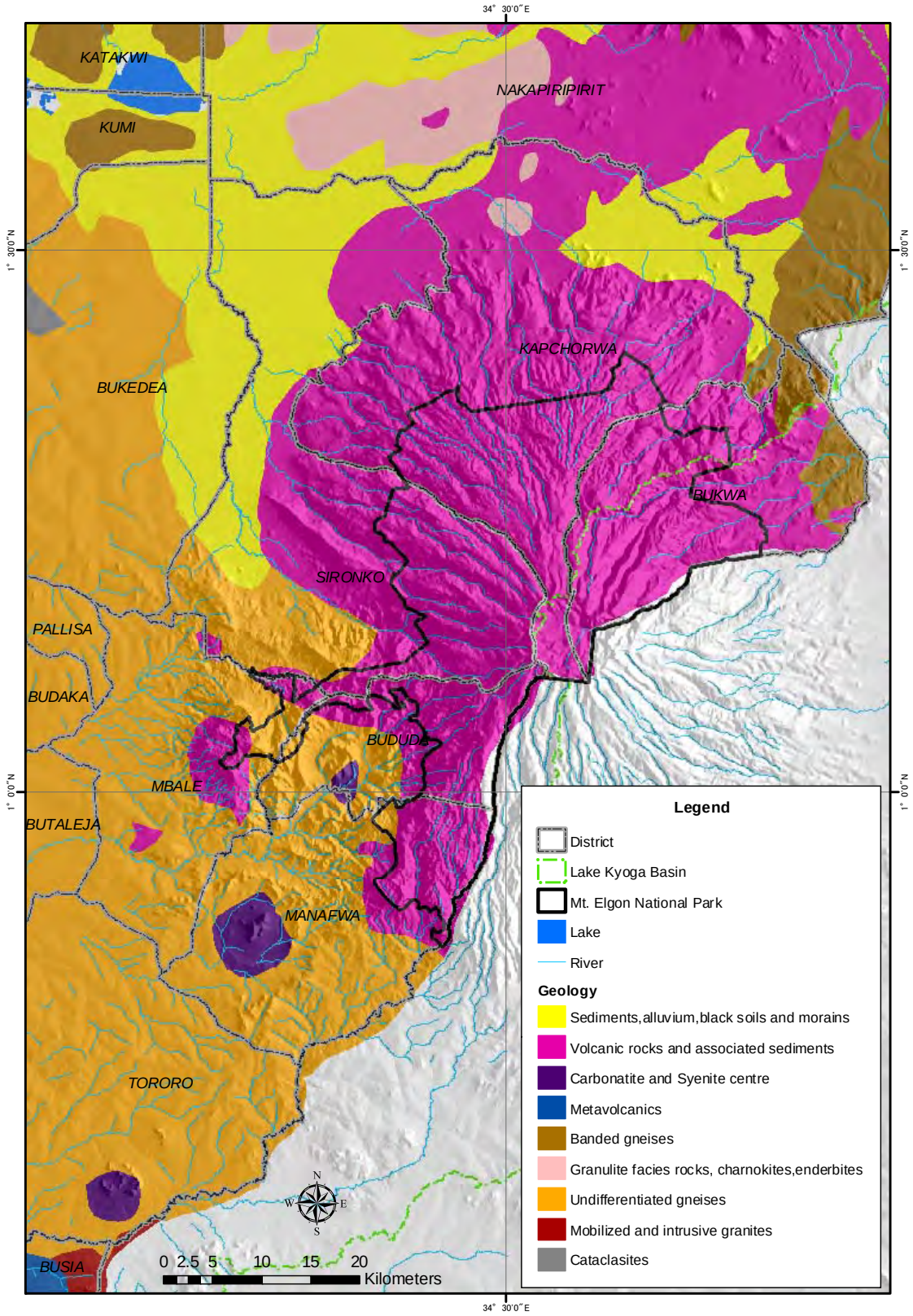
Photo 9-4 Collapsed Slope by Topple

On the other hand, tuff located in a terrace in the upper part of lava is considered that the part made brittle by weathering has been gradually eroded by rain and forms rounded hillside (Photo 9-5). The danger of collapse and slope failure is a little in such an area.

Photo 9-5 Hillside (Terrace)

Moreover, according to the information acquired through the interview survey, sediment disasters have frequently occurred in the area along the road between Kapchorwa city and Bukwa city. In the observation through the field reconnaissance, geographical features of this area are steep slope and deep valley with high-erosion potential, and the potential of sediment disaster (slope failure and slope erosion) is felt to hide in a lot of places. Therefore, it is considered that the danger of mud flow, debris flow and flash flood is high along rivers when heavy rainfall happens, and collapse and others have frequently occurred in the part where balance changed by the change in terrain such as road construction and land reclamation.

