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# 6.0 Environment, Ecosystems, and Tourism

This chapter presents the environmental status of the SMM catchment, wetlands, the unique ecosystems, and nature reserves. The chapter also presents the significance of tourism in the basin and the Mt. Elgon ecosystem which doubles as a major conservation and tourism area. The report provides information on the current environmental status and use of the ecosystem. Major threats to the area's environmental and ecosystem health are outlined along with some recommendations to ameliorate negative impacts of unsustainable land use and management practices. Possible investment proposals are provided in a later section.

## 6.1 Environment

The SMM catchment has a wide array of ecosystems including lakes, rivers, forests, game reserves, and national parks which are home to numerous and varied species. Environmental aspects include: biodiversity, water resources and land resources. Wildlife and forest products are important resources and sources of livelihood.

## 6.2 Biodiversity

The Mt. Elgon ecosystem spans Kenya and Uganda. Mt. Elgon is one of the oldest East African volcanoes formed approximately 15 to 20 million years ago. At a height of 4,320m, it is one of the few single-standing African mountains over 2000m. Mt. Elgon has a unique caldera, moorlands, mountain lakes and bogs, upland and midland wetlands, and rivers. The good climatic conditions in the SMM area contribute to a dynamic ecosystem which is rich in fauna and flora. This abundance of species inhabits a highly diverse ecosystem and natural protected area, for example the Mt. Elgon Forest Reserve and Chepkitale Game Reserve. In the upper catchment, the natural vegetation types include alpine moorland, bamboo forest, mountain forests, lowland forests and wooded grasslands. Mt. Elgon is part of the Eastern

African High-Altitude Biodiversity Hotspot, and it contains a number of endemic, endangered and threatened fauna and flora.

The conservation and sustainable management of the Mt. Elgon ecosystem is of major trans-boundary concern. Diverse biological, ecological, cultural and economic values are provided to neighboring, regional, and global communities. Mt. Elgon is a regional water tower and forms the upper catchment for the Lake Victoria Basin, the Turkwell and Turkana systems, Lake Kyoga, and the Nile River Basin including the Malaba/Malakisi River Basin. Mt. Elgon provides marketable goods such as food, timber, water and medicine. Non-marketable services such as air and water purification, rain formation, soil generation, maintenance of soil fertility, crop pollination, natural vegetation, and biodiversity preservation are also provided. Mt. Elgon provides aesthetic beauty to local communities. Environmentally significant areas of the upper catchment of the SMM basin include:

- Mt. Elgon
- Mt. Elgon Forest Reserve
- Mt. Elgon National Park
- Chepkitale Game Reserve
- Rivers and water falls

### 6.2.1 Significance of Mt. Elgon biological resources to local communities

Mt. Elgon has traditionally been an important resource for the people living in the mountainous districts. Livelihoods revolve around goods and services from the Mt. Elgon ecosystem. The predominant communities living adjacent to the forest are the Bukusu, Sabaot (Ndorobo), Sebei, Luhya, and Iteso. The resources of Mt. Elgon ecosystem fall into the following categories:

- Traditional socio-cultural benefits;
- Ecological benefits; and

- Economic benefits.

**a) Traditional and socio-cultural benefits**

The mountain was used as a sacred worshiping place and was considered the place of gods. Among the Bukusu, the mountain is known as ‘masaba’ or ‘zayuni’. The name zayuni comes from Mt. Zion, the Israelites sacred mountain.

The mountain contains a number of caves with ecological and historical importance. (Caves are known as ‘pango’ in the local language.) For example, Kitum cave is a night shelter for elephants. The caves have salt licks for both domestic and wild animals. The caves are associated with myths and legends and are used for religious and customary rituals. The caves were also the homes of the traditional Ndorobo and sheltered them from the cold of the mountain.

The forest also acted as a hideout from enemies. The natural forest had great thickets below the tree canopy providing a refuge.

The forest has trees used for ceremonial purposes, for example, the Korosiondet, Tekantet, Sinendet (Markhamia lutea) and Kagorwet (Erythrina abbysinica). Ceremonial dress is obtained from the skin of the colobus monkey, blue monkey, buffalo, and elephant as well as from hooves, horns and seeds of the wild animals and plants.

**b) Ecological benefits**

Mt. Elgon has several ecological benefits as a result of the altitude and forest including:

- Abundance of rainfall;
- Water catchment and a source of clean water. It is a catchment for rivers in western Kenya and eastern Uganda which feed into lake Victoria- kamukuywa, Sosio, Kimilili, Kibisi, Kuywa, Malakisi, Tisi, Lwakhakha, Kimothon, Kissawa, Suam, Turkwell and other tributaries feeding into the Nzioa River;
- Rich and fertile soils with immense agricultural potential; and

- Air purification.

**c) Livelihood and economic benefits**

The mountain supports livelihoods and the district economy. These benefits include:

- Fuel wood which is the main source of energy for domestic use;
- Timber for building;
- Pastures and herbal medicines; and
- Edible forest products e.g. honey, vegetables, bamboo shoots, fruits and game meat.

### 6.2.2 Threatened and endemic plant species

The ecosystem has endemic species found in the Afro Alpine region. These are mainly shrubs and herbs found in the high altitude areas. *Ericaceae* family, which is composed of heathers such as *Erica aborea*, and *Etrimera,* is native to the region. Some of the *Oliniaceae* family tree genera, i.e. *Afrocrania, Agenia, Kiggelaria, Leucosidea*, and *Xymalos* are endemic and display the highest number of afro-alpine species. These species are found in scattered dense shrubs in the alpine zone.

The endangered indigenous species occur in the lower forest zones. These are *Olea capensis* (Elgon teak), *Podocarpus*s, *Juniperus procera* (Cedar tree), *Hagenia abyssinica* (Rose wood), and *Aningeria aldolf-fierici*. The exploitation of these species due to their economic value has put them in great demand. *Prunus africana* is threatened due to its medicinal value. These species are mainly found in the afro-montane forest zone mainly composed of indigenous trees. Other trees and shrubs known for their medicinal values are also threatened as result of the unsustainable harvesting practices.

### 6.2.3 Threatened wildlife species

Threats to wildlife in the SMM river basin are linked to loss of habitat through degradation, encroachment, and unsustainable harvesting/utilization of natural resources. The elephant, giant forest hog, leopard and Oribi are highly threatened due to poaching and habitat loss.

Wild fires and general deforestation have further contributed to the constriction of wildlife habitats.

## 6.3 Key biodiversity issues in the Mt. Elgon Mountain District

### 6.3.1 Deforestation

Activities undertaken to meet rising food and forestry product (wood fuel, charcoal, timber etc.) demands affect the local environment through deforestation (Plate 6.1). For example, erosion is accelerated (Plate 6.1) by removing stabilizing root systems and removing forest canopies which deflect rain water and control the intensity of runoff (Plate 6.2 and Plate 6.3). Increased runoff carries large amounts of soil into nearby rivers (Plate 6.2 and 6.3) decreasing the fertility of the originally forested landscape and making forest regeneration more difficult**.**

**Plate 6.1: Hill top deforestation and stone removal to prepare for cropping**

**Plate 6.2: Flooding on the Manafwa River and silt downstream of Mt. Elgon**


**Plate 6.3: The Manafwa River with cultivation up to the riverbank and erosion**


### 6.3.2 Forest fires

Forest fires pose one of the greatest threats to biodiversity in the protected areas. Forest fires thrive due to lack of fire fighting equipment and tools. Inaccessibility of certain areas makes

fire control difficult. Monitoring is also hampered by lack of adequate fire towers. There is a need to train the local communities bordering the forest on fire prevention and fighting.

### 6.3.3 Illegal activities

Illegal activities include wild animal poaching, illegal harvesting of medicinal plants leading to over-exploitation, charcoal burning, and logging inside the protected areas. Although statistics are not available, bio-prospecting for resources is an emerging threat.

### 6.3.4 Other threats

Other threats include:

- Forest encroachment and clearing,
- Insecurity,
- Human-wildlife conflicts,
- Resource use conflicts.

The conservation and sustainable management of the Mt. Elgon ecosystem is of major trans-boundary concern. The Mt. Elgon forest is one of the largest, most ecologically significant, and commercially important natural forest areas in Kenya and Uganda. Mt. Elgon is among the highest priority forests for national conservation.

## 6.4 Wildlife

Different animal species are found in a variety of places such as trees, rocks, rivers, swamps, caves, and other microhabitats situated in Mt. Elgon Forest Reserve and Chepkitale National Game Reserve. Most wildlife is found in the protected areas. Outside the protected areas where human activities have destroyed habitat, wildlife is minimal and mostly birds. Wildlife is comprised of mammals, birds, reptiles, insects, amphibians and mollusks. Of major importance, however, is the mammalian and bird life.

No comprehensive description of the forest fauna has been undertaken. The district serves as a dispersal area for wildlife from the Mt. Elgon National Park in the Trans Nzoia district. Poaching on the Ugandan side of the mountain causes wildlife to migrate to the Kenyan side sometimes beyond capacity. Crowding from migration is further aggravated by smaller available land area due to human settlements and farming.

### 6.4.1 Mammalian species

Original inventories and oral accounts show that the Mt. Elgon ecosystem was inhabited by about 30 mammalian species, but as of now, only 20 can be found. Mammals include elephant, buffalo, defaser waterbuck, bushbuck, giant forest hog, red duicker, impala, olive baboon, blue monkey, black and white colobus monkeys, debrazza monkey, leopard, spotted hyena, rock hydrax, oribi, porcupine, squirrel, hare, civet cat, rat bush pig and various rodents. Among the carnivores are the leopard, spotted hyena, wildcat, and civet.

Different mammalian species inhabit different vegetation zones or habitats. There are three main categories of the Mt. Elgon forest as they relate to wildlife habitation and include montane forest, bamboo zone, and open moorland.

The montane forest (2000-3500m) is comprised of tall trees, bushes, and climbers. Most rivers originate in this zone. Caves providing natural salt licks are found. Among the mammals are buffaloes, cave elephants, black and white colobus monkeys, and antelopes. The area offers abundant resources required by these mammals such as water, forage, and natural salt licks.

The bamboo zone (3500-4000m) is frequented by red duiker and a few varieties of birds like francolins. Seed trees thrive here. Therefore, an abundance of food is available for birds. Leopards can also be found.

The moorland area (4000-4500m) has little vegetation and is cooler due to the higher altitude. Commonly inhabiting the moorland are rock hydrax, leopard, and a variety of rodents. Some stray lowland, mammals are also found in this area, including the buffalo and bushbuck.

### 6.4.2 Birds, reptiles, amphibians and mammals

Records show that approximately 240 bird species are found in the Mt. Elgon ecosystem. Among the most common are the Guinea Fowls, Black and White Casqued Hornbill and the Grey Crowned Crane. The cranes breed in wetlands and forage both inside and outside the wetlands.

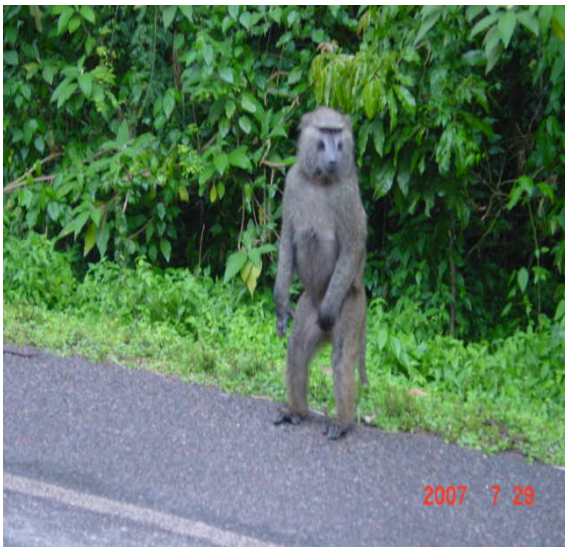
**Plate 6.4: Birds feeding in a flooded rice field on one of the Malaba River tributaries**


The birds have four habitat types, which are the bushy grasslands, open grasslands, cultivated lands and swamps (Plate 6.4). Birds include: Grey Heron, Long-tailed Cormorant, African Darter, Great White Egret, Little Egret, Night Heron, Hammerkop, Yellow-billed Stork, Hadada Ibis, Glossy Ibis, Yellow-billed Duck, Sparrow, and doves others. Mt. Elgon is considered one of the Important Bird Areas (IBA) in Kenya.

This area also represents an Important Bird Area (IBA) where the Papyrus Yellow Warbler *Chrolopeta gracillostris* and Papyrus Gonolek *Laniarius mufumbiri* are found. Certain species such as the Splendid Starling are only found in the Mt. Elgon Region. Apart from the birds, the Mt. Elgon ecosystem is a habitat for many snakes, chameleons, frogs, tortoises, and snails. The tortoise is found in salty springs, which the Sabaot call Kong'ta meaning "the eye".

In eastern Uganda along the Malaba- Mpologoma River system, most wild life has been decimated except the Sitatunga (*Tragelaphus spekei*) and a few bush antelopes and squirrels. The Sitatunga is largely a secretive aquatic animal which primarily uses the wetlands as its habitat and feeding ground.

**Plate 6.5: A baboon in Busitema Forest Reserve in Uganda**




In the Busitema Forest Reserve many baboons (Plate 6.5) are found. Other mammals have been largely wiped out through illegal hunting. The baboon is famous along the Jinja- Tororo highway where passengers enjoy viewing them and offering them food. However, the Baboons are quickly adapting to being fed and are becoming demanding and aggressive.

## 6.5 Forest resources

### 6.5.1 Upper catchment forests

Most of the SMM districts have been deforested for cultivation, fuel wood and other economic activities. Many local technocrats prefer to use the term “devegetation” for these areas rather than de-forestation. An example is the Bungoma District which has no gazetted

forest apart from Webuye Hills. The SMM basin area has the following forest reserves within its catchment: the Mt Elgon Forest Reserve (73,000 ha) and the Kakamega Forest Reserve (23,000 ha). The Mount Elgon Forest is considered one of the five 'regional water towers' providing water to millions of people in the Lake Victoria Basin, the Turkwell, Lake Kyoga, and Nile River Basin.

These forests contribute significantly to the socio economy of many communities by providing wood and non-wood forest products for commercial and domestic use. They support the pulp and paper industries, sawmills, building and construction industries, charcoal production, firewood, transmission posts for electric and telephone lines, and woodcarving for tourism, and beekeeping. Forests are important as a sanctuary for wildlife, birds and insects. Many plants are also important as medicine and food for local communities.

For the Mt. Elgon district in Kenya, approximately 69% has forest cover, with the remaining 31% under human settlement. The vegetation in the high land areas includes trees, bamboo, moorlands, exotic plantations, shrubs, grasslands, herbs, heathers, lianas, moss, and lichens. The total forest area is approximately 50,866.3ha. This includes the Chepkitale National Reserve with 17,200ha, approximately 3000ha under plantation, and natural forest, bamboo and moorlands in the remaining area. The human settlements are concentrated in the lower parts of the district. In Mt. Elgon, the forest is predominantly characterized by indigenous species with considerable economic value: - i.e. *Olea welwitschii, Prunus africana, Ekeberkia ruepelliara, Podocarpus gracilior, Olea africana, Hagenia abyssinica, Olea hochesteter, Acanthus eminens, Croton macrostachys, African volkensi, Vernoma jagalis, Trichillia volkensi, Cussonia soicanta, Juniperus procera*, and others.

### 6.5.2 Forest types in Mt. Elgon District in Kenya

| Type | Coverage (ha) |
|---|---|
| High forest | 26,638.7 |
| Bush land | 8,701.6 |
| Bamboo | 11,479.8 |
| Grassland | 4,046.90 |
| **Total** | **50,866.3** |

*Source: FD, Annual Report, 2004*

#### *a) Bamboo forest (3500-4000m)*

This zone is characterized by mountain Bamboo, *Arundinaria alpina.* Bamboo also covers areas along the river valleys mixed with other indigenous species. Other species in this area are *Juniperus procera* and *Podocarpus.*

- Hagenia-hypericum Zone (2850-3000m): also known as the Rosewood zone, which is a high altitude rain forest.
- Heath Zone (3000-3300m): also known as Ericaceous zone, displays a unique environment with giant heather and grass moorlands.
- The Afro-Alpine Zone (3300-4350m): the home of many unique high altitude plants such as protea, helichyrsums, ostrih plum lobelia, the giant lobelia, Senecious, and tussock grass which is the main cover of this zone.
- The Nival Zone (above 4350m): located on top of the mountain. This is the zone of rock, snow, and ice. Few plants survive, and are mainly in sheltered situations.

### *b) Natural forest cover*

The natural forest constitutes the largest proportion of vegetative cover in the ecosystem. The dominant indigenous species include: *Prunus africana, Aningeria adolfi-friedericii, Olea capensis, Cordial abyssinica, Podocarpus falcatus, Trichillia species, Croton macrostachyus, Podocarpus gracilior, Juniperus procera, Hagenia abyssinica, Ekibergia rurepelliaro, Olea africana, Vitex keniensis, Polycius kikuyensis, African volkensis, Vernoma jagalis, Trichillia volkensi, Cussonia spicata, Croton megalocarpus etc.*

### *c) Plantation forest*

Exotic plantations constitute 20% of the total forest cover in the district. The main plantation stands are composed of exotic softwood trees that are fast growing, namely, *Pinus patula, Pinus radiata and Eucalyptus saligna*. There are a few stands of mixed hardwood plantations such as *Olea capensis, Vitex keniensis, Podo facaltus,* and *Juniperus procera*. The few hardwood plantations do not constitute a significant proportion of the plantation area.

### *d) Lower catchment forests*

In most of the lower SMM catchment, natural forests have been cleared since the turn of the last century to create agricultural land and livestock grazing. The tropical high forests are found around Lake Victoria and on Mt. Elgon in east Uganda. Since the mid-1970s, the lack of forest management has resulted in indiscriminate logging practices and de-gazetting of forests. Most forests in the Malaba and Mpologoma river catchment have been degraded (Plate 6.6) and are now replaced by *Phragmites* and other grass types, bushes, and thickets (*Harrisonia abyssinica, Albizia grandibracteata, Celtis africana*, *Entada abyssinica, Sapium sp Antiarius toxicana* and *Mellicia excelsa).* In the Tororo and Busia districts, trees have recently been cut down for lime burning and charcoal making. In Tororo alone, there are over 50 lime kilns around the Sukulu hills that consume 20 tons of biomass per week.

**Plate 6.6: Degraded forests in the Malaba River catchment in Tororo**


In the Busia District, the West-Bugwe Forest Reserve is the only gazetted reserve in the area. The reserve covers an area of 38.671 km2 and consists of three blocks. This is a medium altitude semi-deciduous forest with *Albizia, Markhamia, Combretum-Cymbopogn, Maesa welwitschii* and *Phyllantus reticilator* and trees. The forest is highly degraded because of agricultural encroachment, illegal timber harvesting, and charcoal burning and grazing. This forest is highly valuable and supports two important tree species and one butterfly (*Belenois robrosignate*) that are not found elsewhere in Uganda. The reserve also has good recreation potential being the only available natural reserve between Iganga and Busia. A picnic area exists at the Namutere Trading Centre.

In much of Busia, Tororo, Butaleja, Mbale and Bugiri, there are small private woodlots of *Eucalyptus*, *Caliandra*, *Markhamia*. Woodlots are planted mainly for firewood, poles and timber. The districts have undertaken deliberate efforts to promote tree growing on private, communal and government land. A number of privately owned tree nurseries have arisen,

and the cost of a tree seedling is presently ranging from 150 to 1,000 Uganda Shillings depending on the species. Demand for tree seedlings has surpassed supply which has resulted in imports from neighboring districts and countries.

### 6.5.3 Forestry issues

Forestry issues the SMM catchment include the following:

- Poverty;
- Clearing trees for agriculture expansion;
- Population increases putting pressure on land;
- Increased demand for forest products;
- Inefficient use of wood fuel;
- Lack of alternative income sources has led to over dependency on charcoal trade by youth and the unemployed;
- Violation of Forest Acts through illegal tree cutting and the use of power saws that are wasteful have been major causes of tree reductions;
- Forestry is not well integrated into the larger land use policies;
- Conservation of biological diversity in the forests is not taken seriously;
- Transboundary legislation for forest management and charcoal burning is not coordinated; and
- Certification mechanisms for forest products are poor and not strictly applied.

The key issues in plantation forestry include the following:

- Insufficient financial resources and manpower;

- Diseases and pests, particularly the cypress aphids;
- Increased incidences of fire outbreaks; and
- Exploitation has adversely affected the age distribution harvested and the growing stock.

## 6.6 Mining resources

In both Uganda and Kenya, mining contributes about 2% of the gross national product. In the SMM river system, mining is very limited. Gold is mined in the Busia District of Uganda. In Kakamega District of Kenya, gold mining has been fully exploited and there is little industrial mining now taking place. However, gold reserves are known to exist in the Sio-Busia-Tororo area. Limestone for cement is found in Tororo, Uganda, and cement is a major industrial product in this area. Phosphates were formerly mined in Tororo, but this industry has collapsed. There is widespread extraction of building materials, such as granite, clay, sand and murram. No information is available on the quantities of these materials excavated and mined.

Quarrying for building materials is currently extensively exploited in the Mt Elgon area and on rock outcrops in the catchment. The main handicaps for quarrying activities include:

- Poor infrastructure, especially the road network;
- Most of the materials are located in private farms whose owners have low economic power to exploit the stones;
- Low local demand due to limited construction activities; and
- Poor restoration and rehabilitation of mining areas.

