FLOOD & DROUGHT MANAGEMENT TOOLS

Lake Victoria Basin

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1. The Lake Victoria Basin

1.1 Physical characteristics and climate

The Lake Victoria Basin is located in the upstream part of the Nile River Basin and is shared among 5 countries, with a total area of about 251,000 km^2. Tanzania covers the largest part of the basin (44%), followed by Kenya (22%), Uganda (16%), Rwanda (11%) and Burundi (7%). The lake itself, which covers an area of about 68,800 km^2, is shared among Tanzania (51%), Uganda (43%) and Kenya (6%). The Lake Victoria Basin falls under the equatorial hot and humid climate with a bi-modal rainfall pattern with long rains from March to May and short rains from October to December. Annual rainfall ranges from a maximum of 2,400 mm in Uganda to 1,350 mm in the Kenyan part of the catchment.

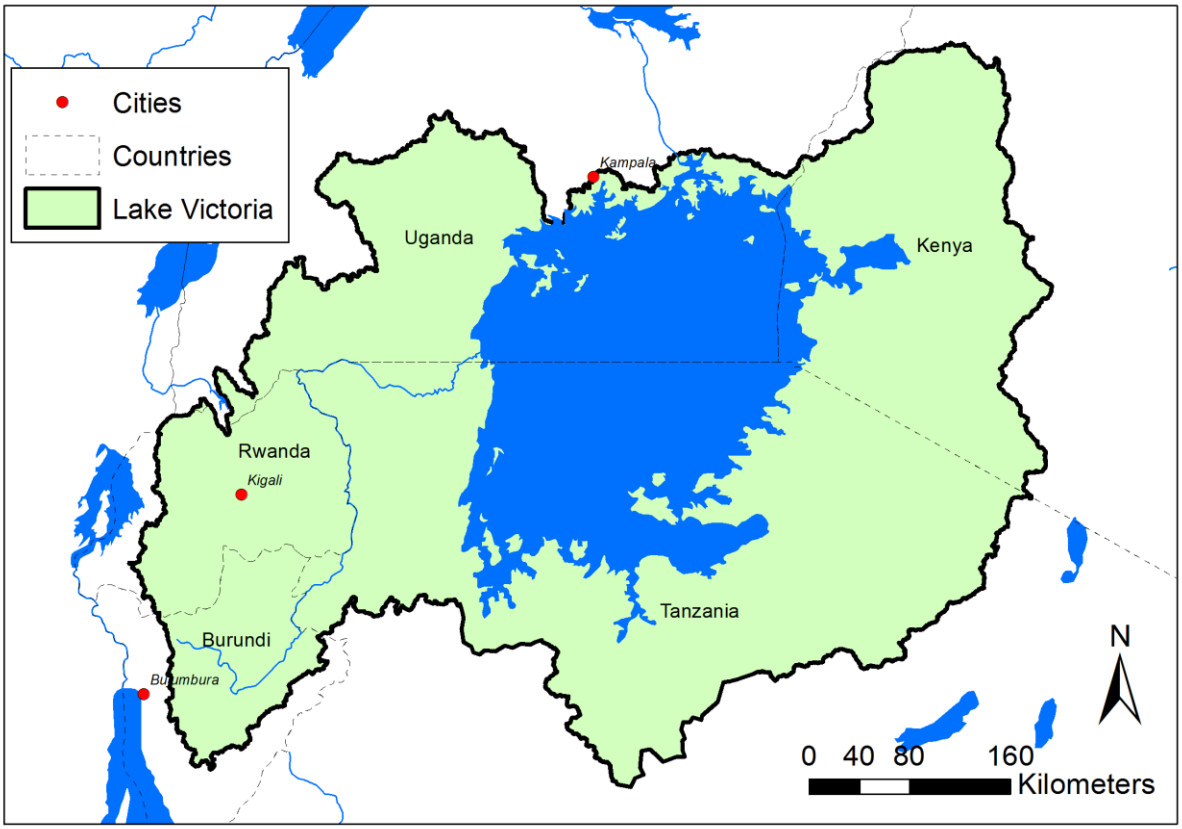

Figure 1. Map of Lake Victoria Basin

1.2 Socio-economics

The Lake Victoria Basin has a population of about 35 million people, with an estimated growth rate ranging between 2% per annum in Burundi to 3.4% per annum in Uganda (United Nations Environment Programme, UNEP, 2006).The rural population is about 60% of the total; with the exclusion of Kampala, the rural population is as high as 90%. On average, 65% of the population is less than 25 years old, which implies a high dependency level. The region is one of the more densely populated in the world, with an average of more than 500 persons/km^2, exceeding 1200 persons/km^2 in parts of Kenya. This is largely due to the regions favourable conditions for agriculture, fishing and other economic activities. The vast majority of the basin's population depends on natural resources and small holdings of one hectare or less. Agriculture and fisheries are the two most important livelihoods. Other economic activities include bee keeping, trading activities, quarrying and sand