The surrounding of Mt. Elgon is the same geological features (alkaline volcanic rocks) as shown in Figure 9-27, and the geographical features are also resembled. As it was informed in the interview survey in Sironko and Manafwa districts that sediment disasters also have frequently occurred in mountainous area of these districts, it is considered that such disasters have occurred in a similar pattern as mentioned above though concrete disaster sites in these districts could not be confirmed.



Data Source: GIS data of National Biomass Study (1996), Forest Department

Figure 9-27 Geology in and around Mt. Elgon Area

9.3.3 Past and Ongoing Projects

Past and ongoing projects regarding forest conservation, tree planting, flood and sediment control, which target at in and around Mt. Elgon area, are described below.

(1) FIEFOC (Farm Income Enhancement & Forestry Conservation Project)

Farm Income Enhancement and Forest Conservation Project (FIEFOC) has started in 2005 with a expected period of over 5 years. The original total project cost is UA 51.15 million (approx. US$ 113 million) funded by ADB, Nordic Development Fund and government of Uganda.

The project is national, though focusing on 37 out of 56 districts of the country (Number and boundary of districts was those at the time of project formulation, therefore they are different from present ones). Sironko and Mbale (present Mbale, Manafwa and Bududa districts) districts were selected in Mt. Elgon area. The objective of the project is to improve incomes, rural livelihoods and food security, through sustainable natural resources management and agricultural enterprise development.

Major project benefits include 1) increased household incomes, 2) improved nutrition and food security, 3) improved general welfare of the community, and 4) protect environment and improved soil fertility for sustainable agriculture.

The project comprises two (2) major components with sub-components as follows:

A: Agricultural enterprise development component
- A1: Soil fertility management sub-component
- A2: Small-scale irrigation and crop development sub-component
- A3: Apiculture support sub-component
- A4: Agricultural marketing sub-component

B: Forestry support component
- B1: Community watershed management sub-component
- B2: Tree planting sub-component

According to the “Uganda Water and Environment Sector Performance Report 2009”, project outputs are summarized below:

Participatory situational analysis was carried out in 94 water catchment areas, as a prelude to preparation of community watershed management plans. 6,500 ha of deforested areas were being re-vegetated through replanting and 1,000 ha of degraded forests were being enriched through planting indigenous species. 42 community nurseries were established at parish level. Over 7 million tree and fruit seedlings (equivalent to an estimated 4,000 ha) were supplied to small-scale tree growers in 50 districts. Over 11,400 individual tree farmers, 250 institutions (schools and churches) and 300 farmer groups with over 540 members benefited. More than 30% of the beneficiary farmers were women. The project built on the tree planting enthusiasm that had gripped the country.

According to the information from DEO or DFO in and around Mt. Elgon area, though the project targets at many districts nationwide, beneficiaries are not so large due to the confined objective area. For example, only one sub-county was selected in each district of Mbale, Manafwa and Bududa districts and concrete projects are conducted targeting at only one parish within each selected sub-county. They are recognized that how to expand the activities is a key issue. Meanwhile, three sub-counties were selected in Sironko district. The difference of number of selected sub-county seems to relate to the condition of district at the time of project formulation when Mbale was a rather large district including present Mbale, Manafwa and Bududa districts. Targeted sub-county and parish in the districts in and around Mt. Elgon area are shown in Table 9-10 and Figure 9-28.

The right photo 9-6 is a tree planting site of the project in Mbale district. Tree species for planting are determined taking consideration of regional characteristics such as soil conservation, profitability, indigenous species and slope. The examples of recommendable species are pine and grevillea.

Photo 9-6 Tree Planting (Mbale)

(2) MERECP (Mount Elgon Regional Ecosystem Conservation Programme)

This programme was started in response to the need for a regional approach to the management of the transboundary ecosystem as an important part of a water catchment for Lake Victoria, the River Nile and Lake Turkana. This program also falls within the framework of Lake Victoria Basin Commission (LVBC) operational strategy 2007-10 under the Environmental and Natural Resources programme area.

MERECP was designed by the International Union for Conservation of Nature (IUCN) and implementation started in September 2005 for a four (4) year period with a total co-financed budget commitment of NOK 34.2 million (approx. US$ 4.827 million) by the Governments of Norway and Sweden.