### 6.6.1 Sand harvesting

Sand harvesting activities predominate in the lower reaches of the Sio-Malaba River catchment (Plate 6.7). In the upper river reaches, there is minimal sand mining activity

because the rivers are fast flowing and sand deposition is minimal. Further, the steep topography of the upper catchment districts does not favor sand deposition.

**Plate 6.7: Sand mining on the Malakisi River**

## 6.7 Wetlands

Wetlands are areas of marsh, fen, peat, and static or flowing water that can be fresh or brackish (Ramsar Convention). On the Kenyan part of the Lake Victoria basin, the main wetlands occur in river mouths including the Yala, Nyando, Sondu Miriu, Oluch Kimira (Mogusi), Nzoia and Gucha Rivers. Wetlands also occur in the middle reaches of the SMM rivers. However, wetlands near dams and rivers are threatened by drainage and siltation. The most prominent wetlands in Bungoma are Namilimo, Sibembe, Kayaya, Chebosi, Matulo, Ngwelo, Nang'eni, Khamoto, Bituyu, Tuti, Sio, Bukananachi, Wekelekha, Syoya, Lumboka, Lunao, Walatsi, Lidabo, Machusele, Bunambombu, Masusi, Masuno, Nabuto, Sikendaloba, Sichei A, Sichei B, Lurembe and Namiama. In Uganda, wetlands are estimated to cover about 13% of the total surface area including swamp (8,392 sq. km), swamp forest (365 sq. km) and zones with impeded drainage (20,392 sq. km).

Wetlands are classified depending on hydrological characteristics, soil, and vegetation types.

In some cases, wetlands are classified using criteria for their ecological functions and their human value for products and services. In this study, wetland classification has been simplified to include aspects of the Ramser Convention nomenclature. In Lakes Victoria and Kioga, wetlands have been characterized according to their major vegetation types as follows:

- Papyrus (*Cyperus papyrus*) wetlands are found in association with *Phragmites*, *Typha*, *Ipomoea, Cyphostema,* and *Vossia* in the background and ferns (*Polygonum* and *Cynodon)*;

- *Pragmites mauritanius* wetlands are frequently on higher ground and in found in association with *Cyperus* and *Melanthera;*

- *Vossia cuspidata* wetlands are seen with *Cyperus* in the background;

- *Typha domingensis* wetlands are found with *Cyperus* and often in association with *Phragmites*l;

- *Sesbania sesban/micrantha* wetlands are found in association with *Ambatch (Aeschynomene)* and *Kotschya africana;*

- *Eichhornia crassipes,* wetlands are found with water hyacinth in sheltered bays and often in association with *Cyperus, Typha and Vosssia;* and

- *Lacustrine Papyrus/Vossia/Miscanthus or Phragmites* wetlands.

These wetlands have mixed nonligneous vegetation with *Cyperus,Vossia, Miscanthus,* or *Phragmies* in areas with perennially fluctuating water levels. The water in these wetlands is often covered with floating but anchored aquatic plants like *Nymphaea* and *Pistia* (water cabbage).

Wetlands have also been categorized into two broad categories, namely those associated with lakes (lacustrine) and those that are found along rivers (riverine).

### 6.7.1 Lacustrine wetland around the Sio River mouth

The wetlands surrounding the Sio River mouth are fringed by extensive wetland plants and are permanently flooded. The most common and dominant vegetation types include emergent *Cyperus papyrus, Phragmites muritianus, Vossia cuspidata and Sesbania sesban.* In the open waters, plants especially water hyacinth and the water lilies (*Nymphea sp Plate 6.8)* occur in the shallow inshore zone (less than 4 meters deep) and along the river channel. The water hyacinth gets blown to the shore and covers the river mouth depending on the prevailing wind systems. When this occurs, the water hyacinth obliterates passage ways for boats and makes fishing hazardous. The wetland at the Sio River mouth has a rich biodiversity of fish. In this area fish feed, breed and shelter from predators. The most common fishes found here are *Clarias spp,* Nile tilapia, Nile perch, *Brycinus sp, Barbus spp, Labo victorianus,* mormyrids and Haplochromines. Fauna of this lacustrine wetland include monkeys, Sitatunga, hippopotamus, monitor lizards, birds including egrets, cormorants, kingfisher, fish eagle, cuckoo, weaver birds, and tern.

**Plate 6.8: Water lilies, *Nymphea sp.*, at the mouth of the Sio River**


### 6.7.2 Floodplains in the Sio, Malaba, Manafwa and Mpologoma Rivers

The Sio River empties into Lake Victoria through a large riverine floodplain area. The river system is associated with an extensive temporary floodplain that extends upstream about 30 km and ranges between 5 km wide near the mouth to half a kilometer wide upstream near the

Busia-Kisumu Road Bridge. The Malaba River wetland originates close to the Kenya-Uganda border post at Malaba Town. This wetland stretches down to the Jinja-Tororo road in the Butaleja and Bugiri districts before it empties into the Mpologoma River (Pallisa district) and finally Lake Kioga in eastern Uganda. The dominant vegetation in the seasonal floodplain wetlands includes sedges, reeds, natural grasslands, bush and shrubs.

Other common natural vegetation include *Laudetia, Marantocloa, Echinocloa, Afromomum, Typha, Miscanthus, Acasia spp, Albizia, Acassia, Euphorbia* and *Carica edulis, Hyperrhenia,* ferns, sedges and *Lantana camara* in disturbed areas. The seasonal wetlands have grasslands that provide good fodder for game and livestock. Converted zones on the wetland fringes consist of farmland for sugar cane, maize, potatoes, cabbages, tomatoes, yams, and rice are grown and livestock.

**Plate 6.9: Papyrus with water hyacinth the Manafwa River wetland**

**Plate 6.10: Pure stand of *Cyperus papyrus* in the Mpologoma River wetland**


### 6.7.3 Wetland reclamation for agriculture

In the SMM Uganda districts, many wetlands have been converted into agricultural use, particularly for rice growing as shown in Table 6.1. The table refers to former districts, some of which have been sub-divided to create new districts. However, conversion of wetlands to agriculture is between 16% to 32% in all districts. For Kenya, there are no details on wetlands conversion to agricultural land.

**Table 6.1: Status of wetland conversion to agricultural land (Uganda)**

| District | Total district area | Total wetland area in District | Area of wetland converted | Total Original wetland area | Converted area as % of total original area |
|---|---|---|---|---|---|
| Iganga/Bugiri | 12,792 | 1215 | 591 | 1806 | 32.7 |
| Kamuli | 4,302 | 1,080 | 316 1 | 396 | 22.6 |
| Mbale | 2,467 | 356 | 68 | 423 | 16.0 |
| Pallisa | 1,992 | 711 | 258 | 969 | 26.6 |
| Tororo/Busia | 2,609 | 787 | 375 | 1,160 | 32.2 |

*Source: National Wetlands Program, 2004 (Uganda)*

### 6.7.4 Regulation policies for wetlands management

Wetlands regulations in Uganda include the Wetlands Policy (1995), the Wetlands Regulations (1995) and the National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, No. 3/2000. In Kenya, similar regulations are being formulated but are not yet in place. The policy and regulations in Uganda provide for conservation and ensure: the sustainable use of wetlands for ecological and tourist purposes; wetlands fauna and flora habitat protection; regulated public use; and research activities. The policy and regulations operate on the following principles:

- Wetlands resource use in a sustainable manner compatible with the continued presence of wetlands and their hydrological functions and service;

- Environmental impact assessment under the statute is mandatory for all wetlands activities with potential adverse impacts;

- Special measures for protecting wetlands: international, national and local importance as ecological systems and habitat for fauna and flora species; cultural and aesthetic purposes; and hydrological functions; and

- Appropriate wetland use integration into the national and local resource management through awareness campaigns.

### 6.7.5 Ecological and socio-economic functions of wetlands

Wetlands have intrinsic attributes, perform functions and services, and produce goods of local, regional, national and international importance. Direct values and benefits include providing fish, fuel wood, building poles, sand, gravel, clay, thatch, water, wild foods, medicines, agriculture and livestock grazing. Wetlands provide indirect non-consumptive benefits such as recreation, biodiversity, conservation, water storage, recharge and purification, flood control, storm protection, nutrient retention, micro-climate regulation, shore stabilization, cultural and aesthetic values. In Uganda, wetlands remain highly susceptible to degradation where about 7% have been converted to other land uses. In addition, many of the transboundary wetlands are threatened by agricultural conversions and drainage.

### 6.7.6 Wetlands as biodiversity refuge

Wetlands support a rich biodiversity of plants and animals. Chaoboridae, Chironomidae, Ephemeroptera, Odonata and Trichoptera invertebrates have been observed in wetlands. Further, Gastropoda, Hirudinea and Oligochaeta are found abundantly in wetlands. Uganda's wetlands are known to support some 43 species of dragon flies (8 of which occur in Uganda only), 8 species of mollusks; 52 species of fish (representing 18% of fish species in Uganda); 48 species of amphibians; 243 species of birds, 14 species of mammals; 19 species of reptiles; and 271 species of macrophytes. Wetland species are highly specialized, and if their habitats are disturbed, this can lead to decline and extinction. In Uganda, two of the ten sites identified as wetland hot spots for biodiversity requiring attention occur in the SMM study

area. These areas requiring special attention are Lake Bisina which feeds into Lake Kyoga and the Doho wetland lying between the Manafwa and Malaba Rivers in eastern Uganda.

### 6.7.7 Wetlands as fish habitats

Wetlands are very important as fish habitats. Many fish breed in wetlands and return to the lake to feed and grow. After spawning, fish use wetlands as nursery grounds where young fish grow away from predators and are protected and by wetland vegetation. The following are the principal species of fish caught in riverine wetlands like those along Lake Kyoga and the great Mpologoma wetland:

- The Cichlidae including *Oreochromis* and *Tilapia*;
- The Lepidosirenidae including *Protopterus aethiopicus*, the African Lung Fish;
- The Clariidae including the Catfishes *Clarias*;
- The Mormyridae including *Gnathonemus* and *Petrocephalus* species,
- The *Marcusenius*;
- The Cyprinidae including *Barbus*;
- The Cyprinodontidae including *Aplocheilichthys;*
- The Haplochromines;
- The Haplotilapia;
- The *Astatoreochromis*;
- The Synodontidae including *Synodontis*; and
- The *Mastacembelus*.

### 6.7.8 SMM wetlands for treating urban/rural sewage and wastewaters

Wetlands play a role in removing pollutants and excess nutrients from wastewaters, and can sometimes be used to treat sewerage in a tertiary waste treatment process. The best applications are the urban wetlands since most urban sewage is partially treated before release. Okurut (2000) demonstrated the ability of a constructed wetland with *Cyperus papyrus* and *Phragmites mauritianus* to treat wastewater. Okurut (2000) estimated that two constructed wetland plants could remove up to 350 kg per day per ha of COD, 100 kg per day per ha of BOD, and 150 kg per day per ha of TSS. There is therefore potential to use wetlands to treat wastewater from urban and rural growth centers in the SMM area. These could be natural wetlands or constructed wetlands as both have the capacity to reduce contaminants.

### 6.7.9 Wetlands as sources of raw materials

Phoenix Palm poles grow extensively in the SMM wetlands. These are frequently cut for fencing and baking bricks. There is extensive sand and clay mining in rivers of the SMM area. Although the mining is useful as it de-silts the rivers, it needs to be controlled and managed. The large expanses of papyrus in the SMM area are valuable for craft making crafts like mats, chairs and hats. Papyrus is also extensively used for fencing and thatching houses.

### 6.7.10 Key issues in sustainable wetlands utilization

The following key issues have been identified as constraints in sustainable wetland use in the lower reaches of the Sio-Malaba river systems.

- Indiscriminate conversion of wetlands into agricultural land;
- Encroachment due to ppopulation pressure;
- Unpredictable and increasingly longer dry seasons;
- Limited awareness about sustainable management of wetland resources;

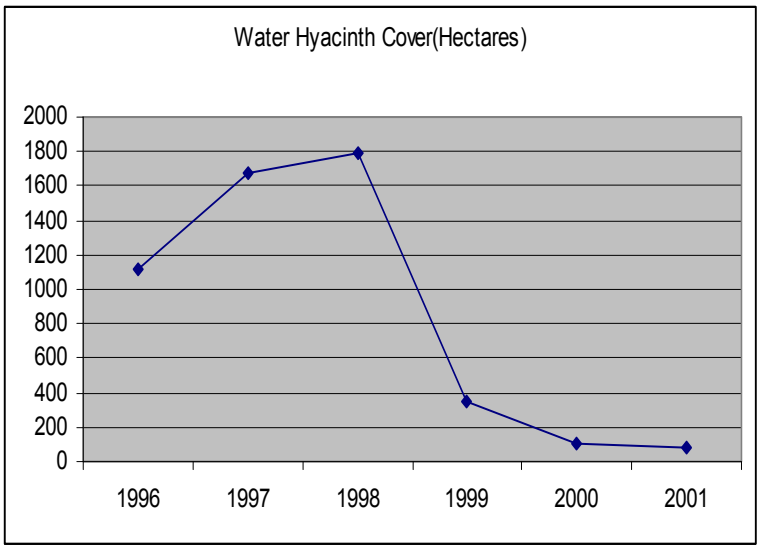
- Limited alternative livelihood for the poor;
- Lack of wetlands ownership since they are held in trust by the government and are therefore considered common property;
- Political interference in the enforcement of management regulations;
- Inadequate sensitization of stakeholders;
- Overloading with sewage, oils and toxic chemicals;
- Inadequate legal provisions and constraints imposed by the land tenure systems;
- Overgrazing; and
- Frequent bush burning leading to severe degradation of pastures and loss of wetland biodiversity.

## 6.8 Aquatic weeds

Aquatic weeds, particularly the water hyacinth, *Eichhornia crassipes,* (Plate 6.11*)* are one of the most notorious plants that have invaded the East African region and are becoming increasingly ecologically disruptive and a nuisance. The water hyacinth is an alien aquatic weed introduced from South America around 1987. This plant has proved to be the most invasive water weed in the Lake Victoria Basin. Water hyacinth growth reached peak proportions in the late 1990s and completely covered the Lake Victoria shoreline and the mouths of all rivers including the Sio River. By 1998 the weed occupied over 17,000 ha and nearly 90% of the shoreline in Kenya (Othina *et al*. 2003; Njiru *et al.* 2002). The water hyacinth was first reported in the Uganda portion of the lake in 1988. Small mats of the weed spread rapidly to reach even sheltered shoreline locations in Uganda 1991. Over 1600 ha of water hyacinth mats, most of them mobile, were recorded in the lake in 1997. The highest estimate of water hyacinth cover in Lake Victoria in Uganda was in 1998, just before it was brought under partial control (Figure. 6.1).

**Plate 6.11: Aquatic duck weeds in a rice field on the Manafwa River in Doho**


**Figure 6.1: Trends in water hyacinth cover in Lake Victoria 1996 – 2001**




***Source: Regional TDA Report, East African Community, Arusha***

Hence, the water hyacinth is of major transboundary concern. At the peak of its invasion, it had completely obliterated the Sio River and its mouth in Lake Victoria. The water hyacinth had enormous socio-economic effects in all the three riparian countries of Lake Victoria. The

water hyacinth has: greatly reduced the operational efficiency the Owen Falls hydroelectric dam at Jinja; blocked access to ports, fish landings, water sports facilities and watering points; and interfered with fishing operations commercial transportation services on the lake and along rivers. There are indications that the water hyacinth is making a come back as masses of it have continued to float down from the Kagera River to Jinja in Uganda. There are also resident masses of the water hyacinth along the Sio River which have the capacity to multiply and move downstream. Lake Kyoga suffered from similar trends of water hyacinth invasion and was likewise brought under temporary control using weevils.

Further, some other aquatic plants native to the region especially *Najas horrida*, *Hydrilla verticillata, Pistia stratiotes*, *Azolla and duck weed (Plate 6.11)* are becoming prolific accompanied by negative ecological and socio-economic impacts. Growth rates need to be monitored closely.

### 6.8.1 Control of water hyacinth

In 1993, the East African countries of Kenya, Uganda and Tanzania adopted an integrated water hyacinth management strategy based on biological control using N. *eichhorniae* and *N. bruchi* weevils supplemented by community manual removal with hand implements and protective gear. Mechanical harvesters were also acquired to remove weed biomass at strategic locations. Research and systematic monitoring of weed biomass as well as socio-economic and ecological impacts were initiated to initiate the weed management process. Capacity building and regional co-ordination were promoted by the three riparian states of Lake Victoria.

### 6.8.2 Key water hyacinth issues

The following issues have been identified with regard to water hyacinth:

- It causes mechanical damage to lake infrastructure;
- It obstructs lake water intake points and other infrastructure;
- It prevents light penetration into the water;

- It stops free aeration of the water column;
- It causes depletion of dissolved oxygen in the water;
- It enhances release of toxic gases like ammonia, methane and hydrogen sulfide;
- It causes accumulation of fine debris due to continuous death and decomposition of the biomass;
- It causes displacement of aquatic biota;
- It causes physical obstruction including interference with fishing activities, transportation on waterways, recreational activities, and water removal;
- It interferes with commercial water transportation, water removal, and hydropower generation;
- It clogs pumps at water treatment plants;
- It causes increased operation costs at hydroelectric power plants (Jinja)

## 6.9 Tourism

This section presents the significance of tourism in SMM catchment. The SMM river basin is endowed with ecosystems of high tourist potential; however, this potential is largely undeveloped. Tourist sites include the Kakamega indigenous forest; Lake Victoria and its many islands; Mt. Elgon Forest Reserve (with 50,886 ha in the Mt. Elgon district and 16,809 ha in the Trans Nzoia district of Kenya) and the Chepkitale Game Reserve of some 17,200 ha. These sites are part of the Eastern African High Altitude Biodiversity hotspots where endemic, endangered and threatened flora and fauna are found. The area has tourism potential that has not yet been tapped.

Wildlife includes three of the big five (buffalo, leopard, elephants), mammals, rare and endangered primates (blue debrazza monkey), bush buck, butterflies, reptiles and amphibians. This area also represents an Important Bird Area (IBA) with over 300 bird

species including the Papyrus Yellow Warbler *Chrolopeta gracillostris* and the Papyrus Gonolek *Laniarius mufumbiri.*

The catchment also has topographic scenery- cliffs of panoramic views, mountains, hills and valleys, calderas, hot springs, gorges, caves with natural salt licks and bird nesting sites. Cultural attractions like historic sites, sacred places, community festivals, art and music can also be developed to promote tourism. In the Teso district, there is a cultural site at Kakapel with writings on rocks (Arabic type) and tools fossilized in rocks around caves. The area is also well endowed with water resources including rivers, hot springs, waterfalls, and natural dams.

Possible tourist activities in the catchment include:

- Animal and bird watching;
- Cave exploration;
- Camping and picnicking;
- Photography;
- Study tours and self guided walking tours;
- Sports – boating and sport fishing;Geological safaris;
- Mountain trekking;
- Cultural/village tours and community festivals;
- Scenic drives;
- Hot springs; and
- Nature visits to forests and parks.

The tourism development in the SMM catchment could be implemented under the proposed "Western Tourist Circuit". The numbers that visited Mt. Elgon National Park on Uganda side increased from 2,024 in 2001 to 3,751 in 2005.

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# 7.0 Energy and Hydropower Development

This chapter gives an overview of energy sources and use patterns in the catchment; electricity generation; transmission and distribution; rural electrification; biomass energy; and deforestation. The SMM catchment has hydro-power potential, but there are no planned hydro-power development projects.

## 7.1 Types and sources of energy

The dominant energy source in the SMM catchment is biomass (e.g. fuel wood, cow dung, crop residue). Among the biomass fuels, firewood and charcoal are the most prominent. A majority of the population uses firewood for cooking and maintaining warmth in homes. Charcoal is more widely used in urban than in rural areas, where majority of the population live. Fuel wood is dominant because it is cheap and easily obtained from farms and the forest reserve compared to other source, and it does not require complex and expensive equipment like gas or electricity. Electricity use is limited to the district headquarters in the SMM catchment. The majority of the people in the rural areas and other urban centers have no access to electricity.

Fuel wood is extensively utilized in food preparation, heating, and curing tobacco leaves. Fuel wood use is estimated at over 11,000 tons each year in the tobacco curing areas of the Teso district. In the Bungoma district alone, an estimated 83.9% of households use firewood or charcoal and an estimated 8.5% use kerosene/gas or biogas. In the Teso district, about 93.3% of the population use firewood and charcoal while about 5.6% use paraffin. The remaining households rely on cooking gas and electricity.

## 7.2 Energy consumption patterns, demand, and supply

Sources of fuel wood include on-farm exotic trees and indigenous trees in non-protected areas and the protected forest reserve. The forest department allows only the gathering of

deadwood and branches for firewood from the forest reserve by the local community. However, due to the high demand for charcoal in the districts and beyond, illegal logging to burn charcoal is a threat to the forest ecosystem.

The demand for electric power is also growing. There is need to make electricity accessible to more households and market centers. Availability of electricity would contribute to positive environmental impacts by:

- Reducing pressure on the forest resources
- Supporting small-scale (jua kali) industries, which provide alternative livelihood systems away from intensive use of natural resources, such as land. The industries also provide an alternative of using natural resources more efficiently.
- Supporting poverty eradication efforts.
- Reduces environmental pollution associated with burning wood fuel.

In Uganda, the industrial and domestic power consumption is illustrated in Figures 7.1 through 7.5. Demographic (urban and rural) and socio-economic data (Gross Domestic Product, per capita income, electricity tariffs, prices of competing energy sources, etc.) can be used to refine electricity consumption forecasts by establishing historical trends.