mining, and mining of gold and other minerals. Agrochemicals production and food processing are also among the important economic activities.

1.3 Hydrology

The Lake Victoria Basin is composed of many sub-basins: Sio, Nzoia, Yala, Nyando, North Awach, South Awach, Sondu, Gucha-Migori, Mara, Grumeti, Mbalageti, East Shore Streams, Simiyu, Magogo Moame, Nyashishi, Issanga, South Shore Streams, Biharamulo, West Shore Streams, Kagera, Bukora, Katong, North Shore Streams. About 33% of the inflow to the lake comes from the Kagera River, shared between Rwanda, Burundi, Uganda and Tanzania, while the Mara River (5%) is shared between Kenya and Tanzania. Other notable rivers are the Nzoia (15%) and the Yala (5%) in Kenya. The total average inflow to the lake is about 800 m^3/sec. Precipitation remains the largest contributor of water to the lake. The changing climate has therefore influenced the lake levels.

The only outflow from the lake is the Nile River, exiting the lake near Jinja, Uganda. This makes the lake the principal source of the Nile.

1.4 Impact of flood and drought

Both flood and drought events are serious issues in the basin, impacting livelihoods, public health and the environment. The root causes of floods are irregular seasonal and year to year variability in rainfall patterns, combined with mismanagement of land and water resources, leading to soil erosion and increased run-off. Droughts are the consequence of long and pronounced dry seasons, which increased in number and severity in recent years due to changes in weather patterns, including rainfall and temperature.

The most severe drought events in the basin occurred in northern Uganda and in some parts of southern Sudan, while flooding arises mainly in the foothills of the highlands and in the flat areas where the rivers flow into the lake. Numerous swamps can be found in most of the plains of the basin; they play an essential role in regulating both the quality and quantity of river flows. Perennial flooding occurs in areas where swamps have been drained and the resident river canalised, as in the case of the Kano Plains, near the outlet of Kenya's River Nyando.

Floods and droughts often result in disasters in the riparian countries. Heavy rainfall upstream coupled by land degradation results in flooding downstream. Rivers banks often burst and submerge communities resulting in the displacement of people and loss of property, livelihoods and in extreme cases life. Droughts in the basin affect food production, availability of water and generation of hydroelectric power generation for industrial and domestic consumption.

1.5 Hydraulic infrastructure

The most important hydraulic structure in the basin is the Owen Falls Dam in Jinja, Uganda, at the outlet of the lake. The dam was built for hydropower generation and has been supplemented by one more dam straddling the Nile downstream of Owen Falls Dam near Bujagali; the Bujagali Dam completed in 2012. The dam at Owen Falls has been operated in such a way that it releases the "natural flow" of the Nile. However the introduction of a second dam has impacted the water levels in the lake and natural flow requirements of the Nile.

1.6 Institutional environment

The institutional environment ranges from transboundary institutions handling water issues across national boundaries to national, regional and local public bodies in charge of developing and setting policies and standards for water management, issuing permits, ensuring compliance, and taking appropriate enforcement actions.

At the basin level, the Lake Victoria Basin Commission (LVBC) was established in 2005 as an apex institution of the East Africa Community (EAC). The Commission functions in the countries through

the designated National Focal Point Ministries and the Ministries responsible for EAC Affairs. LVBC coordinates the sustainable development of the Lake Victoria Basin as well as programs and other interventions undertaken by various stakeholders operating in the basin. Activities of the LVBC contribute to five main policy areas:

1. Ecosystems, Natural Resources and Environment
2. Production and Income Generation
3. Living Conditions and Quality of Life
4. Population and Demography
5. Governance, Institutions and Policies

Another specialised institution of the EAC is the Lake Victoria Fisheries Organization (LVFO), established in 1994. The main goal of the LVFO is for the Member States to collaborate on the development and management of the fisheries of Lake Victoria.