At the mid-term review of the project that was carried out in April, 2008, it was recommended that the programme strategy be redesigned to focus resources towards grass-root level communities living adjacent to the National Parks and Forest Reserves in the Mt. Elgon area of Uganda and Kenya. Under the redesigned programme strategy, implementation is managed by LVBC of the East African Community (EAC). Implementation at the country level is coordinated by the Ministry of Water and Environment in Uganda and Ministry of Environment and Mineral Resources in Kenya. This implementation period is proposed to cover January 2009 - December 2010. The key expected outputs here include benefits sharing and co-management models of ecosystem and biodiversity conservation and management around protected areas demonstrated successfully by end of 2010; Equity and benefit sharing models/revolving funds that

create opportunities for payment of ecosystems goods and services for unproved livelihoods are in place; Linking of livelihoods improvement to climate change mitigation/adaptation demonstrated successfully by end of 2010 and appropriate institutions are strengthened in support of the transboundary ecosystem approach by end of 2010.

According to the information from DFO of Kapchorwa district, activity for sustainable management of river banks has been conducted targeting at Ngenge, Atari and other rivers in Kapchorwa district, which is a part of this programme. The contents of the activity are to plant trees at 5m intervals along the line of 30m distance from ridge of river banks in order to clarity river banks protection area, then to plant grasses inside of the lined trees and to promote tree planting even outside. In addition to this river banks management activity, training to energy conservation techniques and encouraging people's recognition of boundary of protected area are also conducted in this programme.

In Sironko district, Sironko river is a targeted river for this program. And, activities by this programme will be started from 2010 in Bukwa district. The rivers confirmed as a target river in this program are shown in Table 9-10 and Figure 9-28.

(3) UWA-FACE (Forest Absorption Carbon dioxide Emission)

In Uganda FACE started in July 1994 in Mt. Elgon and August 1994 in Kibale. By then the two parks were under Uganda National Parks later on called UWA. UWA-FACE is an activity implemented jointly and is a joint venture between UWA and FACE Foundation of the Netherlands. In the venture, FACE plants the trees and UWA protects/conserves the restored areas for a minimum of 99 years.

Overall goal of UWA-FACE is to restore the bio diverse vegetation of the encroached areas to their original forest ecosystem state. And project objectives include 1) to enhance water catchment values in MENP (Mt. Elgon National Park) through creating forest cover that controls soil erosion, 2) to sequester CO2 to mitigate the effects of green house gasses, 3) creating employment to local communities residing adjacent to the parks hence active involvement of them in the restoration programme and hence foster friendly relationship with them, 4) to provide forest products for the local communities on a sustainable use basis without destruction of the forest, 5) provision of forest management skills to the local communities in the area of nursery, planting, tending and fire protection needed for natural forest.

UWA-FACE has planted 8,403 ha in MENP in past three phases from 1994 to 2002, and reforests 25,000 ha of previously encroached areas of MENP in following three-year phases with a period of 15-20 years. As a part of UWA-FACE project, collaborative forest restoration by community and UWA is conducted from 2009 in Bududa district as a pilot district. Trees are planted in the border of National Park and also in private land. Tree planting as live boundary marks are planned as substitutes of present concrete pillars installed along the border with intervals of 200-300m.

Reforestation areas by this project are shown in Table 9-10 and Figure 9-28.

(4) Other Activities

1) Riverbanks Restoration Action Planning in Mbale District

In Mbale district, one-week exercise was conducted in Bungokho-Mutoto sub-county in July 2009 with the major objective of promoting the management of riverbanks through community participation in the sub-county. The exercise was achieved through 1) resources mapping: communities listed all rivers, 2) timelines/trends: communities discussed and compared the past, current and future situations along the riverbanks, 3) problem tree: communities identified the problems, causes and solutions concerning riverbanks and their catchments, 4) visioning: communities listed the stakeholders and their roles in the management of riverbanks and their catchments. Finally, protection/buffer zone with 2 to 5 meters on either side of the rivers along was determined in each river and action plan such as planting of vegetation and enforcing of bylaws was proposed.

2) Soil & Water Conservation Activity by Community itself in Bukwa District

In some part of Bukwa district, communities conduct tree planting and making terraced fields for soil erosion control and soil & water conservation of their own initiative. Local government will support such activities in future, and it is expected to expand and activate them.