Some useful information of Uganda's renewable energy policy that may be applicable to the SMM catchment is:

- Biomass distribution figures for Mbale and Tororo are below 3,000 tons/hectare;
- Solar energy distribution data indicate a mean solar radiation of 5.1 kWh/$m^2$ per day; and
- Wind energy data indicate average wind speeds at low altitudes range from 2m/s to 4 m/s.

Maximum demand data within the Ugandan SMM catchment from January 2006 to January 2007 has been assembled from Umeme regional offices visits at Iganga, Mbale and Tororo. Data indicate that all consumer categories have been negatively affected by the current shortfalls in power generation. Domestic and commercial consumption has consistently been highest in the Mbale district and reflects a high level of connection to the electricity grid (Figure 7.3). Sustained growth in the commercial consumption category is also clearly evident in Mbale and Tororo.

Similarly, industrial consumption data indicate that Tororo has the highest growth (Figure 7.4). In Iganga, electricity demand by heavy industry was fairly stagnant from December 1999 to January 2004, at which time it increased significantly. No growth for industrial electricity has been registered in the Mbale district from 1999 to date.

**Figure 7.1: Industrial power consumption**

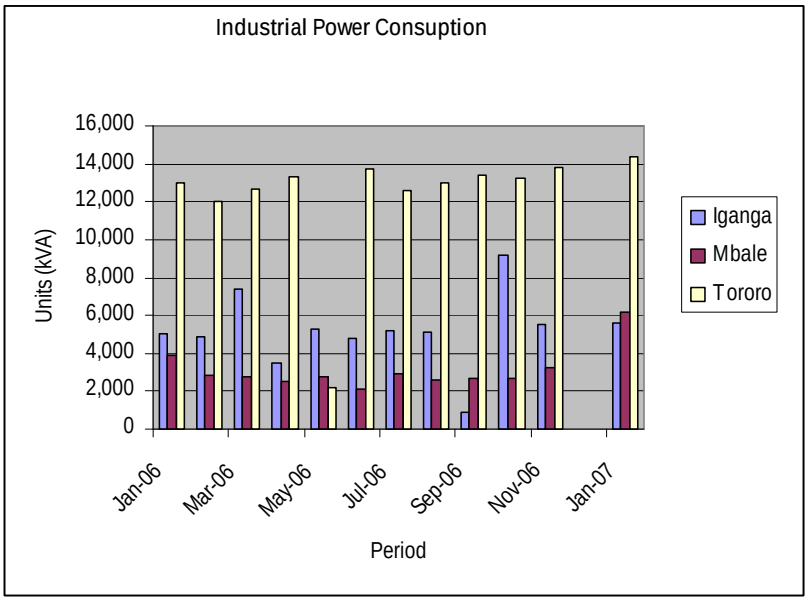


**Figure 7.2: Domestic power consumption**

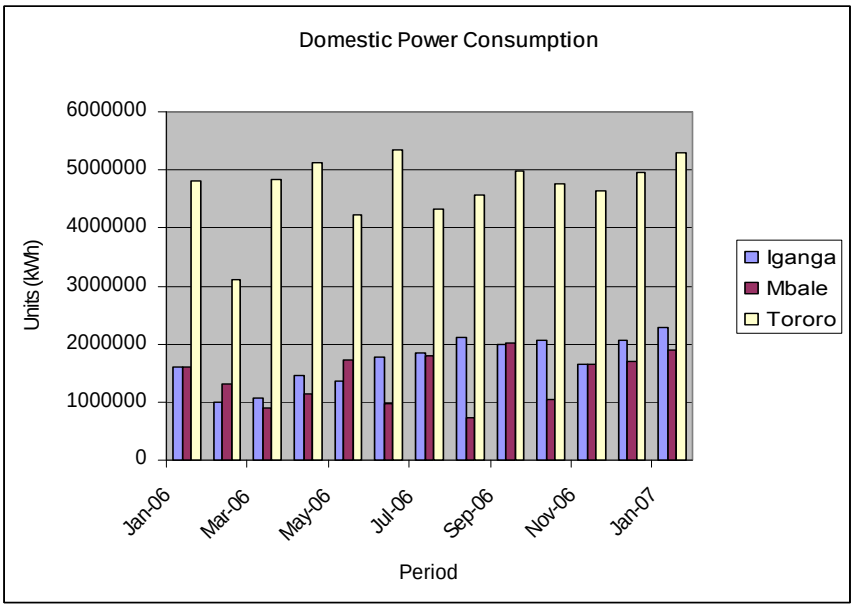
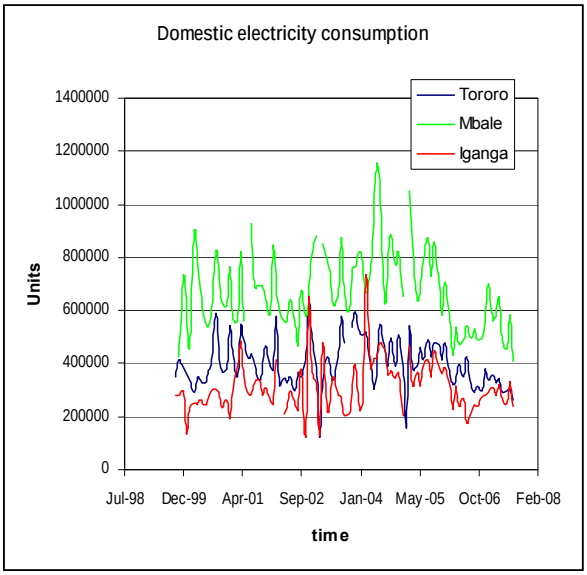



**Figure 7.3: Domestic and commercial electricity consumption**



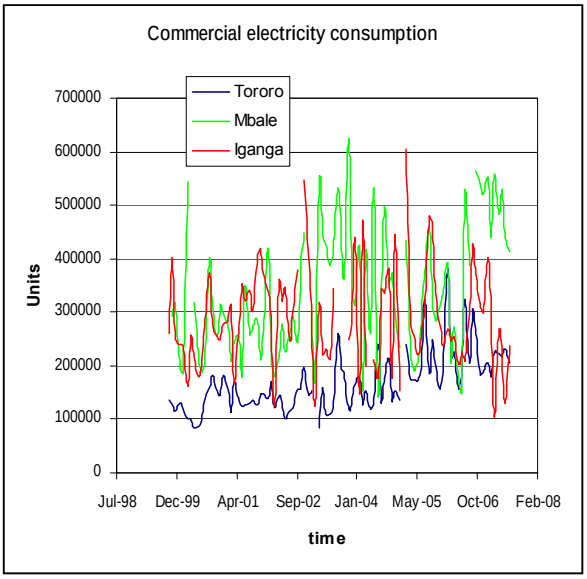
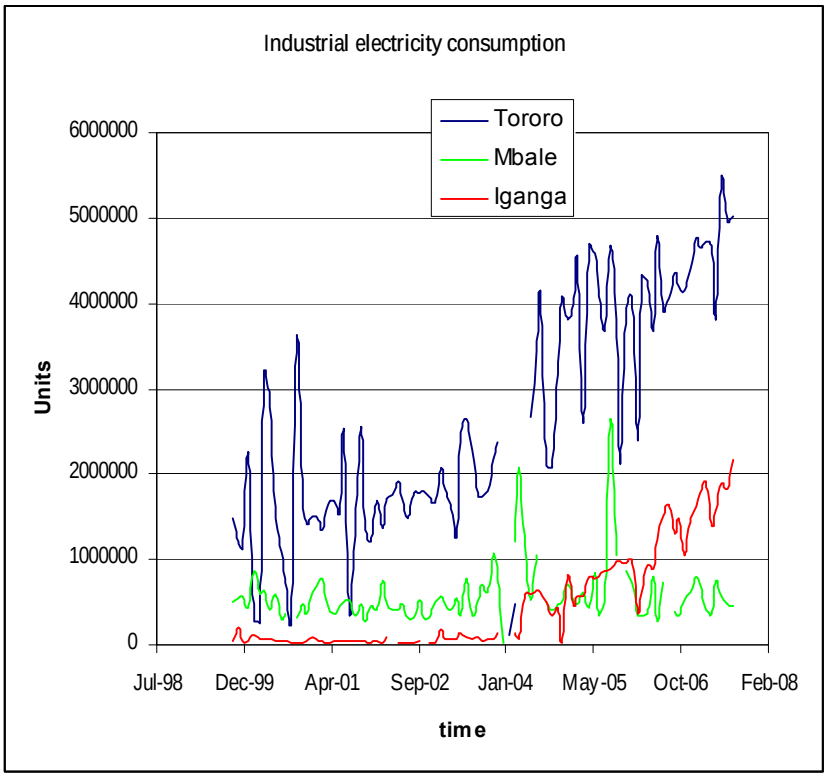



**Figure 7.4: Large industrial electricity consumption in the SMM districts (Uganda)**




## 7.3 Energy status

The energy supply in the catchment is inadequate both in quantity and diversity. The lack of diverse energy types indicates a general of lack of economic diversity. The area is largely a rural subsistence economy. There has been lack of investment in energy to stimulate economic growth and improve the lives of the communities.

As the population increases and land use disproportionately relies on food and cash crops, the supply of fuel wood will continue to dwindle and be unable to meet the demand. High population growth rates translate into higher energy demands. Consequently, some areas like Kopsiro, Kapsakwony, Bungoma and Malaba with the highest population are the most deforested. Dependency on the Mt. Elgon forest for energy has had a negative impact on the forest.

## 7.4 Hydropower

Kenya's power sector falls under the Ministry of Energy, which is responsible for overall management, policy development and implementation. The Electricity Regulatory Board (ERB) is a largely autonomous entity mandated to regulate power. The main bulk power supplier is the Kenya Electricity Generating Company Limited (KenGen), a majority government-owned company, providing about 80% of the annual electricity demand. The Kenya Power and Lighting Company Limited (KPLC), which has 52% private sector shareholding, is currently the sole electricity transmission and distribution company in the country. KPLC purchases bulk power under Power Purchase Agreements (PPAs) with KenGen and other Independent Power Producers (IPPs). The utility also has an energy purchase and sale agreement with the Uganda Electricity Transmission Company (UETCL) on a non-firm basis (which is the third revision of the original 1957 contract when the two power grids were interconnected).

In Uganda, the Ministry of Energy and Mineral Development (MEMD) is the principle regulator in the energy sector. The MEMD mandate is to establish, strategically manage, and safeguard rational and sustainable energy and mineral resources use for social and economic development. The other main entities include the Electricity Regulatory Authority (ERA), which sets the tariffs and issues licenses for studies and generation/ distribution, according to the Electricity Act 1999. The Rural Electrification Agency (REA) is the secretariat of the Rural Electrification Board (REB), which manages the Rural Electrification Fund (REF). The REF provides subsidies to support rural electrification projects. The Uganda Electricity Transmission Company (UETCL) is the System Operator and owns the transmission mains above 33KV on behalf of the government. The Uganda Electricity Distribution Company (UEDCL) is the owner of the electricity distribution network, which is managed by UMEME. Government investments belong to UEDCL. The Uganda Electricity Generation Company (UEGCL) is the owner of Kiira and Nalubaale Power stations at Owen Falls, which are now managed by Eskom Globeq.

The SMM Rivers have potential for mini and micro-electric hydropower generation based on water falls along these rivers. According to the Lake Basin Development Authority Master

Plan (1987), the Lake Victoria Basin has potential to generate 563 megawatts (MW) of hydropower and some of this power could come from the Sio, Malaba and Malakisi Rivers. The steep topography of the Malaba and Malakisi Rivers in the upper reaches favors development of small-scale/micro hydropower for rural markets. There is also potential for micro-hydropower generation on Terem Falls on the Terem/Kuywa River, which is a major tributary of Nzoia River. The Kenyan government has initiated a strong rural electrification program in all the districts within the catchment.

In Uganda there is only one micro-hydropower site in the project area known as Ririma (1.2MW). The Developer is the Mt. Elgon Power Company. In general, the Sio River has a flat topography and therefore does not have suitable sites for hydropower development.

## 7.5 Rural electrification

The Kenya government has intensified the rural electrification program to improve the livelihoods of the local communities and promote agro-based rural industries. This program is of particular importance in the SMM catchment.

Electrical power in western province is handled under the rural electrification program which started in 1973 as part of the basic infrastructure development. Objectives were to stimulate socio-economic growth, stem rural-urban migration by creating social and employment opportunities, and improve the quality of rural life. The rural electrification program is on-going and most areas will be connected to the national electricity grid. Under current Kenyan policy, the goal is to provide electricity to 20% of the rural population by 2010 and increase to at least 40% by 2020. This policy accelerates the pace of rural electrification through grid extension and off-grid projects.

In Uganda, several rural electrification schemes were achieved according to the MEMD – Annual Report 2005. A rural electrification master plan is being formulated to establish priorities for public and private investment in underserved areas. A ten-year least cost investment plan for expanding the national grid into rural areas has been prepared as well as documents to obtain private sponsors. Magale-Lwakhakha-Bubulo in the SMM catchment is

one of the projects. MEMD is also seeking financial assistance from the Japanese government to fund distribution lines for Bugiri – Iwemba (25km).

Efforts to set up a renewable energy resource center are also in advanced stages, and a GIS database for renewable energy has been established. Assessment of existing data quality, reliability, completeness, and formatting has been completed, and equipment has been procured under the Energy for Rural Transformation (ERT) program. Baseline data are available including the number of electrified households, woodstove, charcoal stoves, and Solar Home Systems (KWp). A renewable energy policy for Uganda has been drafted. The policy objectives are to attract private investment in the energy sub-sector, promote renewable energy transfers, and develop and streamline the institutional framework for implementing renewable energy technologies. The promotion of renewal energy is specifically included in GoU Rural Electrification Strategy and Plan (2001-2010). Electrification access in Uganda is still very low, approximately 9% nationally and 3% in rural areas. Recent forecasts of electricity demand presented by the East Africa Power Master Plan 2005 estimate the yearly growth to be 7 to 9%. Consumption history and maximum demand data for the period January 2006 to January 2007 was assembled during visits to Umeme regional offices in Iganga, Mbale and Tororo. This data categorizes tariff structures into large and medium industrial, domestic, commercial and street lighting.

## 7.6 Electricity generation, transmission and distribution

In Kenya, there is no electric power generation in the catchment area; however, electrical power distribution is ongoing. Electricity grids mainly serve the major towns such as Busia, Amagoro, Bungoma, Webuye, Kimilili, Sirisia, Malakisi, Bungoma, Malaba, and Kapsakwony. The current program is to ensure the availability of electric power in the rural market centers, schools and health facilities.

Within the SMM catchment, the current electrical power transmission grids are as follows:

- Kenya and Uganda power systems have been interconnected since 1957 through a 132 kV double circuit transmission line with a capacity of carrying 80 MW (Jinja-Tororo-Lessos). The power imports to Kenya have declined over the years from a contracted

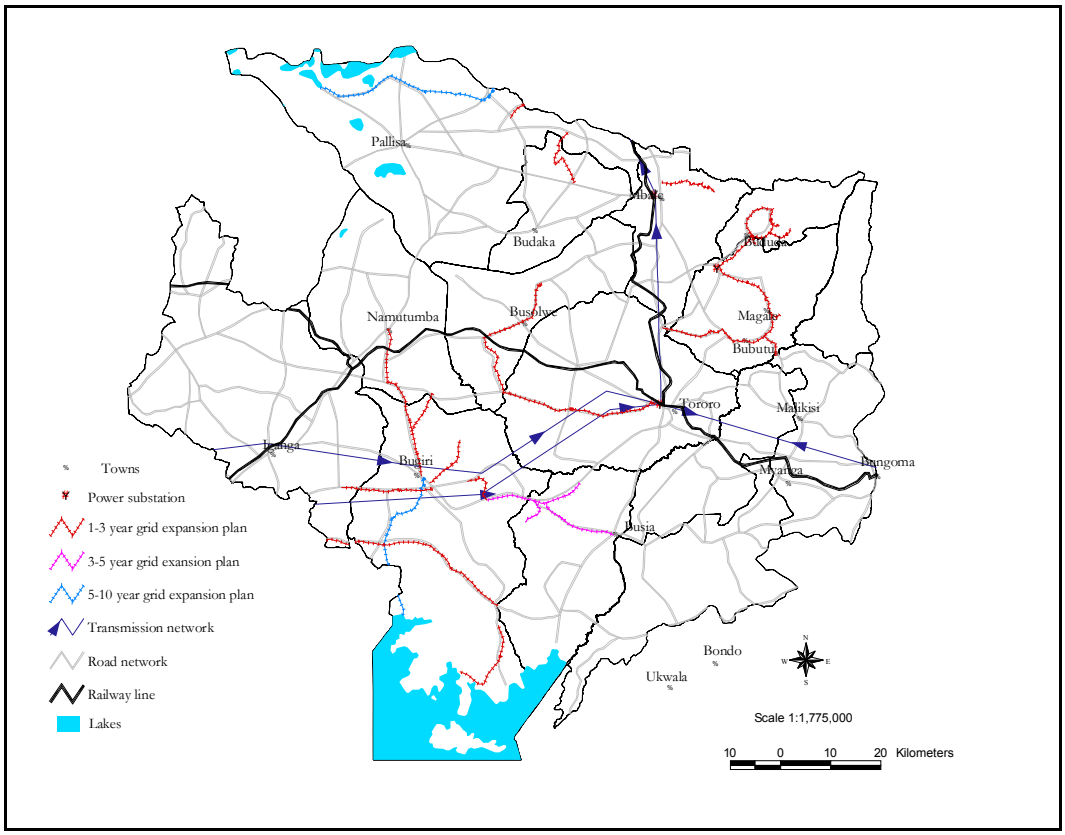
30MW to the current low non-firm level. Reduced imports are attributed to delays in Uganda's generation projects and the rising demands in the two countries. Currently there is minimal power exchange between the two countries because Uganda is experiencing power shortfalls. The three East African Community members have been pursuing further power trade to optimise energy resources in the region. The 132 KV transmission line passes through the Bungoma district and has a connection at Musaga Market to Webuye PanPaper Industry;

- A 33KV line from Sibembe through Bungoma Town to Sirisia Town serves the rural markets along the Bungoma to Sirisia road;
- An 11KV line connects Webuye and Kanduyi Market within Bungoma;
- A 33 KV line from Mumias to Mayoni and Sibembe Markets;
- An 11 KV line from Bungoma Town to Kolanya and Malakisi Markets;
- A proposed 11 KV line between Napora and Bisunu Markets to Malakisi Market;
- A 33KV line from Busia to Nambale, Bumala, Myanga, Kimaeti, Kocholia and Amagoro;
- A proposed 11KV line from Malaba to Kamurai Market in Teso district;
- An 11KV line between Busia Town and Malaba Market;
- A proposed 11KV line connecting Sirisia, Chesikaki, Cheptais, and Chepkube Markets in the Mt. Elgon district;
- A proposed 11KV line connecting Sirisia, Lwandanyi, Lwakhakha, Chemasiri, and Moding Markets (Bungoma and Mt. Elgon districts);
- A proposed 11 KV line from Bumala through Nangina Market to the beaches along the Lake Victoria (Busembe, Bujwang'a, Buworogoma, Busijo, Bumbe, Budubusi, and Bukoma);

- An 11KV line connecting Nangina, Nasianda and Garuala; and
- A proposed 33KV line connecting Nambale with Lugulu Market.

In Uganda, special financial mechanisms have been instituted to facilitate rural electrification and renewable energy investments. These include the Credit Support Facility (CSF) known as the Uganda Energy Capitalization Trust, which was instituted to provide partial guarantees for private sector borrowing from the local financial markets. Participating Financial Institutions (PFIs) will include Commercial Banks, Development Banks and Microfinance Institutions (MFIs). An indicated, the Rural Electrification Master Plan has been formulated to establish public and private investment priorities in underserved areas. A ten-year least cost investment plan for the expansion of the national grid into rural areas has also been to obtain private sponsors. Magale –Lwakhakha-Bubulo is one of the projects within the SMM. MEMD is also seeking financial assistance from the Japanese government to fund a distribution lines for Bugiri – Iwemba (25km). Figure 7.5 illustrates the 3 to 10 year grid expansion plans in Uganda, location of existing power substations, and transmission network extending to Kenya. This diagram also illustrates the extent of the road network within the two countries. There is only one micro-hydropower site in the Malaba catchment area known as Ririma (1.2MW), which was developed by Mt. Elgon Power Company.

**Figure 7.5: Electricity network in the SMM catchment**




## 7.7 Potential energy sources

The catchment has a number of potential energy sources which have yet to be developed. They include micro-hydropower generation especially on the Terem River, solar energy, wind energy, and bio-gas. Small-scale hydropower schemes could also be developed on the upper reaches of the Malakisi and Lwakhakha Rivers in the Mt. Elgon district.

Alternative renewable energy sources, including solar and wind, offer tremendous environmental advantages compared to woody biomass. Exploitation of renewable energy sources would also create employment opportunities, improve the quality of life, and reduce poverty.

Kenya experiences good year round solar exposure coupled with moderate to high temperatures, estimated at 4-6 kWh/m²/day. Solar energy can be harnessed for water heating, cost effective crop drying, and electricity generation for households and telecommunications facilities in isolated locations. Solar power is currently widely used for crop applications and fish and wood drying (through direct sun exposure which affects product quality).

In Uganda, existing data show that the solar energy availability is high throughout the year. The mean solar radiation is 5.1 kWh/$m^2$ per day. This level is favorable for a number of solar technologies including small heating systems and photovoltaic systems for rural areas not connected to the grid. Solar technology can also be used for power generation; however the prohibitive costs make it less favorable than other energy sources.