A number of institutions have also been established to spearhead development in the basin through better water resource management and through general supervision and co-ordination over all matters relating to the environment. These are, for example, country level ministries and a number of on purpose established authorities, as the Lake Basin Development Authority (LBDA), the National Environment Management Authorities (NEMA) of Kenya and Uganda and the National Environment Management Council (NEMC) in Tanzania.

1.7 Key issues

Over the last four decades the Lake Victoria region has faced a number of environmental problems, including pollution of the lake from domestic, industrial and agricultural activities, biodiversity loss, habitat destruction and soil erosion. It is estimated that the lake's indigenous fish species have been reduced by 80% and over 70% of the forest cover in the catchment area has been lost. In addition, the water quality in the rivers flowing into the lake continues to carry increasing amounts of silt and nutrients, causing eutrophication. Parts of the lake are now considered dead zones, unable to sustain life due to oxygen deficiency in the water.

The fishery of Lake Victoria has undergone a tremendous commercial transformation during the last 20 years. Fish processing factories funded from international sources are now exporting fish to the developed world, getting high profits. As a result, local communities whose livelihood depends on the lake are trapped in a vicious downward cycle of food insecurity.

1.8 Future changes

Lake Victoria has been facing significant fluctuations in the water level and an irregular hydrological behaviour during the last century. This characteristic of the lake has significant consequences for downstream countries that are also dependent on the Nile, in particular Sudan and Egypt. It has been observed that the fluctuations are highly dependent on rainfall. Changes in precipitation patterns due to climate change are already causing more intense and unpredictable flooding and drought events, jeopardising the availability of water resources, the health of aquatic ecosystem and the main socio-economic activities in the basin; i.e. agriculture and fisheries.

1.9 Projects and programs

One of the key programmes in the basin is the Lake Victoria Environmental Management Program currently in Phase II (LVEMP II). The purpose of LVEMP II is to contribute to the EAC's Vision and Strategy Framework for the Management of the Lake Victoria basin – "a prosperous population living in a healthy and sustainably managed environment providing equitable opportunities and benefits". The project was designed to address major environmental concerns in the Lake Victoria Basin which had adverse impact on the basin's ecosystem, as well as the economy and livelihood of the region.

Another key programme is the Lake Victoria Water Supply and Sanitation (LVWATSAN) Programme Phases I and II. The initiative was launched in 2004 by the United Nations Human Settlement Programme (UN-HABITAT), in association with the Governments of Kenya, Tanzania and Uganda, to address the water and sanitation needs of the population, particularly the poor, in the secondary urban centres around Lake Victoria. The initiative receives funding from a variety of donors including the African Development Bank. Phase I was aimed at small towns in Uganda, Kenya and Tanzania, and Phase II saw the addition of 15 towns, including a number of towns in Rwanda and Burundi.

A regional initiative funded by the United States Agency for International Development (USAID) is the Sustainable Water and Sanitation in Africa (SUWASA). The initiative is designed to spread effective models of reform at the water utility and sector levels, and to facilitate innovative financing approaches for African water providers. There is special consideration of improving and expanding the delivery of water and sanitation services in urban and peri-urban settings. Projects are implemented in a number of countries including Kenya and Uganda.

Under the Shared Vision Program of the Nile Basin Initiative (NBI), the Nile Basin Decision Support System (NB-DSS) has been developed. The NB-DSS is an information-based decision support tool that allows the involvement of various stakeholders in making decisions regarding water resources management and development in a given catchment. National and regional level capacity building trainings are currently taking place across the basin.

Other relevant projects and programmes present in the region are the Maritime Communication for Safety on Lake Victoria (MCSLV) Project, the Mount Elgon Regional Ecosystem Conservation Programme (MERECP), the Planning for Resilience through Policy Adaptation, Research and Economic Development (PREPARED) Programme and the Population, Health & Environment (PHE) Programme.

2. Urban environments and utilities

2.1 Overview of urban areas in the basin

The majority of the population in the basin lives in rural villages and small towns. However, the region has experienced a process of rapid urbanisation – at a rate far in excess of the regional average of 3% per year – to towns concentrated along the lake edge growing at rates. The urbanisation process has been accelerating due to several factors, including rural poverty, land pressures and lack of job opportunities in rural areas.