Table 9-10 Projects and Target Area in and around Mt. Elgon Area

District	Sub-County	Parish	Project
Kapchorwa	Benet	-	Erosion & Sediment Control
	Ngenge & Atari River etc.		MERECP
Sironko	Bukhulo	-	FIEFOC
	Butandigl	-	FIEFOC
	Bunambutye	-	FIEFOC
	Sironko River		MERECP
Bukwa	Bukwo	Chepkwasta	Erosion and sediment control, and Reforestation by Community
Mbale	Busova	-	FIEFOC
	Wanale	*Bordering Area of National Park*	UWA-FACE
	Bungoko-Mutoto	Bumutoto, Bumboi, Mooni, Bukhasakya,	Riverbanks Restoration Action Planning by District
	Bukhasakya (Newly created)		
Bududa	Bukigal	Bumatanda	FIEFOC
	Bubita	*Bordering Area of National Park*	Collaborative Forest Restoration on Degradaded Area of Bududa to the National Park by UWA-FACE
	Bulucheke		
	Bumayoka		
	Bushika		
	Bududa		
Manafwa	Butiru	Bukhotu	FIEFOC

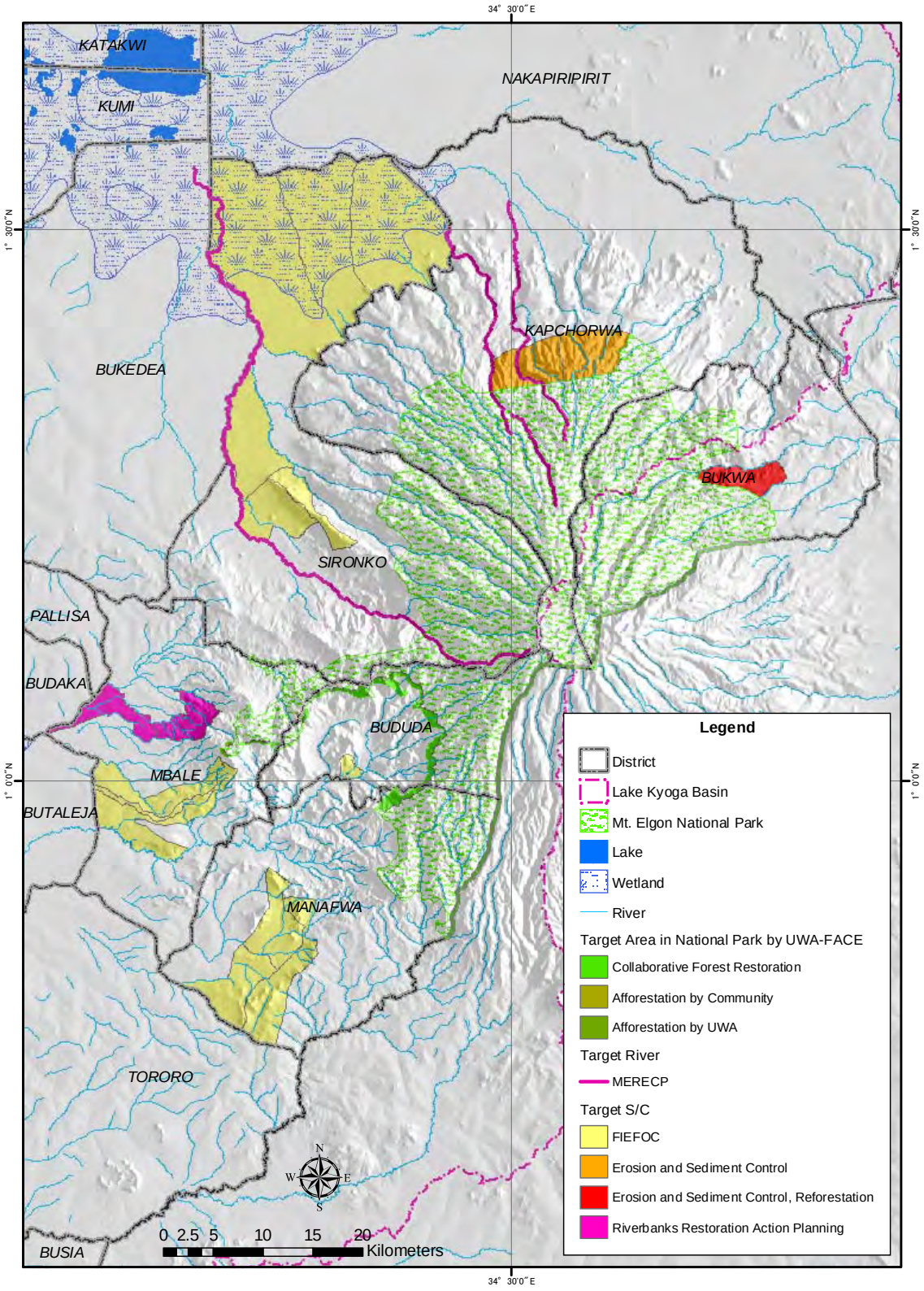


Figure 9-28 Projects and Target Area in and around Mt. Elgon Area

9.3.4 Relevant Law and Regulations

Law and regulations relevant to watershed and forest management are described below.