Wind speed is moderate in most areas of Uganda. The average wind speeds at low heights (less than 10 m) generally range from about 2 m/s to 4 m/s. In some areas with complex terrain, the wind speed may increase due hills, escapements, and tunneling effects. Based on wind data collected by the Uganda Meteorology Department for a period of 3 years, it was concluded that the wind energy resource in Uganda is sufficient for small scale electricity generation and for special applications, such as small wind mills ranging from 2.5 kV to 10 kV. However, the Renewable Energy Policy (MEMD, 2007) identified several barriers to the development of alternative renewable energy resources such as high upfront investment costs and limited technical and institutional capacities in both the public and private sector.

## 7.8 Electric power tariffs

In Kenya, the increase in power generation/transmission projects following the donor aid embargo lift (in the second half of the 1990s) contributed to higher consumer tariffs. Operational inefficiencies and the fees charged by Independent Power Producers (IPPs) also resulted in higher tariffs. In turn, tariffs affected affordability and hence accessibility of electricity, thus leading to marginalisation of low-income consumers including some small-scale commercial and industrial enterprises.

High electricity tariffs are a disincentive to social and economic development. Consequently, there is need to reduce tariffs to encourage growth. Tariff reduction strategies include: cost effective operation and maintenance of generation and distribution companies; project implementation based on least cost criteria; efficient corporate management, fiscal review including indirect taxes on power generation, transmission, distribution and supply equipment, plant machinery, spare parts and related accessories; and, implementation of energy projects on schedule to avoid undue increased finance costs.

In Uganda, electricity access is still very low, 9% nationally and 3% in rural areas. Recent forecasts of electricity demand presented by the East Africa Power Master Plan 2005, estimate the yearly growth to be 7 to 9%. Large industries account for 44% of the government subsidy to this sector. Electricity supplied to residential houses, small shops and kiosksis metered at low voltage single phase and supplied at 240volts. According to the current tariff structure for this consumer category, the rate for the first 15 kWh is Ushs 62 per kWh. Any additional units are charges at a rate of 426.1 per kWh. Umeme also applies a fixed monthly charge of 2000 Ushs per month to the domestic sector. Other users are categorized as follows:

**Commercial**: Low voltage supply for small general services, supplied at three phase with a load not exceeding 100 amperes to small-scale industries, like maize mills, water pumps metered with connected load at low voltage (415 Volts).

**Medium industry**: Low voltage supply (415 V) to medium scale industries with a maximum demand of up to 500kVA.

**Large industry:** Electricity supply to large industrial users taking power at high voltage (11,000 V or 33,000 V), with maximum demand exceeding 500kVA but up to 10,000 kVA.

The corresponding tariffs for these categories are tabulated in table 7.1.

**Table 7.1: Electricity power tariffs**

| Category | Rate in Ushs per kWh by time of use | | | Average tariff per month (Ushs per kWh) | Fixed monthly service charge (Ushs) |
|---|---|---|---|---|---|
| | Peak | Shoulder | Off-peak | | |
| Commercial | 464.9 | 399.3 | 306.6 | 398.8 | 2,000 |
| Medium industry | 434.3 | 370.3 | 280.7 | 369.7 | 20,000 |
| Large industry | 238.7 | 192.7 | 135.3 | 187.2 | 30,000 |

Medium scale industries are levied a charge of Ushs 5000 per KVA per month above the 500 kVA threshold maxim demand. With regard to large industrial users, the maximum demand charge applicable up to 2,000 kVA is 3,300 Ushs per kVA per month. Between 2,000 and 10,000 kVA, the tariff is Ushs 3,000 per kVA per month.

## 7.9 Challenges in the power sector

A developing economy requires large quantities of affordable quality electricity services for economic development. Access to electricity services by all sectors of the economy is, therefore, crucial for favorable domestic and international market competition. However, development of the power systems faces many challenges including:

- Lack of aaccessibility to affordable electricity services due to a combination of low consumer incomes and high electricity tariffs. Currently about 15% of the population has electricity which is low due to the high costs of consumer connections and network expansion (particularly in rural areas and among the urban poor). In the rural areas, where access is about 4%, the scattered nature of human settlements further escalates the supply costs;

- The need to carry-out detailed feasibility studies to evaluate hydroelectric power projects and evaluation of least-cost power development;
- High tariffs;
- High cost of undertaking feasibility studies and resource development;
- Inappropriate credit schemes and financing mechanisms;
- Non-availability of small hydro systems and accessories on the local market;
- Lack of domestic manufacturing capacity for hydro systems of all sizes;
- Obsolete and inefficient technologies in old hydro plants;
- Destruction of water towers has and climate variability make investment in hydropower systems risky;
- Inadequate hydrological data;
- Inadequate policy, legal and regulatory frameworks to support exploitation of the natural resource;
- Finding adequate financial resources to modernize the power transmission and distribution infrastructure to guarantee quality and cost-effective electricity supplies.

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# 8.0 Land, Water, and Air Transport

This chapter gives an overview of infrastructure development in the SMM catchment. In general, the area does not have well developed roads, airports, ports, harbors, telecommunications networks, or institutions like hospitals, schools and universities. The chapter also covers the existing water transport infrastructure.

## 8.1 Road network

The road network in Kenya and Uganda is classified into the following main categories, namely:

- Class A roads which comprise international trunk roads;
- Class B roads which connect administrative provincial headquarters (i.e. national trunk roads);
- Class C roads which connect district headquarters (primary roads);
- Class D roads which comprise local access roads (secondary roads);
- Class E roads which are minor roads; and
- Class F roads which are special purpose roads.

The SMM road network comprise a combination of all the above. Most roads in the area are gravel, which require frequent maintenance. Many of these roads are impassable during the rainy seasons, causing serious disruption of movement of people and goods and imposing huge costs on transport service providers.

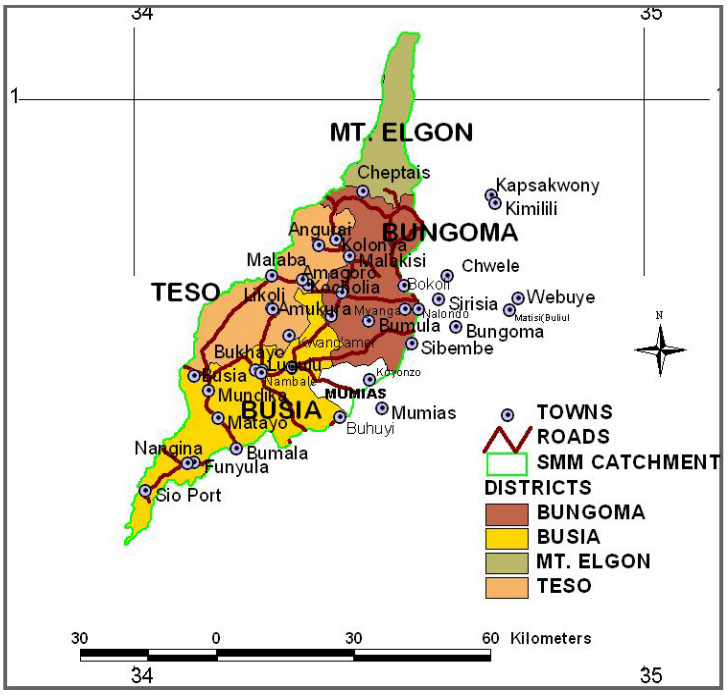
Within the Mt. Elgon and Teso districts in Kenya, most roads are dry weather and less developed than roads in the Bungoma and Busia districts. Currently, there are no tarmac roads in the Mt. Elgon district. However, the Kenyan government has initiated a program to pave the main road connecting the district headquarters at Kapsakwony with Chwele town in the Bungoma west district (through the Kopsiro and Namuela Markets). In the Teso district, the main road from Mombasa to Malaba on the Kenya-Uganda border cuts across the district from east to the west. This road also passes through Bungoma Town.

The primary transboundary transport in the SMM catchment is the road through the Eldoret-Malaba-Tororo border post, the Mbale-Lwakhakha-Bungoma border post and the Kisumu-Busia-Busia border point.

There are also numerous Class D and E roads and other tracks criss-crossing the catchment. A bridge is planned on the lower Sio River from Uganda to Kenyan, but the large wetlands expanse is creating significant challenges. Buses, mini-buses (matatus), trucks, oil tankers, pick-up vehicles and small vans are the major means of public transboundary transport. Figure 8.1 shows the main road network in the SMM catchment.

Another emerging type of public transport is the bicycle taxi, popularly known as ‘boda boda’. These are found in all major towns, rural centers and crossing points, and they contribute significantly to employment of young people. The bicycle is now a major, informal player in transport including border crossings where smuggling occurs. Bicycle taxi services extend to the major transboundary areas, including the official border posts and the unofficial cross-border routes in the region. The main problems facing bicycle transporters are unwillingness to follow traffic rules and regulations, high accident rates, and lack of traffic regulation training.

**Figure 8.1: SMM road network (Kenya)**




## 8.2 Railway transport

The Kenya – Uganda railway line from Mombasa to Kampala and beyond follows the Class A road as closely as possible. The railway and road pass through Bungoma and cross the border at Malaba Market.

In the past, the railway had been used for passenger transport as well as cargo to and from Uganda. These activities were disrupted by the availability of faster road transport which had made the railway obsolete. However, the railways are expected to improve and facilitate faster cargo movement.

## 8.3 Water transport (ports and harbors)

Water transport and navigation is widely practiced in Lake Victoria and across the Sio River near its mouth. The lake serves the communities living along the lake shores and on several

islands. There are several small passenger and goods boats operating informally in the lake with virtually no regulation.

Port Victoria in the Busia district is a major fish landing site. The location of Sio Port provides opportunities for further development of the lake services and connecting the market centers in the SMM catchment.

The topography and size of the Sio, Malaba and Malakisi Rivers do not support river based transport. The existing road network allows the local communities easy land transport, and therefore, river transport has not been extensively developed. In addition, the lower reaches of the rivers pass through extensive wetlands that further complicate the development of river transport.

There is little data and information available on the volume and value of the water transport industry. The major problems are lack of regulations, high accident rates, lack of disaster preparedness, poor transport facilities and services, and lack of monitoring and enforcement.

## 8.4 Airports

Airport facilities in the catchment are underdeveloped. There are however a number of airstrips in the basin but they are rarely used due to lack of maintenance. These airstrips are found in Busia and Bungoma towns in Kenya. The airstrips require rehabilitation to make them operational.

The SMM catchment is accessed by air in Kisumu or Entebbe and then traveling by road to the catchment. From Kisumu, the 130-km Kisumu-Busia road crosses the Kenya – Uganda border at Busia. From Entebbe, the Entebbe-Kampala-Tororo-Malaba Road crosses the border at Malaba.

# 9.0 IWRM Cooperative Framework

## 9.1 Introduction

Integrated Water Resources Management (IWRM) is a process that promotes the coordinated development and management of water, land and related resources to equitably maximize economic and social welfare without compromising the sustainability of vital ecosystems. The underlying principle of IWRM is that different uses of water resources are interdependent. For example, high irrigation demands and polluted drainage flows from agriculture could lead to less freshwater for drinking or industrial use; contaminated municipal and industrial wastewater pollutes rivers, increases the cost of water supply through increased treatment costs, and threatens ecosystems; on the other hand if water has to be left in a river to protect fisheries and ecosystems, less can be diverted to grow crops.

An integrated approach to water resources management ensures that water allocation and management decisions consider the effects of each use on other competing uses to ensure sustainable socio-economic development. An integrated approach also ensures coherent policymaking and planning in all water related sectors. The IWRM approach emphasises participatory decision-making, which ensures that all stakeholders are involved in the planning and decision-making processes at the relevant levels.

IWRM is intended to address issues of access and equity, resource protection, efficient use, governance and land use with the overall goal to alleviate poverty, improve the quality of life, and maintain environmental integrity.

## 9.2 Situation analysis

Although both Kenya and Uganda have yet to achieve the Millennium Development Goals (MDG) on developing National IWRM and water use efficiency plans, both countries have made

significant progress towards strengthening their national policies, institutional frameworks, and laws to address the emerging water resources management and development challenges. The existing policy, legal and institutional frameworks in both countries incorporate the fundamental IWRM principles, which are currently being promoted at both national and local levels as part of the ongoing water sector reforms. The reforms aim at improving the efficiency and cost-effectiveness of service delivery by promoting effective cross-sectoral stakeholder coordination, gender balance and private sector and local community participation in water resources planning and decision-making processes. Both countries have also recognized the importance of integrated transboundary water resources management and development as a catalyst for regional cooperation and economic growth.

In Kenya, the Ministry of Water and Irrigation has formulated the National Water Resources Management Strategy (NWRMS) to make the IWRM process operational. The overall goal of the NWRMS is to eradicate poverty by providing portable water for human consumption and production. In Uganda, the process of reviewing the Water Action Plan and developing a holistic National Water Resources Management Strategy is currently ongoing.

## 9.3 Existing policy, legal, and institutional framework for water resources management

Both Kenya and Uganda have put in place elaborate policy, legal and institutional frameworks for sustainable water resources management and development. These frameworks have been discussed in detail in the SMM component and are highlighted below.

### 9.3.1 Constitutional provisions

In Uganda natural resource management (including water) is specified in the Constitution, which is the supreme law of the land. The Constitution provides that the state shall promote sustainable development and public awareness of the need to manage land, air and water resources in a balanced and sustainable manner for present and future generations. The Constitution further provides that natural resources be managed to meet the development and environmental needs of present and future generations. In particular, the state is required to take all possible measures to

prevent or minimize damage and destruction to land, air, and water resources due to pollution or other causes.

The state, including local governments, is required to: create and develop parks, reserves and recreation areas; ensure conservation of natural resources; and promote the rational use of natural resources to safeguard and protect bio-diversity.

Article 237 provides that "natural lakes, rivers, wetlands, national parks, game reserves, forest reserves and any land to be reserved for ecological and tourism purposes" are to be held, by the government or a local government, in trust for the people as determined by Parliament by law. This provision introduces the management of water resources and other named natural resources, as a public trust. As a trustee, the law of trusts limits the powers of the state in dealing with these resources. The state cannot manage these resources wastefully or inconsistent with its obligations to safeguard the long-run interests of the people who are the beneficiaries named by the Constitution. The Constitution also imposes a duty on the state to protect important natural resources, including water, on behalf of the people of Uganda.

In Article 245, the Constitution provides that parliament shall:  protect and preserve the environment from abuse, pollution and degradation; manage the environment for sustainable development; and promote environmental awareness. This has already been done through the enactment of the National Environment Act, the Water Act, and the Wildlife Act, in addition to other laws that existed before 1995.

Kenya does not have constitutional provisions that deal directly with environmental and natural resources management and conservation. All provisions dealing with the conservation of natural resources are found in the laws enacted under the Constitution. However, the need to explicitly include provisions dealing with natural resources conservation in Kenya's supreme law was recognized by the government and proposed in the 2005 new Constitution. Unfortunately, the proposed new Constitution, which includes extensive provisions dealing with natural resources management, was not approved at the national referendum held in November 2005 and is still pending further review.

### 9.3.2 Water policies and legislation

#### *9.3.2.1 Water policy*

The overall policy objectives of the Ugandan water and sanitation sector, as specified in the National Water Policy of 1999, are to:

(i) Manage and develop Ugandan water resources in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations with full participation of all stakeholders (MWLE, 1999);

(ii) Ensure 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 (MWLE, 1999 revised 2004, from 2000 to the 2015 target year); and

(iii) Promote development of water supply for agricultural production to modernise agriculture and mitigate effects of climatic variations on rain fed agriculture (MWLE, 1999).

The water policy also acknowledges the need for cooperation on transboundary water resources management issues and promotes decentralization of water management functions.

Similarly, the Kenya National Water Policy establishes the policy direction for water resources management and development in the country. The policy provides for the following specific principles to guide the activities in the water sector:

(i) Preserve, conserve and protect available water resources and allocate it in a sustainable, rational and economical way;

(ii) Supply water of good quality and in sufficient quantities to meet the various water needs, including poverty alleviation, while ensuring safe disposal of wastewater and environmental protection;

(iii) Establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector; and

(iv) Develop a sound and sustainable financing system for water supply and sanitation development.

The policy also highlights the important role of the private sector and local communities in ensuring sustainability.

The key gap in both policies is with respect to the management of transboundary water resources. Although mentioned in both polices, no specific strategies or measures are outlined regarding how shared water resources are to be managed in a policy and legal framework with a predominantly national focus. As part of the ongoing water sector reforms, both countries have embarked on a process of revising their national water policies to specifically address the management of trans-boundary water resources.

#### 9.3.2.2 Water legislation

A comprehensive legal framework underpins the national water policies in both countries. In Uganda the Water Act, Chapter 152, was enacted in 1997, and in Kenya the Water Act was enacted in 2002. The two pieces of law are consistent with their respective policy principles outlined above for the sustainable management of water resources.

The Ugandan Water Act vests water resources ownership in the state and water resources use and management in the Minister of Water Resources.

Both Water Acts recognize permits as an important regulatory instrument for sustainable use of their limited water resources.

In Uganda, the Act establishes the Water Policy Committee, an inter-sectoral body, whose function among others is to coordinate the preparation, revision, and updates of the comprehensive water action plan for the investigation, control, protection, management and administration of water for the nation. Such planning may specify activities and work, which require the prior approval of the Policy Committee.

The provisions regarding strategic planning in the Kenya legal framework are equally elaborate. The Water Resources Management Authority is mandated to formulate for each catchment area, a catchment area management strategy, which shall be in line with the national water resources management strategy.

With the decentralization of water resources planning and management to the catchment level, Kenya has incorporated water resources management at the lowest appropriate level. Although water resources management at the catchment level was one of the issues discussed and recommended during the recently concluded water resources management sub-sector reform study, it is yet to be reflected in Uganda's national legislation. However, Uganda has demonstrated its willingness to adopt the new management approach by implementing it in one pilot catchment (Ruizi). The lessons learned from the pilot catchment can guide the decision making process in Uganda on this particular issue.

### 9.3.3 Environmental policies and legislation

The Uganda National Environment Management Policy provides the overall policy framework for environmental management in Uganda. The environmental policy and legislation are overarching in nature and include water sector policy- related issues. The policy, under section 3.5, recognises water as a major factor in the social-economic development of Uganda.

Unlike Uganda, Kenya has no gazetted National Environment Management Policy.

Both countries have enacted legislation dealing with environmental impact assessment (EIA) of planned projects. Regulations have been adopted detailing the measures to be taken in conducting an EIA and environmental audits. However, EIA provisions in both countries do not make provisions for trans-boundary impact assessments. Thus, the laws of both countries lack the mechanism for potentially affected persons across the border to be consulted on the potential impacts.

### 9.3.4 Wetlands management policies and legislation

In addition to the National Environment Management Policy, Uganda also has an elaborate National Wetlands Management Policy. The National Policy for the Conservation and

Management of Wetland Resources was adopted in 1996 and highlights the importance and functions of wetlands as a vital resource, covering almost 10% of the country's surface area. The policy sets out five goals: to ensure optimal use of wetlands; stop degradation of wetland productivity; maintain biological diversity of natural and semi-natural wetlands; maintain wetland functions and values; and integrate wetland concerns into the planning and decision making of other sectors.

Uganda has gone further and developed legislation dedicated to sustainable wetlands management and the national environment (Wetlands, River Banks And Lake Shores Management Regulations, 2000). The regulations require that a permit be sought, and certain pre-requisite procedures be followed before wetlands can be drained. The regulations also provide for riverbank and lakeshore protection by prohibiting cultivation or development within a distance of 100 metres from the riverbanks and lakeshores.

Kenya has no national wetlands management policy and is in the process of developing one. The associated impact on wetlands has been devastating. There is indiscriminate drainage of wetlands for agricultural production with impunity. Apart from the protected wetlands, ordinary wetlands are private property whose ownership goes hand-in-hand with the property rights of the adjoining land. This ownership makes it very difficult to regulate drainage of these wetlands since they are considered to be private property and use is at the owner's discretion. The WRMA is currently in the process of gazetting rules dealing with the wetlands management.

### 9.3.5 Agricultural and land use policies and legislation

In Kenya land is owned under a series of statues, but agricultural land must be managed under the Agriculture Act, Chapter 318 of the Laws of Kenya. These provisions give power to the Minister, which is exercised through the Agriculture Officer at the district level. The Physical Planning Act, Chapter 286 and the Land Control Act, Chapter 302 require that physical development plans be formulated and any land which is used for agricultural purposes may not be converted to other use without the consent of the Land Control Board.

Kenya's Agriculture Act aims to promote and maintain a stable agriculture, to provide for soil conservation and fertility, and to stimulate the development of agricultural land in accordance

with the accepted practices of good land management and good husbandry. The Act also provides for the enactment of rules for the preservation, utilization and development of agricultural land. These powers enable the Minister to control the land use and encourage sustainable management of agricultural land.

In Uganda, the Land Act provides for the tenure, ownership and management of land. Under the Land Act, a person who acquires land is required to manage and utilize it in accordance with the existing environmental laws, and any land use must conform to planning laws. However, Uganda does not have a statute that is comparable to the Agriculture Act of Kenya, and therefore, the power to control land degradation is not anchored in law.

Regarding irrigation, both Kenya and Uganda promote irrigation as a means to enhancing agricultural production and food security. Irrigation tends to target wetland areas and is a major user of water resources.