There are 87 large towns in the Lake Victoria Basin, of which 51 are in Kenya, 30 in Tanzania and 6 in Uganda. The major urban areas located on the lakeside are Mwanza, Bukoba, Musoma, Kampala, Jinja, Entebbe, Masaka, Kisumu, Homa Bay, and Kendu Bay.

Table 1. Population distribution around Lake Victoria

Country	City	Population
Kenya	Kisumu	427,000
	Homa Bay	59,528
	Kendu Bay	29,638
Tanzania	Mwanza	385,810
	Bukoba	105,000
	Musoma	104,851
Uganda	Kampala	1,659,600
	Jinja	89,700
	Entebbe	79,700
	Masaka	74,100

These cities and towns are sources of pollution for the basin due to their inadequate solid and liquid waste handling capacity. A study by COWI Consulting Engineers indicated that the pollutant loading to the lake from urban areas was 17,938 tons/year of Biochemical Oxygen Demand (BOD), 3,505 tons/year total Nitrogen, and 1,624 tons/year total Phosphorus. The flow of nutrients and effluents from urban sources (as well as from deforestation and agriculture) has resulted in increasing eutrophication near the lakeshore. Poor water quality means that the inhabitants of the towns and cities surrounding Lake Victoria suffer from a shortage of safe (good quality, clean and reliable) drinking water.

2.2 Major utilities in the basin

The largest utilities in the Basin are located in Kisumu (Kenya), Kampala (Uganda) and Mwanza (Tanzania).

In Kenya there are 8 regional Water Service Boards responsible for the development and rehabilitation of water and sewerage facilities and for investment planning and implementation in their service areas. The Lake Victoria South Water and Sewerage Board (LVSWSB) appointed Kisumu Water and Sewerage Company (KIWASCO), a publically owned company, to supply water within the jurisdiction of Kisumu municipality. Most of the water used in Kisumu is extracted from Lake Victoria.

The National Water and Sewerage Corporation (NWSC) is the primary supplier of water and sanitation services in Uganda, withdrawing water from Lake Victoria. It is owned by the Government of Uganda. NWS currently serves 23 towns – 2.9 million people out of and approximate 32 million, with major operations in Kampala and Jinja.

The Mwanza Urban Water and Sewerage Authority (MWAUWASA) is a Government agency of Tanzania, established for the provision of water and sewerage management services in the city of Mwanza. Lake Victoria is the major source of the piped water scheme, which serves about 84% (500,000 people) of the Mwanza city and Kisesa township population.

Other relevant utilities in the basin are the Bukoba Water Supply and Sanitation (BUWASA) Authority and the Musoma Urban Water and Sewerage Authority (MUWASA) in Tanzania. BUWASA serves around 53,000 people in Bukoba, which are about 61% of the total population. Almost 60% of water supplied to the town comes from Lake Victoria. MUWASA is responsible for the overall operation and management of water supply and sanitation services in the Musoma Municipality. It draws water from 3 Lake Victoria intakes and serves around 90,000 people.

2.3 Water Safety Plan implementation status

At the moment the utilities are in various stages of their Water Safety Plan (WSP) implementation. In December 2012, KIWASCO partnered with MWAUWASA and the NWSC-Jinja in a WSP Water Operators Partnership agreement to promote good practices and share experiences to improve the performance of utilities. The three utilities rely on the Lake Victoria catchment as main source for water abstraction. It is thus envisaged that the development and implementation of the WSPs will guide the utilities in working closely with stakeholders in the catchment to ensure that both the quality and quantity of water in the catchment is sufficient.

2.4 Management of floods and droughts in urban areas

The Lake Victoria Basin is prone to floods in the low lying areas during the rainy season where water reaches peak levels and river banks are breached. Heavy sediment loads brought down by rivers from deforested upstream areas decreases the carrying capacity of the rivers and consequently generates a rise in flood levels. In some years, the lake rises to unexpected levels when the major rivers reach their peak, flowing back over the lands increasing the flooding areas in the lowlands. This threatens houses, infrastructure, agricultural lands, crops, and in extreme cases results in fatalities of humans and livestock.

With regards to droughts, there has been an improvement in recent years with seasonal and long-term climate predictions, such as those issued by many national and regional institutes in Africa, including drought monitoring centres. The improvements have assisted in the implementation of drought disaster mitigation and effective contingency plans.