(1) National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000.

The regulations apply to all wetlands and all river banks and lake shores in Uganda. The major objectives of the regulations are 1) to provide for the conservation and wise use of wetlands and their resources in Uganda, and 2) to facilitate the sustainable utilization and conservation of resources on river banks and lake shores by and for the benefit of the people and community living in the area.

According to the article 29 of the regulations regarding the rivers, the rivers specified in the Sixth Schedule to these regulations shall have a protection zone of one hundred meters from the highest water mark of the river, and the rivers not specified shall have a protected zone of thirty meters. No activity shall be permitted within protected zones without the written authority.

In the Lake Kyoga Basin, Manafwa, Sezibwa, Malaba, Sipi, Namatala, Sironko, Muzizi and Nabuyonga Rivers are specified in the Sixth Schedule.

(2) National Environment (Hilly and Mountainous Area Management) Regulations, 2000.

The major objectives of the regulations are 1) to facilitate the sustainable utilization and conservation of resources in mountainous and hilly areas by and for the benefit of the people and communities living in the area, and 2) to promote the integration of wise use of resources in mountainous and hilly areas into the local and national management of natural resources for socio-economic development;

The regulations stipulate to identify and register mountainous and hilly areas which are at risk from environmental degradation and to make an application when a person desires to conduct some activities in mountainous and hilly areas where the slope exceeds 15%. Also, rules for soil conservation are stipulated by the type of slopes, which are gentle slopes (slopes up to 3%), medium slopes (slopes of 3 to 15 %) and steep slopes (slopes of 15% and above).

(3) National Forestry and Tree Planting Act, 2003

The major objectives of the act are 1) to create an integrated forest sector, 2) to guide and cause the people of Uganda to plan trees, and 3) to ensure that forests and trees are conserved and managed.

Forests in Uganda are classified as central forest reserve, local forest reserve, community forests, private forests and forests forming part of a wildlife conservation area. In the act, objectives and process of declaration of forest reserves, and process of declaration of community forests are stipulated. As for private forests, rights of owner, a contractual for its development and governmental role are stipulated.

In forest reserve and community forests, a responsible body shall prepare a management plan in consultation with the local community, and a management plan shall be revised every five years. Activities for taking and using forest produce and construction in these area are strictly prohibited except in accordance with a management plan or a licence granted under the act.

In addition, the act stipulates issuing directions for the planting and growing of trees, establishing and managing a Tree Fund, a process of a licence for utilization of forest produce, trade in forest produce, administration of the Minister, organization and responsibility of National Forest Authority, and others.

9.3.5 Apply of Survey Results to the Basic Plan

Survey results as described above are summarized as follows:

- Deforestation and forest degradation has gradually progressed. Deforestation and forest degradation also occur even in regulated areas and it may be caused by encroachment by pressure of rapid population increase.
- Major factor of deforestation and forest degradation is considered as expansion of human activities by rapid population increase.
- Land development and cultivation are progressing in everywhere around Mt. Elgon but densely-populated areas are not so many and seem to locate in comparatively low disaster potential area.
- Although sediment disasters and flood have frequently occurred, there are not many disasters cause heavy damage.
- The reason why heavy damage has not often occurred is considered that magnitude of disaster is not so large and population living in high disaster potential area is not so much.
- However, heavy damage can be occurred in 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.
- Large-scale collapse and slope failure, which may cause heavy damage, are considered to be drawn by phenomenon of topple or debris avalanche.
- It has a possibility that one of the factors of flood is an increase of runoff ratio due to deterioration of the upstream area.
- There are several past and ongoing projects for forest conservation, environmental conservation and afforestation, which have achieved some positive results.
- Law and regulations regarding wetlands, river banks and lake shores management, hilly and mountainous area management, and forestry are developed.

Comprehensively investigating disaster characteristic, geology, topography, beneficiary, benefit by cost, construction experience, operation & maintenance and others against the background of the above, it is judged that non-structural measures with medium and long-term point of view are more suitable as measures for hilly and mountainous area in the basin than structural measures.