### 9.3.6 Fisheries management policies and legislation

In Uganda the Fish Act of 1964 governs the utilization and management of fisheries resources. Kenya operates under the Fisheries Act, Chapter 378. These statutes vest ownership of fisheries resources in the central government. For example, the Fisheries Act, Chapter 378 of Kenya had the objective of "providing for the development, management, exploitation, utilization and conservation of fisheries." To manage fisheries it provides for: closed seasons; prohibited fishing areas; limitations on the methods of gear; limitations on the amount, size, age and other characteristics and species of fish that may be caught; management of fish landing areas; the control of aquatic plants in fishery waters and registration; and licensing of fishing vessels.

The Government of Uganda developed a new National Fisheries Policy in 2000 to provide for the sustainable management and exploitation of the country's fisheries resources. Among the objectives was to give both the local government and local communities responsibility for sustainable resource management, development, and utilization. The policy also called for the legal recognition of fisheries communities and their management rights for fish resources in their locality.

In line with the National Fisheries Policy, a new bill (the Fisheries Bill) was drafted in 2004. Pending the enactment of the Bill, a subsidiary statutory instrument (the Fish Beach Management Rules 2003) was promulgated to provide the legal basis for the creation of beach management units (BMUs) in Uganda. The fisheries resources management arrangements currently operating in Uganda comprise: at national level the Department of Fisheries; at district level the district officers from the District Fisheries Department; and BMUs at community level, including in the SMM basin.

Kenya has largely followed the same path that has been followed by Uganda. Kenya's efforts are being formalized through the development of legal instruments. The Fisheries Beach Management Unit Regulations of 2005 have been drafted and await promulgation, but presently Kenya does not have a legal basis for the operation of BMUs. To put the legalization of BMUs on an even firmer footing legislatively, it will be necessary in the near future to entrench the role of BMUs in fisheries management in the Fisheries Act, through an amendment of the Act. Pending the promulgation of the regulations, the BMUs in Kenya are presently registered as self-help groups with the Department of Social Services under the Ministry of Culture and Social Services. The BMUs have a constitution as well as rules and regulations that they develop with the assistance of the Fisheries Department.

### 9.3.7 Forest management and wildlife conservation policies and legislation

Both countries have well developed legal frameworks for the management of protected areas, such as wildlife reserves and forests. The forest law in Uganda is the National Forestry and Tree Planting Act, 2003, which provides for conservation, sustainable management and development, and beneficial use, while the forest law in Kenya is the Forest Act, 2005.

In both Kenya and Uganda, the law provides for the involvement of user groups and local communities in forest management. The law in Kenya, which recognizes community forests, is more recent than the Ugandan law. However, neither law recognizes the role of cross-border communities in forest management.

The Uganda Wildlife Statute, which repealed earlier laws, was enacted in 1996 to: provide for sustainable wildlife management; consolidate the law relating to wildlife management; and

establish a co-ordinating, monitoring and supervisory body for that purpose. The Statute created the Uganda Wildlife Authority.

Similarly in Kenya forests are managed under the Wildlife (Conservation and Management) Act, which provides for the establishment of game parks and reserves and prohibits activities that might hamper the proper management of wild animals. The Act was amended in 1989 to provide for the establishment of Kenya Wildlife Service (KWS) to be the national body responsible for the management of wildlife in Kenya.

### 9.3.8 Water resource management institutional frameworks

In Kenya, section 7 of the Water Act creates the Water Resources Management Authority (WRMA) as the agency responsible for the regulation of water resources.

Section 14 of the Act provides that WRMA may designate catchment areas, defined as areas from which rainwater flows into a watercourse. Section 10 states that WRMA shall establish regional offices in or near each catchment area. Section 16 provides that WRMA shall appoint a committee of up to fifteen persons for each catchment area to advise its regional officers on matters concerning water resources management, including the issuance and revocation of permits.

The Act provides a role for user groups, organized as water resources users associations, in water resources management. User groups provide a mechanism for local level participation in water resources management. In this respect, the Kenyan institutional framework has devolved water resources management not just for the catchment level, but also to the local community level.

In Kenya the law vests other catchment level institutions – particularly, Regional Development Authorities - with other water resources management functions to compliment the work of the WRMA.

Table 9.1 below summarizes the key institutions involved in water sector activities in Kenya, together with their corresponding roles.

**Table 9.1: Key institutions involved in water sector activities in Kenya**

| INSTITUTION | | ROLES AND RESPONSIBILITIES |
|---|---|---|
| 1. | Ministry of Water and Irrigation (MWI) | Development of legislation, policy formulation, sector coordination, guidance, monitoring and evaluation. |
| 2. | Water Resources Management Authority (WRMA) | • Planning, management, protection and conservation of water resources.<br>• Allocation, apportionment, assessment and monitoring of water resources.<br>• Issuance of water permits.<br>• Water rights and enforcement of permit conditions.<br>• Regulation of conservation and abstraction structures.<br>• Catchment and water quality management.<br>• Regulation and control of water use.<br>• Coordination of the IWRM Plan. |
| 3. | Catchments Area Advisory Committees (CAACs) | • Advising WRMA on water resources issues at the catchment level. |
| 4. | Water Resource Users Associations (WRUAs) | • Involvement in the decision-making process to identify and register water user.<br>• Collaboration in water allocation and catchment management.<br>• Assisting in water monitoring and information gathering.<br>• Conflict resolution and co-operative management of water resources |
| 5. | Water Services Regulatory Board (WSRB) | • Regulation and monitoring of Water Services Boards.<br>• Issuance of licenses to Water Services Boards.<br>• Setting standards for provision of water services.<br>• Developing guidelines for water tariffs. |
| 6. | Water Services Boards (WSBs) | • Responsible for efficient and economical provision of water services.<br>• Developing water facilities.<br>• Applying regulations on water services and tariffs.<br>• Procuring and leasing water and sewerage facilities.<br>• Contracting Water Service Providers (WSPs). |
| 7. | Water Service Providers (WSPs) | • Provision of water and sewerage services |
| 8. | Water Services Trust Fund (WSTF) | • Financing provision of water and sanitation to disadvantaged groups. |
| 9. | The Water Appeals Board (WAB) | • Arbitration of water related disputes and conflicts. |

| | | |
|---|---|---|
| 10. | National Water Conservation and Pipeline Corporation (NWCPC) | • Construction of dams and drilling of boreholes |
| 11. | Kenya Water Institute (KEWI) | • Training and Research |
| 12. | National Irrigation Board (NIB) | • Development of Irrigation Infrastructure |

The water sector institutional framework in Uganda is equally elaborate although the devolution of water resources management to catchment level is yet to take root. Despite this difference at catchment level, national level water sector institutions in Uganda to a large extent find parallels in the Kenyan water sector institutional framework.

The Local Government Act mandates districts and lower local councils to control and manage their natural resources and environment. The District Councils are responsible for the following functions, which are relevant to water resource management: (i) management of forests and wetlands; (ii) environment and sanitation; and (iii) protection of streams, lakeshores, wetlands and forests. The District Councils may devolve services and functions to the local governments including the protection of wetlands and the protection and maintenance of local water resources.

A summary of the major institutions involved in the water sector is given in the Table 9.2 below.

**Table 9.2 – Institutions involved in the Water Sector in Uganda**

| INSTITUTION | ROLE |
|---|---|
| Ministry of Water, Lands and Environment (MWLE) | Policy formulation, setting standards, strategic planning, coordination, quality assurance, technical assistance, and capacity building. |
| Directorate of Water Resources Management (DWRM) | Lead agency responsible for water resources management including policy development, planning, monitoring, assessment and regulation. DWRM is also responsible for coordination of trans-boundary water resources issues. |
| Directorate of Water Development (DWD) | Lead agency responsible for coordinating and regulating all water supply and sanitation activities and providing support services to local Governments and other service providers. |
| National Water and Sewerage Corporation | Autonomous entity responsible for the delivery of water supply and sewerage services in the major towns and large |

| | |
|---|---|
| (NWSC) | urban centers (a total of 16 service centers in June 2004). |
| Ministry of Finance, Planning and Economic Development (MFPED) | Mobilization and allocation of financial resources including co-ordination of donor inputs and the privatization process. |
| Ministry of Local Government (MoLG) | Establish, develop and facilitate the management of efficient and effective decentralized government systems capable of delivering the required services to the local people. |
| Ministry of Health (MoH) | Promotion of hygiene and household sanitation. |
| Ministry of Education and Sports (MOES) | Promotion of sanitation and hygiene education in schools. |
| Ministry of Gender, Labor and Social Development | Coordination of gender responsive development and community mobilization. |
| Ministry of Agriculture, Animal Industries and Fisheries (MAAIF) | Planning, coordination and implementation of all agriculture development in the country including irrigation development, aquaculture, and livestock development. |
| Local Governments (LGs) | Responsible for the provision and management of water and sanitation services in rural areas and urban areas outside the jurisdiction of NWSC, in liaison with DWD; |
| User Communities | Planning, implementation, operation and maintenance of the rural water and sanitation facilities. User communities are also obliged to pay for urban water and sanitation services provided by NWSC and other service providers. |
| Donors | Provide financial resources for implementation of water sector activities. |
| Private Sector | Provide consultancy services and undertake design and construction of water supply and sanitation facilities under contract to local and central government. Private hand pump mechanics and scheme attendants provide maintenance services to water users in rural and peri-urban areas. Private operators manage piped water services in the majority of small towns with piped water and vendors often bring water from the point of collection to the user. |
| Non Governmental Organizations (NGOs) and Community Based Organizations (CBOs) | Complement public sector efforts in the provision of water supply and sanitation services, especially in the rural areas and ensure that concerns of the underprivileged/poor are cared for. NGOs also provide financial and planning support to communities and local governments. |

In addition to the national frameworks, both Kenya and Uganda, are members of the East African Community and the Nile Basin Initiative. The Sio and Malaba-Malakisi Rivers are, therefore, also managed under existing international legal and institutional frameworks for the larger basins (Victoria and Nile) of which they form part.

While both rivers originate from Mount Elgon and eventually become part of the Nile basin, they belong to two different international legal and institutional frameworks. The Sio flows into Lake Victoria and is governed by the legal framework for the Lake Victoria basin under the *Protocol for the Sustainable Development of the Lake Victoria Basin.* The Malaba – Malakisi River, flows into Lake Kyoga where no specific framework has been elaborated except the general framework of the Nile.

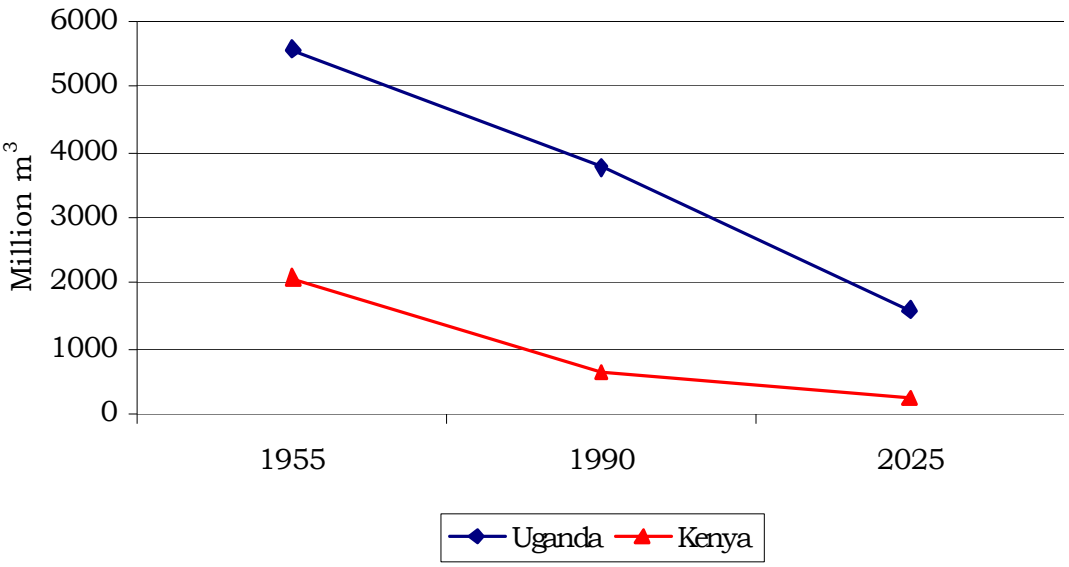
## 9.4 Water resources availability

The annual per capita renewable water resource is used as a yardstick for describing the overall water stress situation in a country. When it exceeds about 1700 $m^3$/year, a country is likely to suffer only occasional or local water problems. Below this threshold, countries begin to experience periodic or regular water stress. When water availability falls below 1000 $m^3$/year, countries experience chronic water scarcity and below 500 $m^3$/year, the situation moves towards absolute scarcity. Figure 9.1 below illustrates the dramatic reduction of per capita annual renewable water resources that has taken place in Kenya and Uganda since 1955. As can be seen, the overall water situation in Kenya is already very critical, whereas Uganda is expected to approach the critical levels by 2025.

Generally, Kenya is classified as a water scarce country with only 647$m^3$ of renewable fresh water per capita. The country's water resources are characterised by high spatial and temporal variability with high incidences of droughts and floods. The bulk of Kenya's renewable water resources are derived from an average annual rainfall volume of 322.77 billion $m^3$ translating to an annual runoff of 20 billion $m^3$. Of the ground water resources, the total safe abstraction rate is approximately 193 million $m^3$ per year (*National Water Master Plan, 1992*).

Unlike Kenya, Uganda, with annual per capita renewable fresh water estimated at 3,500$m^3$, is generally well endowed with water although its temporal and spatial variability is a major concern. Water scarcity is already a problem in certain parts of the country, especially during droughts.

**Figure 9.1: Per capita annual freshwater availability in Kenya and Uganda**




*Source: Water Resources Management Sub-sector Reform Study Report, DWD 2005*

Within the SMM catchment, the main surface water resources comprise the river watercourses themselves and the water bodies to which they discharge (Lake Victoria for Sio and Kyoga for Malaba). The mean annual runoff (MAR) for Sio is 10.3 $m^3/s$ and for Malaba (Station 82218) is 17.0 $m^3/s$ (SWECO, 2003). The runoff in the SMM catchment is highest around the slopes of Mt. Elgon and Lake Victoria (>10 $l/s/km^2$) and decreases gradually towards Lake Kyoga (1-10 $l/s/km^2$). Mean annual rainfall in the SMM catchment varies from above 2000mm on the slopes of Mt. Elgon and near the lake Victoria shores to less than 1200mm in the drier downstream reaches of the catchment. The catchment experiences two rainy seasons extending from March to May and September to November.

There are significant groundwater resources in the upper parts of the catchment with typical observed yields of 5 to over 20 $m^3/hr$. However, the abundance of surface water resources in this part of the catchment and the expense involved in the development of groundwater resources has resulted in minimal exploitation of these groundwater resources. The downstream parts of the catchment also contain significant ground water resources that have been extensively developed

for rural water supplies. Unlike the upstream part of the catchment, typical yields in the downstream part of the catchment are much lower and range from 1.5 to 5 $m^3$/hr.

## 9.5 Water resources demand and development

The surface water resources potential for the three river systems is hardly exploited for productive purposes except for a few rural minor irrigation, and urban water supply schemes. Similarly, there is very little exploitation of the ground water resources in the catchment except in the downstream parts where significant ground water development has been undertaken for rural water supply.

***Existing Water Use Estimates and Demand Projections***

The current and projected water use in the SMM catchment has been discussed in detail in previous chapters of the Monograph and will not be repeated here.

However, what is emphasized here is that most of the current and projected water demands cited in the above chapters were estimates based on limited data and information available at the time of compiling the Monograph. Therefore, it is important that as part of the priority future activities in the catchment, a comprehensive water resources assessment and water demand analysis be conducted to obtain more accurate estimates of water resources potential and existing and projected water demands and uses in different sectors.

## 9.6 Ongoing and planned water related projects

There are a number of ongoing water related projects and programs at regional, national and local levels aimed at addressing water related issues in the SMM catchment. The most notable of the national and local projects include water supply and sanitation projects, afforestation projects, soil and water conservation projects, agricultural projects, water resources management projects, biodiversity conservation projects, irrigation development projects, and many others. A list of some of these projects is contained in Appendices 2 and 4.

There are also a number of regional projects within the Lake Victoria Basin which have relevance to the SMM catchment. These include among others:

### 9.6.1 Lake Victoria Environment Management Project (LVEMP)

LVEMP-I included studies in water quality/limnology, fishery biodiversity, and aquaculture potential. The project also collected baseline data that improved the riparian countries (Kenya, Uganda, and Tanzania) long-term, sustainable resource management and environmental improvement. This phase was funded by the World Bank. The preparation of LVEMP –II, which includes Rwanda and Burundi, is nearing completion. LVEMP-II will focus on applied research, socio-economic development, and development of a comprehensive lake Victoria water resources management framework.

### 9.6.2 Mt. Elgon Regional Ecosystem Conservation Program (MERECP)

Mt. Elgon is a regionally shared natural resource that serves as a water tower for Lake Victoria, Lake Kyoga and Lake Turkwel. MERECP was initiated to promote conservation and protection of Mt. Elgon as a transboundary ecosystem. The program objectives include: the promotion of conservation and management of natural resources and biodiversity in and outside the protected areas; the enhancement of sustainable development in the ecosystem; the integration into national, regional and international development frameworks of the conservation and management needs of the ecosystem. The program is funded by Norway and Sweden and the IUCN office in Nairobi provides technical backstopping.

### 9.6.3 Maritime Transport, Safety and Security

The Government of France is supporting the Lake Victoria Basin Commission (LVBC) in activities relating to maritime transport, safety and security on Lake Victoria. The major activity to date has been the preparation of the Lake Victoria Transport Bill. The Bill has been submitted to the East African Legislative Assembly (EALA) for debate and enactment. As part of this program, the LVBC is currently carrying out a hydrographic survey of Lake Victoria, initially starting with the access to three ports on the lake, namely Kisumu, Port Bell and Mwanza.

### 9.6.4 Lake Victoria Fisheries Management Plan (LVFMP)

The LVFMP is being implemented by the Lake Victoria Fisheries Organization (LVFO) with focus on: supporting fisheries monitoring, control and surveillance; promoting community

participation in the management of fisheries resources; monitoring the Lake Victoria fisheries resources; addressing the environment and socio-economic factors affecting the Lake Victoria fisheries sector; providing information and databases to guide fisheries management decisions; providing appropriate policies, laws and regulations for the management of fisheries resources and the fish habitat; and building capacity to implement fisheries activities nationally and regionally.

### 9.6.5 Lake Victoria Region Water and Sanitation Initiative (UN Habitat-LVWATSAN)

The UN Habitat-LVWATSAN initiative covers six towns around Lake Victoria, Kisii and Homa Bay in Kenya, Mutukula and Kyotera in Uganda, and Muleba and Bukoba in Tanzania. The main objective is to support secondary urban centers around the lake area to achieve the Millennium Development Goals target for water and sanitation (to halve the number of people without access to water and sanitation by 2015). The Government of Netherlands funds the project.

### 9.6.6 Lake Victoria Region City Development Strategy Programme

In 2002 and with the support of Sida, the UN HABITAT through its Urban Management Programme (UMP) initiated the Lake Victoria Region City Development Strategies Programme to strengthen the capacities of urban centres located along the shores of Lake Victoria with the aim of:

(i) Mobilizing local authorities and stakeholders to develop programmes for laying out city development strategies (CDS) for improved urban environment and poverty reduction.

(ii) Addressing the absence of effective planning in the urban centres.

The pioneer cities in the CDS Phase I were Kisumu, Kampala and Musoma. The next group of towns will include Homa Bay, Entebbe and Bukoba.

### 9.6.7 FAO Nile Basin Water Resources Project

This regional project was implemented by the 10 Nile basin countries, with funding from the Government of Italy and technical support from FAO. Major areas included; development of

the Nile Basin Decision Support System (Nile DST); upgrading the hydrometric monitoring system in the basin; strengthening water resources databases; capacity building in legal, institutional and GIS skills; and improving agricultural water use efficiency in the basin.

### 9.6.8 FAO Transboundary Agro-Ecosystem Management Project for the Lower Kagera Basin

The project is implemented by the governments of Rwanda, Tanzania and Uganda with funding from GEF and technical support from FAO.

The objective is to protect ecosystems in the lower Kagera basin through the productive and sustainable use of biodiversity resources and agricultural ecosystems.

### 9.6.9 The Nile Basin Discourse (NBD)

The NBD was created to mobilize civil society and enhance their effective participation in the development of the Nile basin. The NBD has facilitated the establishment of national civil society forums and initiated capacity building activities in all the Nile basin countries.

### 9.6.10 Nile Basin Initiative Shared Vision Program

This is a regional initiative implemented by 9 Nile basin countries and comprises 7 projects in the following areas: environment, applied training, agriculture, hydropower, water resources management, socio-economics, and confidence building.

### 9.6.11 Nile Equatorial Lakes Subsidiary Action Program

This is a regional program implemented by 6 countries (DR Congo, Burundi, Rwanda, Kenya, Tanzania and Uganda with Egypt and Sudan as observers) and comprises several projects in the following areas: river basin management, fisheries management, hydropower development, and agriculture development.

## 9.7 Water resources data management and information sharing

*The status of water related data collection, processing, storage and dissemination in the catchment is discussed in detail in Chapter 2 and will not be repeated here.*

The water resource data that currently exists in the basin database are inadequate. The data do not reflect the significant changes in flows, climatic changes and sediment loads that have occurred over the recent years as a result of catchment degradation, urbanisation, pollution, and other impacts. This unreliable and unavailable data creates uncertainty in water planning and increases investment risks (SMM River Basin IWRM Project – Appendix III, technical and environmental aspects). Data collection is irregular and uncoordinated. Data gaps are due to inoperative gauging stations, disruptions in water resource assessment programs, and inadequate funds at the central, district and provincial government levels.