Information on how utilities and urban areas are managing floods and drought situations is limited. In Mwanza, MWAUWASA has needed to make major changes in their abstraction system due to a reduction in the lake level. They have constructed a new sump which is lower than the original, and added more pumps to enable pumping of water to the treatment plant from the new sump.

NWSC has made efforts to protect the lake through the construction of infrastructure, for example through a EUR 100 million project, WATSAN, around wastewater infrastructure development. Furthermore, there are ecosystem related projects concerned with wetland restoration; these are currently ongoing.

The Nile Basin Capacity Building Network (NBCBN-RE) in the study "Flood and Drought Management for Sustainable development in the Nile Basin" proposed protocols for community-based early flood and drought warning system (case of Nzoia River Basin, Kenia) and for community-based flood mitigation measures (case of Kagera River basin, Rwanda and Burundi). These procedures involve local communities, forecasting centres, local administrations and district commissions, water resources management authorities, universities and research institutions.

2.5 Interaction between Water Utilities and Basin Organisation

Interaction between utilities and the LVBC occurs through various projects. The LVWATSAN initiative, managed by the LVBC, involves utilities in the participating towns and promotes cooperation to meet targets defined in the Millennium Development Goals (MDGs) for water and sanitation and to ensure the long-term sustainability of the physical interventions.

The LVEMP II promotes various initiatives in collaboration with water utilities, as the "rehabilitation and improvement of wastewater treatment facilities", which is part of the programme component 2 ("Point Source pollution control and prevention"), and aims at reducing point source pollution from municipal waste by supporting public investments for the rehabilitation and improvement of selected wastewater facilities, in order to reduce untreated effluents in the Lake.

2.6 Data and information availability

Basin data, including data on surface water, groundwater, floods and droughts, are collected by the national water resources authorities and to a lesser degree by the LVBC. DHI is currently contracted by the LVBC to prepare a Water Resources Information System (WRIS). In Uganda, the collection of data is managed by the Directorate of Water Resources Management. In Kenya, data is gathered by the Water Resources Management Agency and by national catchment authorities. In Tanzania, the responsible authority for data collection is the Ministry of Water & Livestock and the local basin water boards. Data is collected by the Ministry of Natural Resources in Rwanda and by the Ministry of Water, Energy and Mining and the Directorate General for Water and Energy in Burundi.

2.7 GEF past and present involvement in basin

Through the World Bank, as implementing agency, the Global Environmental Facility (GEF) has invested significantly in foundational projects, supplying about USD 45 million, with more than USD 150 million in additional leveraged resources. A Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP) have been produced (dated 2007), identifying key priorities for the following areas:

1. Ecosystems, Natural Resources and Environment
2. Production and Income Generation
3. Living Conditions and Quality of Life
4. Population and Demography

5. Governance Institutions and Policies

Climate change, related to the lake's water balance with specific mention of floods and droughts, is a priority transboundary issue identified within the Ecosystems, Natural Resources and Environment theme, however, specific actions in this area are not explicitly outlined.

2.8 Key contacts

Name	Organisation	Contacts
Mr. Omari R. Mwinjaka Water Resources Management Officer	Lake Victoria Basin Commission (LVBC)	mwinjaka@lvbcom.org
Mr. Meck Manyama Commercial Manager and WSP Team Leader	Mwanza Urban Water and Sewerage Authority (MWAUWASA)	meckmanyama@yahoo.com
Mr. David Ogaram Head of Regional Lab and WSP Team Leader	National Water and Sewerage Corporation (NWSC)	David.Ogaram@nwsc.co.ug
Mr. George Odero, Water Production Manager and WSP Team Leader	Kisumu Water and Sewerage Company (KIWASCO)	gokodero@gmail.com; oderogeorge@yahoo.com
Eng. David Onyango Managing Director	Kisumu Water and Sewerage Coompany (KIWASCO)	md@kiwasco.co.ke; moagumba@hotmail.com
Peter Kabok Aguko Managing Director	Lake Basin Development Authority (LVBDA)	kabpaguko@yahoo.com
Patrick Khisa Water Resources Management Authority	Lake Victoria South Catchment Kisumu	patkhisa@yahoo.com
Abdulkarim H Seid Head - Water Resources Management	Nile Basin Initiative (NBI)	aseid@nilebasin.org

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