In both Kenya and Uganda, various institutions and programs dealing with water resources have developed their individual databases. There are databases developed by ministries responsible for water, meteorological departments, the Lake Victoria Environmental Management Project, FAO-Nile Basin Water Resources Project, and others.

The FAO-sponsored Nile Basin Water Resources Project established a comprehensive geo-referenced database, with a common structure for the Nile Basin countries, and with considerable capacity building at the ministries in charge of water affairs of each respective country. However, this capacity might no longer be available due to staff changes.

Clear procedures and protocols have not been developed for water resources data and information sharing. Some government institutions are required to raise part of their operational and maintenance budget for their water resources data collection systems by charging for the data. Other institutions have developed Memoranda of Understanding (MOUs) under which they exchange data and information. In some instances, institutions have assisted each other in the establishing data collecting systems and have signed MOUs on data sharing and exchange. This is the case between Kenya Meteorological Department and the Kenya Agricultural Research Institute. This is also the case between the Meteorological Department and the Directorate of Water Resources Management in Uganda.

Recently, the Government of Kenya has recommended that government institutions should, to the maximum extent possible, share data and information without charging each other, especially where the government provides operation and maintenance of the data collecting systems. However, this recommendation has not been implemented.

At the regional level, there is also need to develop data and information sharing/exchange protocols. This issue is being addressed as part of the current SMM project. There is need to develop database structures that are harmonized for ease of exchange. Currently, the two neighbouring countries of Kenya and Uganda use different formats in data collection and the development of geo-referenced information. These differences make it difficult to merge even simple GIS layers of the SMM catchment area.

# 10.0 Population and Social Development

This chapter presents demographic characteristics of the SMM catchment including: population, population densities, fertility, migration, housing characteristics, education, literacy, HIV/AIDS, gender, and food security. The chapter is divided into three sections: demography and housing; health which covers health trends, morbidity, health institutions, food and nutrition, HIV/AIDS; and gender issues.

## 10.1 Demography and housing

In Kenya, major parts of the Bungoma, Teso, Busia and Mt. Elgon districts fall within the SMM catchment. The population for these regions is presented in Table 10.1.

**Table 10.1: Population densities in Kenya SMM districts**

| **Busia District** | | | | | |
|---|---|---|---|---|---|
| **Division** | | **1999** | | **2002** | |
| | **Area ($Km^2$)** | **Population** | **Density** | **Population** | **Density** |
| Budalangi | 306.5 | 53,356 | 174 | 58,363 | 190 |
| Butula | 245.2 | 95,489 | 389 | 104,450 | 426 |
| Funyula | 281.2 | 73,875 | 263 | 80,808 | 287 |
| Matayos | 173.7 | 55,186 | 318 | 60,365 | 348 |
| Nambale | 22.2 | 67,544 | 291 | 73,883 | 318 |

| | | | | | |
|---|---|---|---|---|---|
| Township | 232.5 | 25,158 | 1,133 | 27,519 | 1240 |
| Totals | 1261.3 | 370,608 | 294 | 405,389 | 321 |
| **Teso District** | | | | | |
| | | **1999** | | **2002** | |
| **Division** | Area ($Km^2$) | Population | Density | Population | Density |
| Amagoro | 91.2 | 33,744 | 370 | 36,662 | 402 |
| Amukura | 181.8 | 47,995 | 264 | 52,177 | 287 |
| Angurai | 145.6 | 44,554 | 306 | 48,485 | 333 |
| Chakol | 139.9 | 54,981 | 393 | 59,737 | 427 |
| Totals | 558.5 | 181,274 | 333 | 197,061 | 362 |
| **Mt. Elgon District** | | | | | |
| | | **1999** | | **2002** | |
| **Division** | **Area ($Km^2$)** | **Population** | **Density** | **Population** | **Density** |
| Cheptais | 222.36 | 40,069 | 180 | 42,931 | 193 |
| Kapsokwony | 255.66 | 24,526 | 95 | 26,278 | 103 |
| Kaptama | 209.95 | 23,885 | 114 | 25,592 | 122 |
| Kopsiro | 248.78 | 46,553 | 187 | 49,878 | 200 |
| Totals/density | 936.75 | 135,033 | 144 | 144,679 | 154 |
| **Bungoma District** | | | | | |

| | | 1999 | | 2002 | |
|---|---|---|---|---|---|
| **Division** | **Area ($Km^2$)** | **Population** | **Density** | **Population** | **Density** |
| Kanduyi | 319.4 | 119.456 | 374 | 135,745 | 425 |
| Webuye | 269.1 | 108,716 | 404 | 123,786 | 460 |
| Sirisia | 110.5 | 53,371 | 483 | 60,775 | 550 |
| Bumula | 344.0 | 176,128 | 512 | 200,208 | 582 |
| Nalondo (Central) | 150.1 | 80,754 | 538 | 91,861 | 612 |
| Tongaren | 375.9 | 162,765 | 433 | 185,319 | 493 |
| Kimilili | 179.7 | 71,700 | 399 | 81,584 | 454 |
| Chwele | 85.2 | 30,246 | 355 | 34,421 | 404 |
| Malakisi | 101.4 | 43,196 | 426 | 46,441 | 458 |
| Ndivisi | 132.3 | | 355 | | 404 |
| | | | | 997,175 | |

*Source: CBS Analytical report on Population Projections, Volume VII*

Selected socio-economic indicators for the above districts are summarized in Table 10.2.

**Table 10.2: Selected socio-economic indicators (Kenya)**

| District | Total Area | Population (2002) | Population density (People/Km$^2$) | Literacy rate | Infant Mortality Rate/ 1000 live births | Poverty incidence |
|---|---|---|---|---|---|---|
| Bungoma | 2,068 | 997.175 | 482 | 89.5 | 78 | 56 |
| Busia | 1261 | 405,388 | 321 | 66 | 75 | 66 |
| Mt. Elgon | 937 | 144,679 | 154 | 57 | 64 | 56 |
| Teso | 558 | 197,395 | 354 | 67.4 | 75 | 56 |

In Uganda, selected socio-economic indicators for the SMM districts are summarized in Table 10.3.

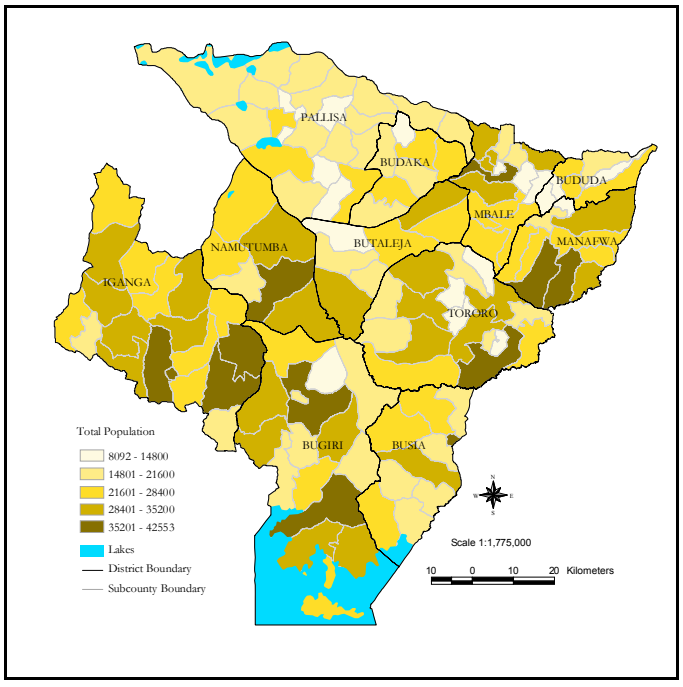
**Table 10.3: Selected socio-economic indicators (Uganda)**

| District | Total Area | Population ( 2002) | Population density (Persons/Km$^2$) | Literacy rate | Infant Mortality Rate per 1,000 live births | Poverty incidence |
|---|---|---|---|---|---|---|
| Bududa | 274 | 123,102 | 450 | 63% | | 30 – 40% |
| Manafwa | 451 | 262,566 | 493 | 67% | 59% | 30 – 40% |
| Tororo | | 381,259 | 313 | 57% | | 40 – 50% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Busia | 743 | 225,008 | 325 | 63% | | 50 – 60 % |
| Butaleja | 644 | 157,489 | 245 | 78% | | 40 – 50% |
| Bugiri | 5,701 | 412,395 | 284 | 59% | 104 | 50 – 60 % |
| Namutumba | 802 | 167,691 | 242 | 34% | | 40 – 50% |
| Pallisa | 2,051 | 384,118 | 328 | 54% | | 50 – 60% |
| Budaka | | 136,475 | 372 | 60% | | 50 – 60% |
| Total | | **2,250,103** | | | | |

Figure 10.1 illustrates the spatial distribution of the population in Uganda.

**Figure 10.1: Population distribution in the SMM (Uganda)**



The rapid population increase is negatively impacting water resources. Poverty in Africa has sometimes been linked to available water resources, and this has partly been observed in Kenya and Uganda. The social costs that are not captured in macroeconomic analyses become apparent when conflicts break out over water use. Water use conflicts and scarcity have become more acute, particularly in the arid and semi-arid (ASAL) areas. Social consequences from poor water resources management have been costly. An example is the illegal and excessive water withdrawals from the headwaters of Kenya's water towers, especially the Aberdares Range and Mt. Kenya, resulting in shortages to downstream users.

Although the loss of production may not be large, the downstream effects on community livelihoods and the increased vulnerability are considerable. Many of these downstream communities are among the poorest in Kenya. The increase in flooding due to loss of vegetative cover, the decrease in water quality, and the increased eutrophication of lakes from nutrient loading are all caused by upstream actions but borne by downstream communities.

These downstream communities are not compensated for the increased cost of production. In addition, downstream communities bear the social costs arising from dams and other impoundments. People have been displaced because of these developments, fish catches have been reduced and spiritual/aesthetic benefits are reduced because of the changes in flows.

### 10.1.1 Human settlements

Rural and urban settlements have important implications on the environment and natural resources. Urban centers concentrate human activity and create high demands for basic services and infrastructure (water supplies, sanitation, waste disposal, healthcare, roads and public transport). In the SMM catchment, the settlement patterns are predominantly rural with agriculture being the main activity. The settlement patterns do not follow any particular order, although people tend to concentrate in the urban centers and areas with potential economic activities.

In the upper region of the catchment that includes the Mt. Elgon district in Kenya and, Manafwa and Bududa districts in Uganda, the mountainous topographical profile influences

the settlement patterns and infrastructure development. Human settlements are concentrated in the lower regions of these regions. For the Mt. Elgon district, the upper regions comprise the forest reserves and the Chepkitale National Reserve. Human settlements occupy approximately 31% of Mt. Elgon district, and forest cover occupies the remaining 69% .

The main towns in the catchment are slowly being urbanized. However, there is poor infrastructure to support urban migration. The mountainous terrain in Mt. Elgon presents technical difficulties infrastructure development, especially road construction. The district does not have a single tarmac road, and electricity supply coverage is sparse.

Overall, the urban centers in the catchment lack physical development plans, water and sanitation services and solid waste disposal. The absence of planning strategies poses the greatest challenge in improving the environmental conditions and sustainability of these towns. Most unplanned settlements exist in the various towns.

In the Busia District, the settlement pattern of people is largely evenly distributed within the divisions with major concentration in the main urban centers of Busia, Port Victoria, Bumala, Nambale and Funyula. The hilly areas in the Funyula and Bundalangi divisions and the wetland areas, especially in the Southern parts of Bundalangi, have low population density.

In Uganda, selected district population highlights have been extracted from the 2002; Uganda Population and Housing Census reports and these are tabulated for the SMM districts in Uganda in Table 10.4

**Table 10.4: Population highlights**

| District | Highlights | | | | |
|---|---|---|---|---|---|
| | **% of population living in urban areas** | **Mean household size (persons)** | **% of household dependent on subsistence farming** | **% of dwelling units with permanent roof, wall & floor materials** | **Total number of orphans in children less than 18 years old** |
| Iganga | 6% | 5 | 74% | 17% | 33,378 |
| Mbale | 10% | 4.4 | 72% | 10% | 34,744 |
| Busia | 16% | 4.7 | 68% | 17% | 16,880 |
| Tororo | 7% | 4.8 | 78% | 11% | 32,198 |
| Pallisa | 6.2% | 5.2 | 85% | 29% | - |
| Bududa | - | 4.4 | - | 4% | - |
| Manafwa | - | 4.5 | 87% | - | - |
| Namutumba | None | 5 | 86% | 16% | - |
| Butaleja | - | 4.9 | 85% | - | - |

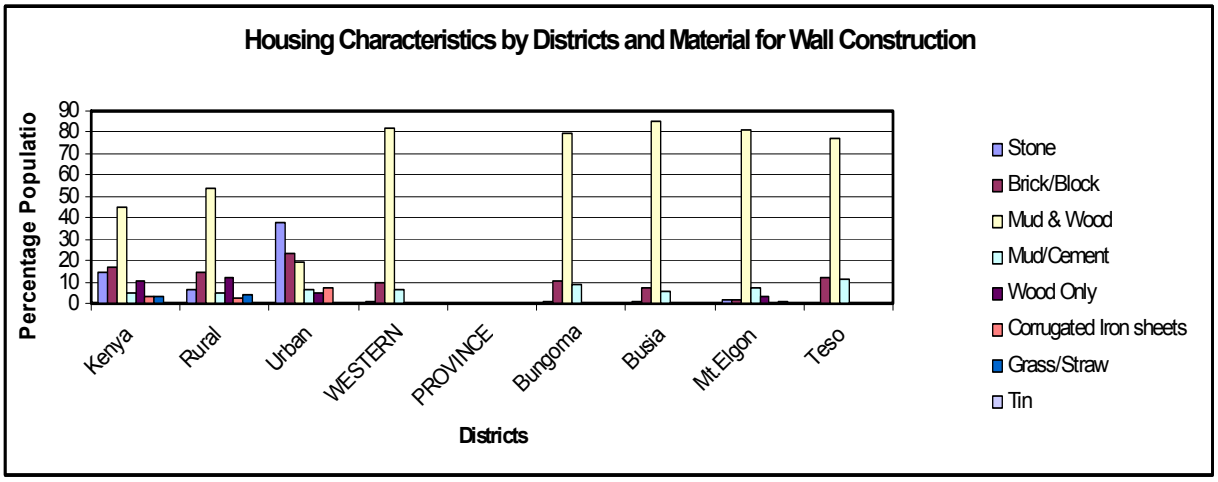
### 10.1.2 Housing characteristics in Kenya

Given the strong relationship between household economic conditions and exposure to diseases, information on housing characteristics such as access to electricity, drinking water

sources, sanitary facilities, flooring and roofing is key to understanding potential disease exposure and prevalence. Housing characteristics also indicate potential future resources demands.

The wall materials used by the majority of rural households include mud/wood, mud/cement, iron sheets, stone and sand. The largest proportion of Kenyan households uses mud/wood for wall construction. Nationally, 37.9% of urban houses are made of stone walls while 54% of rural houses are mainly made of mud walls. Figure 10.2 compares the distribution of materials used for wall construction, at the province and district levels in the SMM catchment.

**Figure 10.2: Housing characteristics by wall construction material (Kenya)**




*Source: KDHS, 2003*

For roofing materials, iron sheets, tiles, asbestos sheets, tin and thatch (makuti) are used, with the majority of rural households using grass or thatch. The predominant flooring materials used by Kenyan households are earth, mud, dung, and sand. About two-thirds of Kenyan households (69%) live in dwellings with corrugated iron *(mabati)* roofs and 22% have grass thatched roofs. Urban-rural differences in roofing material are not as pronounced as those for some of the other housing characteristics, with 73% of urban households having corrugated iron roofs, compared with 69% of rural households. Data from the 1999 population census show a slightly larger proportion of households with grass or thatched

roofs (28%) and fewer with iron sheet roofs (64%), as compared with the 2003 KDHS (Central Bureau of Statistics, 2002g: 25).

The 2003 KDHS also collected data on the number of rooms used by members of the households for sleeping. This information provides a rough measure of the degree and severity of household crowding. Most households in Kenya (77%) have 1 to 2 persons sleeping together in a single room.

For cooking fuel, two-thirds of Kenyan households depend on firewood. Urban households mostly use kerosene (51%) or charcoal (26%), while 85% of rural households use firewood

### 10.1.3 Migration (Kenya)

People move from perceived low to high economic potential areas. In Mt. Elgon for example, most people have immigrated and there are few new settlers for the area. The population is fairly evenly distributed. However, there is a tendency for people to be concentrated in the major urban centers like Bungoma, Malaba, Busia, Webuye, Malakisi and Chwele that offer more infrastructure and hence attract more people through rural-urban migration. People also tend to concentrate around the major industries in the catchment like the Nzoia Sugar Company, the Webuye PanPaper Mills and the Tobacco Leaf Centre in Malakisi in search of employment. Cross-border migrations occur in the Busia, Teso, and Mt Elgon districts particularly in the Chepkube and Cheptais divisions (Mt. Elgon).

Due to economic and ethnic factors in Kenya and rural-urban migration movements, most towns are inhabited by migratory workers and traders. The political turmoil in Uganda in the late 1980's forced many refugees into the districts along the common border..

### 10.1.4 Family planning policies and programs (Kenya)

In 2000, Kenya launched the National Population Policy for Sustainable Development (National Council for Population and Development, 2000). The policy outlines the program developed at the 1994 International Conference on Population and Development in Cairo. Policy implementation is being guided by the national and district action plans formulated by the National Council for Population and Development (NCPD).

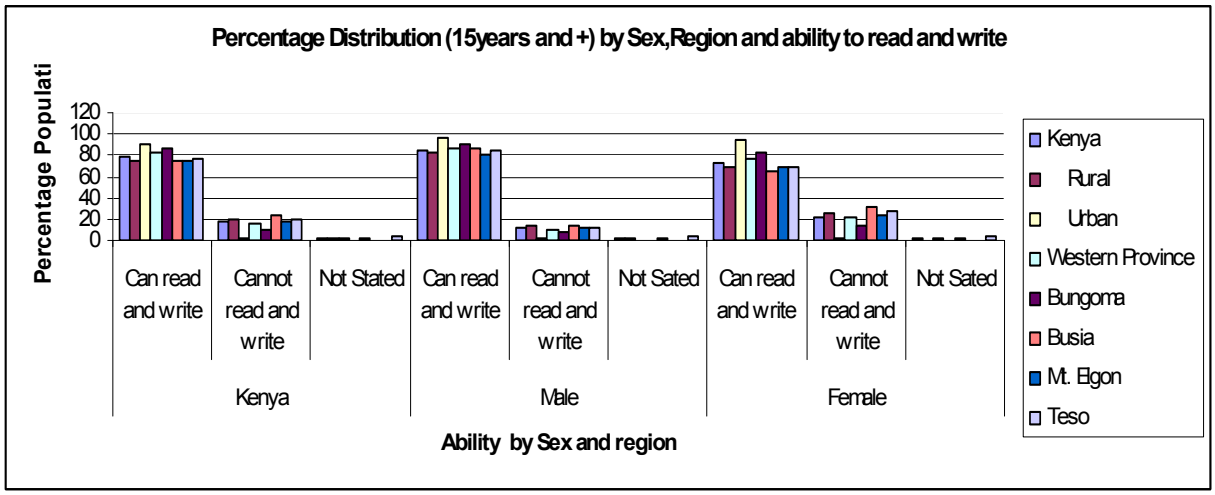
The policy also addresses environmental, gender, and poverty issues as well as problems facing youth. The goals and objectives include motivating and encouraging Kenyans to practice responsible parenthood; empowerment of women; and integration of the youth, elderly, and disabled into mainstream national development. The overriding concern is for population growth to fit the available national resources and to improve the quality of life.

### 10.1.5 Education and literacy (Kenya)

The Kenyan education system is categorised into primary (standard 1-8), secondary (Form 1-4) and tertiary schooling (vocational and university education). As part of the Millennium Development Goals on Universal Primary Education (UPE), the government introduced the Free Primary Education Program in 2003. The key educational indicators include school attendance, highest grades completed, type of school attended and literacy.

According to KIHBS 2005/06, adult literacy is the percentage of people aged 15 years and above who can, with understanding and ability, read and write simple statements in at least one language. The population who can both read and write nationally stands at 79.0%. Over 90% of the urban dwellers can read and write compared to 75.7% of the rural population. The population aged 15 years and above by ability to read, write and gender in the SMM catchment is presented in Figure 10.3. The literacy distribution compares the national literacy levels and with the SMM catchment.

**Figure 10.3: Population literacy distribution (15+ years; Kenya)**

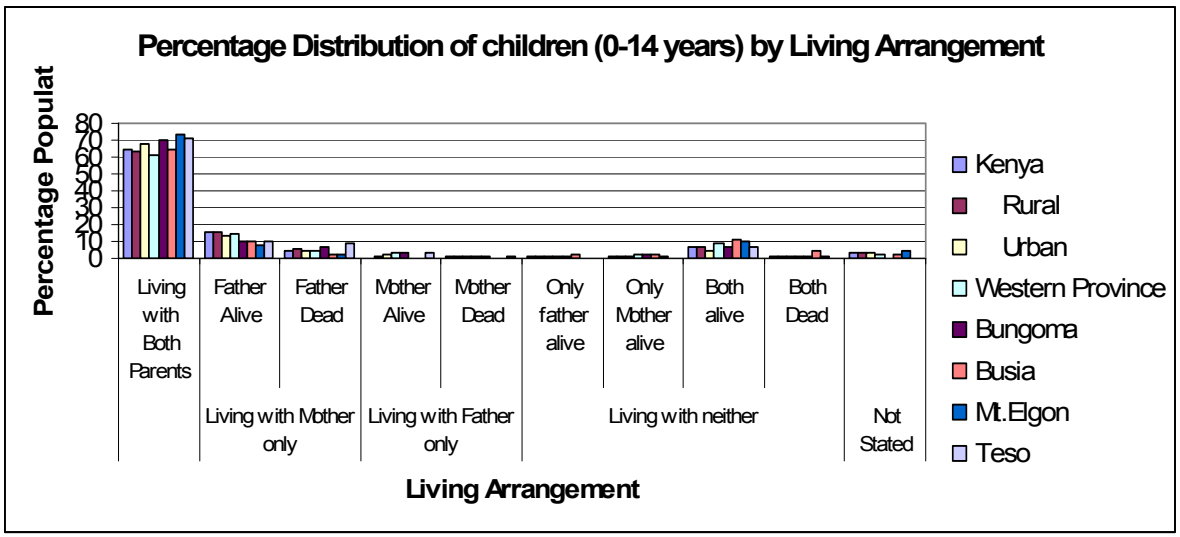



*Source: KIHBS 2005/06*

### 10.1.6 Orphanhood

Figure 10.4 illustrates the distribution of children aged 0-14 years by living arrangements and parent survival status. The table compares the national orphanhood levels with those in the SMM catchment. Nationally, 64% of children live with both parents, 20.5% live with their mothers only, 2.4% live with their fathers only (KIHBS 2005/06).

**Figure 10.4: Distribution of children (0-14 years) by living arrangements**




*Source: KIHBS 2005/06*

## 10.2 Public health

This section gives an overview of health trends, causes of death; diseases (HIV/AIDS); infections; immunizations; food security; and nutrition in the SMM catchment.

### 10.2.1 Health trends in Kenya

The health trends of a nation are gauged by indicators including life expectancy, child mortality levels, crude birth rates, crude death rates and fertility rates. For the SMM districts, the health trends have followed the national trend.

A gradual fall in the crude death rate (from 17 to 11 per 1,000) and the persistently high crude birth rate (over 40 per 1,000) have driven the population growth rate. The total fertility rate rose from 6.7 in 1948 to 7.9 in 1979 before dropping back to 6.7 in 1989 and to 4.8 in 2003. The life expectancy at birth rose to reach a peak at 60 years in 1989 from 50 years in 1969. In 1999 the life expectancy was 56.6 (52.8 years for males and 60.4 years for females). Life expectancy has since fallen and is currently estimated at 47 years.

Data from the 2003 demographic and health survey show that child mortality levels have been fairly stable over the last few years. For the five-years preceding the survey, infant mortality was 77 deaths per 1,000 live births and under-five year mortality was 115 deaths per 1,000 live births. These statistics indicate that one in every nine children born in Kenya die before attaining their fifth birthday.

### 10.2.2 Health trends in Uganda

Ugandan health trends in the SMM are best described by consolidating data from following publications:

- The Uganda Demographic and Health Survey (UDHS) conducted in 1988, 1995 and 2000-2001.
- Extracts from the Uganda National Household Survey (UNHS - 200/2003, 2005/2006). The variables included are prevalence of disease, availability and utilisation of health facilities, distance to health facilities, and the major reasons why

no medical attention was sought for those who fell sick. Of particular interest are malaria and use of insecticide treated nets (ITNS).

- STD/HIV/AIDS surveillance reports of the STD/AIDS Control Program of the Ministry of Health (MoH) in Uganda.
- Weekly epidemiological newsletters of the Epidemiological Surveillance Division of the MoH, Kampala.
- MoH Annual Health Sector Performance Reports.

### 10.2.3 Causes of death and diseases

The national morbidity trend has remained relatively constant over the last four decades with malaria and respiratory infections the number one and two causes, respectively, accounting for over 55% of the total (Ministry of Health, 2003). Other morbidity causes include diarrhea, skin and intestinal worm related diseases, pneumonia, and rheumatism. The same trend is observed in the SMM districts. Table 10.5 depicts the outpatient morbidity trends for the Busia, Teso, Mt. Elgon and Bungoma districts for 2003 and 2004. A graphical presentation is provided in Figure 10.5.

Water borne and water related diseases are among the top ten causes of outpatient morbidity. Pollution to water systems by sewage and chemical effluents has resulted in unsafe drinking water and the subsequent escalation of waterborne diseases. Solid waste dumping, which is a common in the urban centers in the SMM districts, has resulted in garbage accumulation that also becomes mosquito breeding grounds.

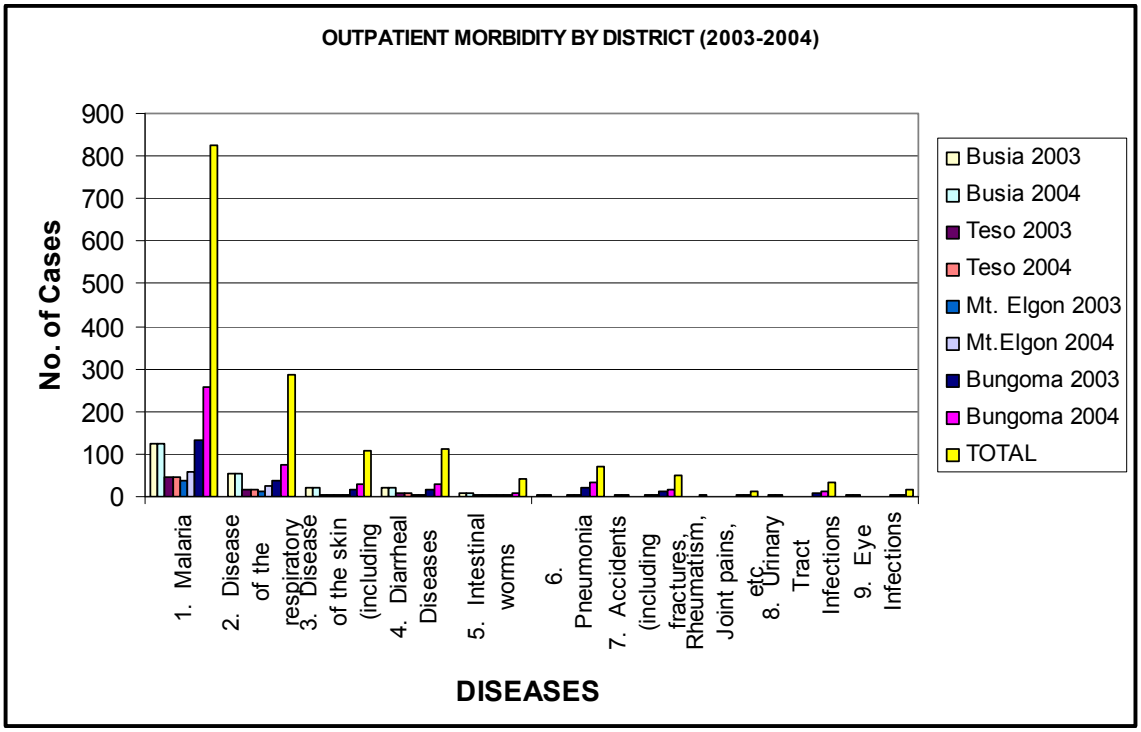
Respiratory diseases are exacerbated by increased use of firewood and charcoal. Epidemics (malaria, cholera, and typhoid) are very common in the catchment. These diseases are mainly caused by lack of sanitation facilities and contaminated water and food. The Ministry of Health through the Public Health Department has been promoting public education on general hygiene through public barazas and health institutions.

## Table 10.5: Outpatient morbidity by district 2003 and 2004

| DISEASE | BUSIA | | TESO | | MT. ELGON | | BUNGOMA | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2003 | 2004 | 2003 | 2004 | 2003 | 2004 | |
| **1.** Malaria | 125,980 | 122,860 | 47,333 | 47,426 | 35,785 | 56,207 | 133,020 | 255,121 | 823,732 |
| **2.** Respiratory System Diseases | 52,971 | 52,780 | 15,474 | 17,143 | 10,791 | 23,406 | 36,888 | 74,720 | 284,173 |
| **3.** Skin diseases (including ulcers) | 19,965 | 20,914 | 5,375 | 6,148 | 3,175 | 5,957 | 15,183 | 30,092 | 106,809 |
| **4.** Diarrhea Diseases | 21,472 | 19,823 | 7,654 | 8,005 | 3,064 | 6,115 | 16,014 | 29,620 | 111,767 |
| **5.** Intestinal worms | 9,571 | 8,973 | 2,656 | 4,113 | 2,531 | 2,670 | 3,966 | 7,599 | 42,079 |
| **6.** Pneumonia | 3,577 | 3,227 | 1,058 | 1,611 | 3,037 | 3,662 | 21,673 | 32,960 | 70805 |
| **7.** Accidents (including fractures, burns, etc) | 4,932 | 3,892 | 1,534 | 1,765 | 2,800 | 2,786 | 12,737 | 17,600 | 48,046 |
| Rheumatism, Joint pains, etc | 1,663 | 2,122 | 598 | 547 | 511 | 295 | 2,249 | 3,683 | 11,668 |
| **8.** Urinary Tract Infections | 4,141 | 4,022 | 1,153 | 1,105 | 882 | 1,189 | 9,694 | 12,499 | 34,685 |
| **9.** Eye Infections | 3,083 | 3,481 | 712 | 1,156 | 618 | 1,178 | 3,106 | 5,187 | 18,521 |

*Source: Ministry of Health Performance Status Report 2003-2004 - Kenya*

**Figure 10.5: Top nine causes of morbidity 2003/2004**




*Source: Ministry of Health Performance Status Report 2003-2004 - Kenya*

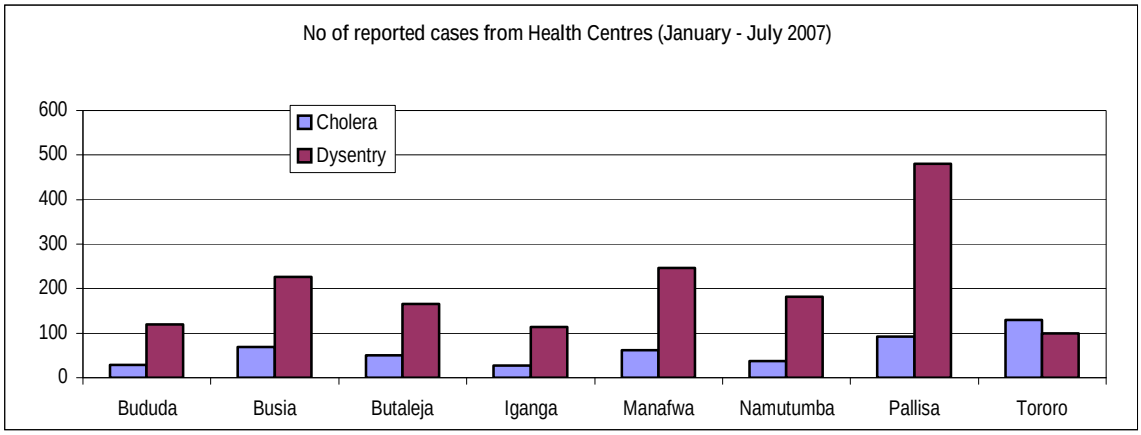
Disease prevalence in eastern Uganda increased from 35.9 % to 48.7% from 2002 to 2006 (Uganda National Household Survey 2005/2006). According to this study, malaria was the dominant cause of sickness accounting for about 51.4% of the sickness reported. Disease surveillance statistics from MoH indicate that from 2003 to 2006, malaria and neonatal tetanus were the major causes of mortality in the Busia, Mbale, Pallisa and Tororo districts. Although the use of mosquito nets increased from 11% in 2002/2003 to 17% in 2006, malaria still poses a major challenge to health service delivery. Table 10.6 shows the number of deaths reported and their causes.

**Table 10.6: Reported deaths and causes in Uganda 2003 to 2006**

| Cause of death | Number of deaths reported | | | |
|---|---|---|---|---|
| | **2003** | **2004** | **2005** | **2006** |
| Sleeping sickness | - | - | 1 | 1 |
| Malaria | 722 | 641 | 629 | 373 |
| Measles | 48 | - | - | - |
| Meningitis | 9 | - | 11 | 2 |
| Neo-Natal Tetanus | 30 | 23 | 7 | 8 |
| Cholera | - | - | 7 | - |
| Plague | - | - | 1 | - |
| Dysentery | - | 2 | 8 | - |

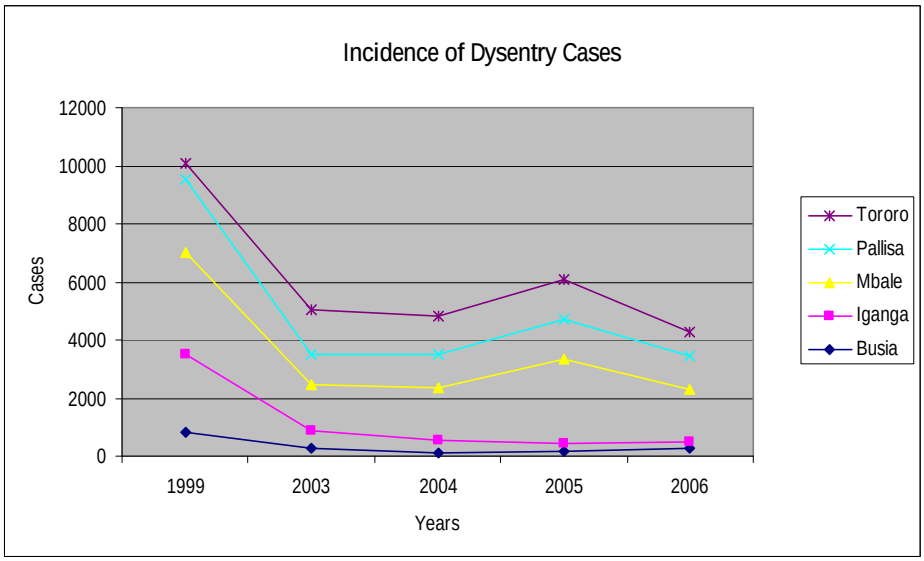
Diarrhoeal diseases (cholera & dysentery) continued to be the major killer of young children, accounting for 19% of all infant deaths in Uganda. Data from the 2006 UDHS showed that 26% of children under age five had severe diarrhoea in Eastern Uganda, while 56% had symptoms of Acute Respiratory Illness (ARI). Cholera and dysentery cases reported by the Epidemiology Surveillance Department for the first six months of 2007 are illustrated in Figure 10.6.

**Figure 10.6: Incidence of cholera and diarrhea in the SMM - Uganda**




Poor sanitation and hygiene continue to be major predisposing factors for disease in these districts. The trend from 1999 to 2006 indicates that the Tororo district has consistently recorded the highest number dysentery cases as illustrated in Figure 10.7.

**Figure 10.7: Incidence of dysentery**



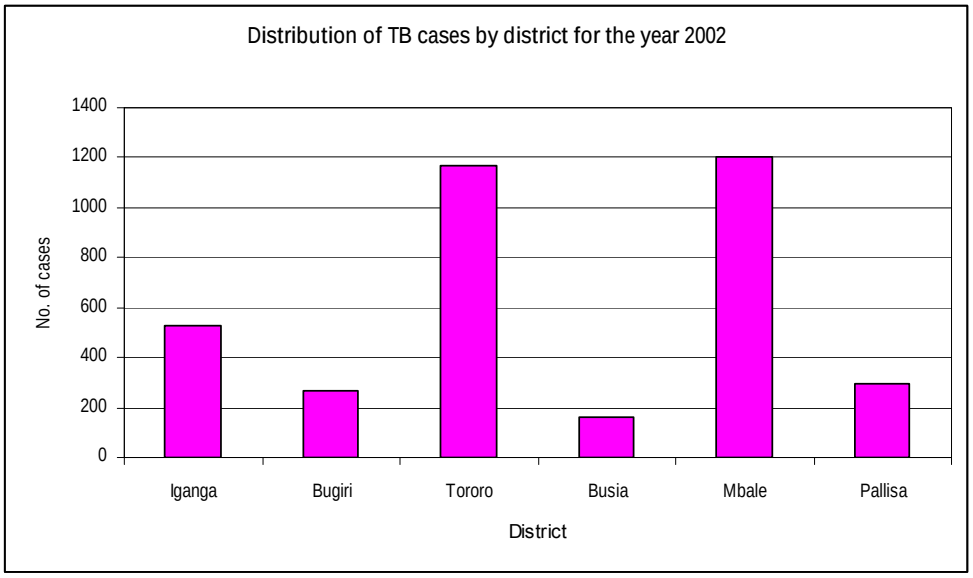
Cholera was widely prevalent in 1997 and 1998, with the highest number cases registered in the Iganga, Mbale, and Tororo districts (Table 10.7). The Cholera Fatality Rate (CFR) fell from 6% in 2000 to 2.5% in 2005 (WHO recommends a CFR of less than 1%). Outbreaks were attributed mainly to poor sanitation, low safe water coverage (less than 50% in some parts) and poor domestic and personal hygiene practices.

**Table 10.7: Cholera in SMM districts in Uganda**

| District | Yearly recorded cases of Cholera | | | | |
|---|---|---|---|---|---|
| | **1997** | **1998** | **1999** | **2005** | **2006** |
| Busia | 0 | 131 | 4 | 5 | 0 |
| Iganga | 379 | 2103 | 0 | 0 | 5 |
| Mbale | 56 | 8363 | 0 | 216 | 0 |
| Pallisa | 0 | 39 | 1 | 0 | 0 |
| Tororo | 4 | 955 | 27 | 0 | 0 |

Similarly, Figure 10.8 illustrates tuberculosis prevalence by SMM district in 2002.

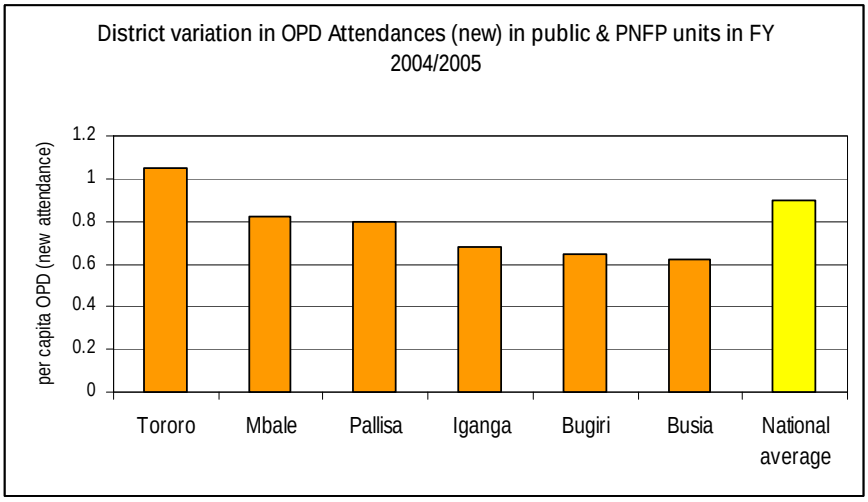
**Figure 10.8: Distribution of tuberculosis by district in 2002 -Uganda**




*Source: National TB/Leprosy Control Programme, 2002*

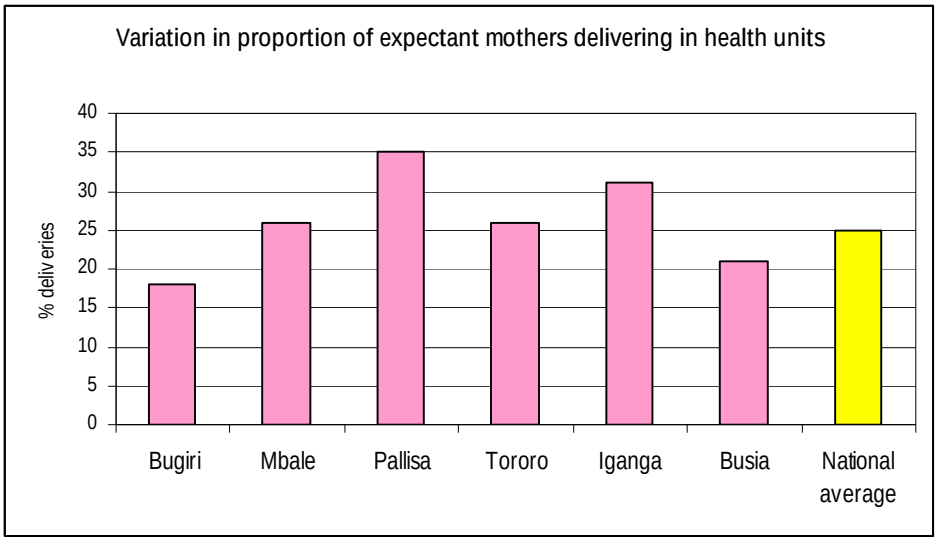
New outpatient attendance in government and private not for profit (PNFP) units is the preferred measure of health services utilisation under Uganda's Poverty Eradication Action Plan (PEAP). Hence, figures of new per capita Out Patient Department (OPD) attendances from individual districts can indicate health services requested by the population. This indicator is illustrated in Figure 10.9.

**Figure 10.9: New OPD attendance by district (MoH, 2005) - Uganda**



The Tororo district is the best performing within the SMM catchment with per capita OPD services of over slightly over 1.0. The Busia and Bugiri district performances are below the national average statistic. The Busia and Bugiri districts are also the poorest performers with respect to reproductive health if the proportion of expected deliveries in public and PNFP facilities is considered as shown in Figure 10.10.

**Figure 10.10: Percent of expectant mothers delivering in health units -Uganda**



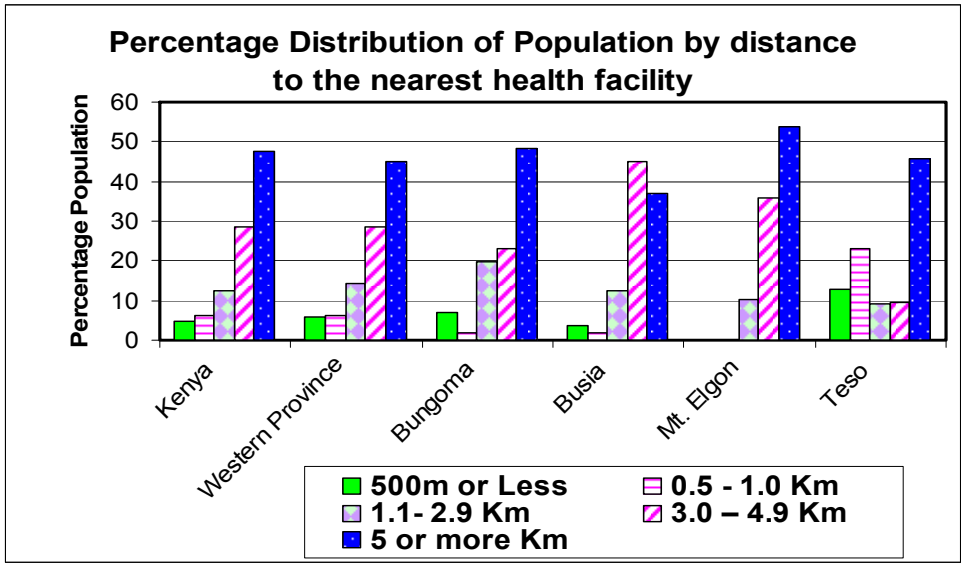

The figure above indicates that utilisation of health facilities for safe deliveries remains low within the Ugandan SMM catchment. The national average of expecting mothers who deliver in government and PNFP health units stayed stagnant at 25% between 1999 and 2005 (MoH, 2005). Among women who had a live birth in the five years preceding the UDHS 2006, the percentage of women that delivered in a health facility was 39.5% in Mbale and Pallisa and 54.2% in Bugiri, Busia and Iganga. The low percentage has been attributed to: perceived poor quality services; lack of equipment, supplies, and water; and inadequate access to maternity services etc. For instance, the SMM districts are served by only one regional hospital at Mbale. Although Health Centre IV (HC- IV) facilities are considered to be critical to efficient maternity health services, only one of the two facilities (50%) in Busia is operational. An HC-IV facility is one that is able to perform caesarean sections.

### 10.2.4 Health institutions

The health facilities in the SMM catchment in Kenya comprise government and private hospitals, health centers, dispensaries and private clinics. Appendix 6 presents a list of the health facilities.

Estimates are that only 11.3% of Kenyans travel one kilometer or less to reach a health facility, while about 47.7% travel for five kilometers or more. However, the national averages do not reflect huge urban and rural differences. Figure 10.11 shows the percentage distribution of population by distance to the nearest health facility in the SMM districts.

**Figure 10.11: Percent population by distance to the nearest health facility - Kenya**




*Source: Kenya Integrated Household Budget Survey (2005/06)*

### 10.2.5 Immunization

Child immunization is vital to survival and growth as it prevents immunizable diseases. Kenya has adopted the WHO vaccination guidelines (BCG for tuberculosis, diptheria/pertussis/tetanus (DPT), hepatitis B, influenza, polio, and measles).

Table 10.8 presents the distribution of children by immunization type given in the SMM districts. The analysis focuses on children 12-23 months old since they should have been

fully immunized. Overall, 64.2% had vaccination cards. According to the mothers' recall and health cards, 91.2% had received BCG, 90.0% polio, and 89.2% the first dose of DPT-Hepatitis B. The data show a decline in the second doses for all the antigens.

At the national level, 65.9% of the children are considered fully immunized. At the district level, over 90% of children in Teso and Busia were reported fully immunized.

The immunization results are comparable to the Kenya Demographic and Health Survey (KDHS). In the 2003 KDHS, mothers were able to show a health card with immunization data for only 60% of children age 12-23 months. Immunization data from are based on mothers' recall where cards are not available. The data show that 57% of children 12-23 months old are fully vaccinated which represents a decline. Seven percent of children 12-23 months have not received any of the recommended immunizations.

**Table 10.8: Immunization rates of children (12-23 months)**

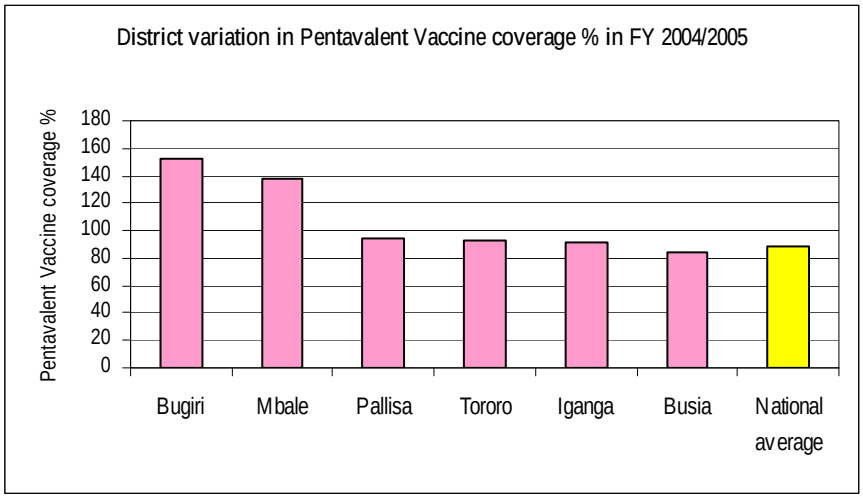
| Region | Vaccination | BCG | POLIOB | POLIO1 | POLIO2 | POLIO3 | DPT 1 | DPT 2 | DPT 3 | MEASLES | Fully Immunized | Total Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Kenya** | 64.2 | 91.2 | 75.5 | 90.0 | 87.4 | 77.6 | 82.9 | 85.9 | 80.3 | 76.7 | 65.9 | 1,006,733 |
| Rural | 64.6 | 91.3 | 73.8 | 89.7 | 86.7 | 77.6 | 89.3 | 85.6 | 79.3 | 74.7 | 64.8 | 808,212 |
| Urban | 62.5 | 91.1 | 82.6 | 91.0 | 90.4 | 77.4 | 89.0 | 87.2 | 84.2 | 84.9 | 70.2 | 198,520 |
| **Western Province** | 63.2 | 93.6 | 75.1 | 93.9 | 91.2 | 83.2 | 93.3 | 90.3 | 84.1 | 82.4 | 75.8 | 143,384 |
| Bungoma | 50.5 | 85.3 | 88.2 | 89.2 | 88.4 | 87.7 | 92.5 | 88.6 | 83.2 | 79.9 | 77.9 | 32,825 |
| Busia | 98.2 | 99.4 | 99.4 | 99.4 | 99.4 | 99.4 | 99.4 | 99.4 | 99.4 | 99.4 | 99.4 | 13,526 |
| Mt. Elgon | 42.3 | 88.7 | 42.0 | 95.6 | 84.3 | 72.4 | 84.7 | 84.7 | 75.2 | 62.0 | 59.2 | 7,931 |
| Teso | 67.4 | 96.5 | 88.7 | 97.3 | 97.3 | 93.1 | 96.5 | 96.6 | 96.5 | 96.3 | 90.3 | 9,387 |

*Source: KIHBS 2005/06*

The Ministry of Health Performance Status Report (2003/2004) indicates more immunizations in 2004 than 2002 (86% versus 49% based on the Kenya Expanded Programme on Immunization, KEPI). Penta-One coverage was 84% down from 87% in 2003 indicating a reduction EPI services, and measles coverage also reduced from 69% to 65% in 2004.

In Uganda, the Ministry of Health utilises the Pentavalent Vaccine as a proxy indicator for immunisation services. According to the Annual Performance Report for FY 2004/2005, the national immunisation services in Uganda improved from 41% in the FY 1999/2000 to 89% in FY 2004/2005. Following this improvement, measles are no longer among the top ten causes of childhood illness and deaths. Figure 10.12 illustrates the percentage of Pentavalent Vaccine in the SMM districts in Uganda.

**Figure 10.12: Pentavalent vaccine coverage in Uganda (MoH, 2005)**




In FY 2004/2005 coverage varied from 153% in Bugiri to 84% in Busia. The UDHS 2006 data on vaccinations for children under five reported that the proportion 41% - 46% of children aged 12-23 months were fully vaccinated in Eastern Uganda. The proportion of children that received no vaccinations ranged from 3.7% in the Mbale, Tororo, and Pallisa to 6.7% in Bugiri and Busia.

### 10.2.6 HIV/AIDS infections in Kenya

Acquired Immune Deficiency Syndrome (AIDS) is caused by a human virus (HIV) that weakens the immune system, making the body susceptible to other diseases that lead to death through secondary infections (KDHS, 2003). This is a serious public health and socioeconomic problem in many countries around the world. The most affected countries are found in sub-Saharan Africa, especially those located in the eastern, central, and southern parts of the continent.

In Kenya, as in most of sub-Saharan Africa, national HIV prevalence estimates have been derived primarily from sentinel surveillance in pregnant women. Currently, the national sentinel surveillance system consists of 42 government and mission health facilities that represent the different groups, regions, and rural and urban populations.

For three months each year since 1990, pregnant women registering their first visit and patients with sexually transmitted diseases have been anonymously tested for HIV. The results have been entered, analyzed and reported by the National AIDS/STD Control Program (NASCOP) (Ministry of Health, 2001). The latest round of sentinel surveillance was conducted between May and August 2003, during the same time period as the KDHS.

HIV/AIDS remains a major concern in Kenya because of high prevalence rates reported among adults and significantly higher rates among younger ages (Ministry of Health, 2001). The prevalence of HIV is lower in rural areas, where about 80% of the total population lives. About 75% of all AIDS cases occur among people in the most economically productive age group, 20 to 45 years (Ministry of Health, 2001), see table 10.9. The deaths of these individuals constitute a serious economic and social tragedy in the lives of surviving family, friends, and employers.

**Table 10.9: HIV prevalence by age**

| Age | Women | | Men | | Total | |
|---|---|---|---|---|---|---|
| | Percent HIV positive | Number | Percent HIV positive | Number | Percent HIV positive | Number |
| 15-19 | 3.0 | 711 | 0.4 | 745 | 1.6 | 1,456 |
| 20-24 | 9.0 | 658 | 2.4 | 566 | 6.0 | 1,224 |
| 25-29 | 12.9 | 522 | 7.3 | 428 | 10.4 | 950 |
| 30-34 | 11.7 | 438 | 6.6 | 368 | 9.4 | 806 |
| 35-39 | 11.8 | 345 | 8.4 | 321 | 10.1 | 666 |
| 40-44 | 9.5 | 276 | 8.8 | 260 | 9.1 | 535 |
| 45-49 | 3.9 | 202 | 5.2 | 163 | 4.4 | 364 |
| 50-54 | na | na | 5.7 | 193 | na | na |
| Total age 15-49 | 8.7 | 3,151 | 4.6 | 2,851 | 6.7 | 6,001 |
| Total age 15-54 | na | na | 4.6 | 3,043 | na | na |

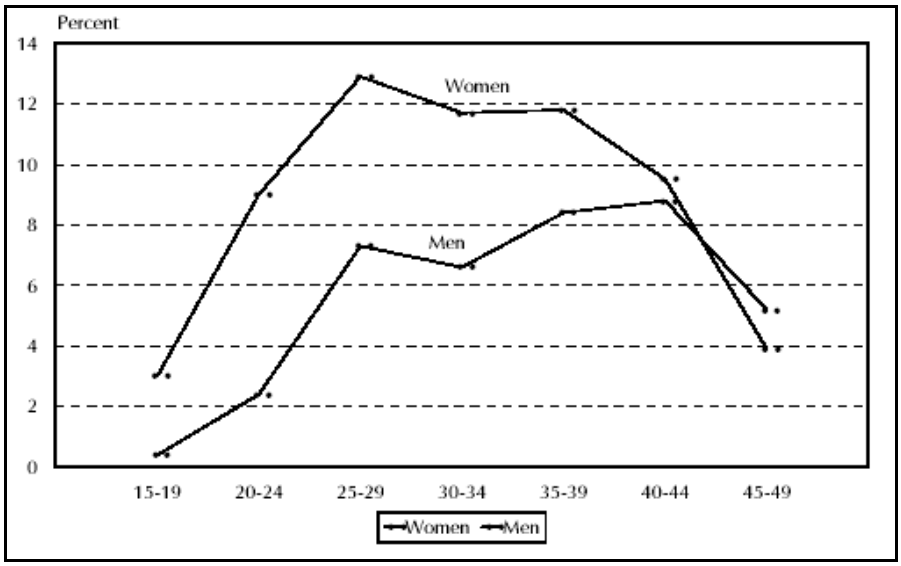
na = Not applicable

*Source: KDHS, 2003*

Results from the 2003 KDHS also indicate that HIV prevalence in women aged 15-49 years is nearly 9%, while for men aged between 15-54 years it is under 5%. This female-to-male ratio of 1.9 to 1 is higher than that found in most population-based studies in Africa and implies that young women are particularly vulnerable to HIV infection compared to young men.

Figure 10.13 shows, for example, that 3% of women age 15-19 are HIV infected, compared with less than half of one percent of men 15-19. HIV prevalence among women 20-24 is over three times that of men in the same age group (9% and 2%, respectively). The peak prevalence among women is at age 25-29 (13%), while prevalence rises gradually with age among men to peak at age 40-44 (9%). Only in the 45-49 year age group is HIV prevalence among men (5%) higher than that for women (4%).

**Figure 10.13: HIV prevalence by age group and sex**

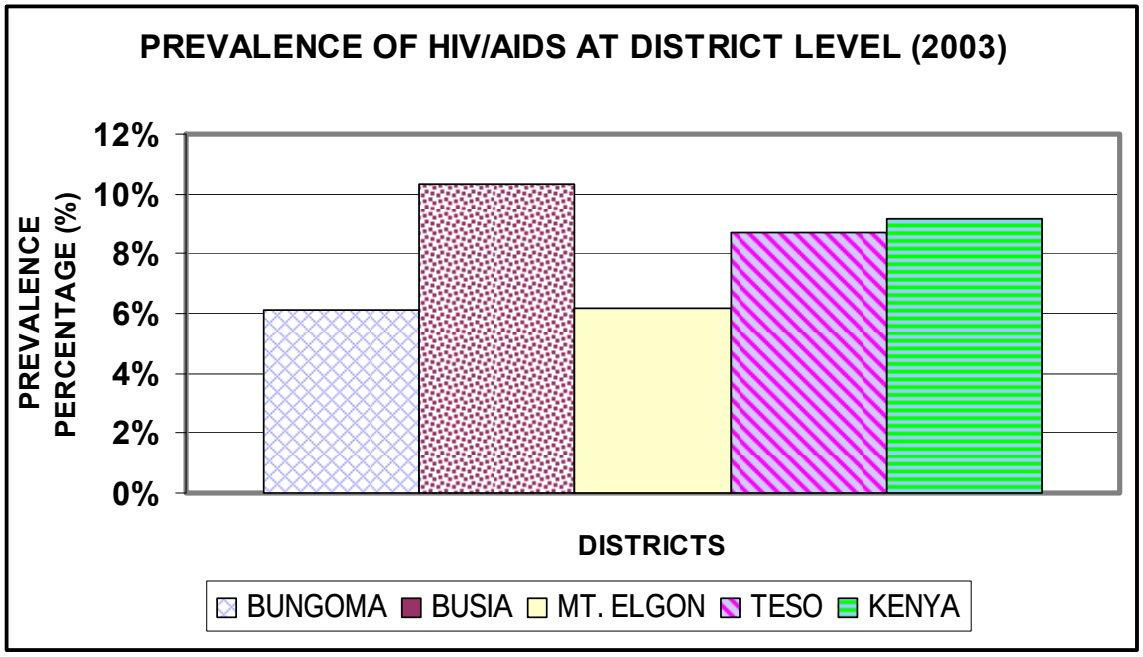



*Source: KDHS, 2003*

In the SMM catchment, the HIV/AIDS prevalence was between 20% and 30 % while bed occupancy in hospital wards due to HIV/AIDS related conditions was 50% prior to 2001. The age-group prevalence rates indicate that 80-90% of infections are among young people. Infections mostly occur between ages 15-30 for women and ages 18-35 for men. Field reports indicate the number of deaths due to HIV/AIDS infections is at least two per day in the Teso district and about ten per month in the Busia district.

The joint efforts to fight the HIV/AIDS scourge are producing positive results as evidenced by the falling levels of the HIV/AIDS prevalence. Figure 10.14 illustrates the HIV/AIDS prevalence in the four districts of Bungoma, Busia, Mt. Elgon and Teso compared with the national prevalence for 2003.

**Figure 10.14: HIV/AIDS district prevalence (2003)**




Some socio-cultural factors leading to infections include traditional circumcision, wife inheritance, high mobility in search of employment (especially in the agro-industries), extensive brewing and consumption of local illicit brews, the cross border Trans-Africa Highway from Mombasa to Mbale, Kampala, and Kigali through Malaba border town. Other factors include high poverty levels forcing women to opt for commercial sex, lack of information and mis-information by herbalists, and ignorance among rural people.

The impact of HIV/AIDS has already been felt in many areas. These impacts include increased number of orphans, child prostitution, child labor, decreased agricultural and industrial productivity, increased dependency rates, increased high school drop out rates, and increased healthcare costs.

Some measures to help curb of the spread of HIV/AIDS and eliminate the stigma are increasing awareness by the Ministry of Health, churches and NGO's; peer group education; school curriculum education; video shows, posters and booklets, promotion of condom use (for example, use of condom dispensers in public offices). Other measures include introduction of home-based care and provision of anti-retroviral drugs at subsidized prices.

HIV/AIDS management at the district level is done through the District AIDS Control Committees (DACCs) and the Constituency AIDS Control Committees (CAACs) with technical assistance from the Ministry of Health. The biggest challenge in the fight against HIV/AIDS is human sexual behavior since it is the major cause of infection.

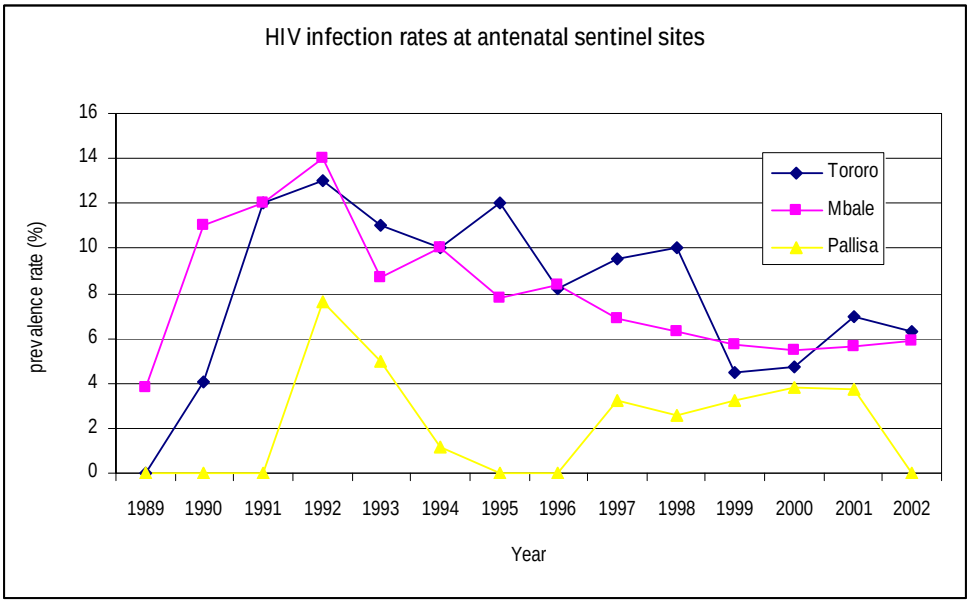
Voluntary Counseling and Testing (VCT) is now acknowledged as an effective strategy for HIV prevention. HIV testing through VCT or in clinical settings is essential for access to AIDS care. To meet the challenge of the HIV/AIDS epidemic, in September 1997 Kenya approved Sessional Paper No. 4 on AIDS in Kenya, (Ministry of Health, 1999). The intention was to support effective programs to control the spread of AIDS, to protect the human rights of those with HIV/AIDS, and to provide care for those infected and affected by HIV/AIDS. The goal of the Sessional Paper was to "provide a policy framework within which AIDS prevention and control efforts will be undertaken for the next 15 years and beyond."

The Sessional Paper recognizes that responding effectively to the HIV/AIDS crisis will require a strong political commitment at the highest level; implementation of a multi-sectoral prevention and control strategy with priority focus on young people; mobilization of resources for financing HIV prevention, care, and support; and establishment of a National AIDS Control Council to provide leadership at the highest level possible.

### 10.2.7 HIV/AIDS infections in Uganda

After more than one quarter of a century, the HIV/AIDS epidemic continues to pose serious public health challenges, contributes significantly to morbidity and mortality in Uganda, and strains the public health budget. According to the Uganda MoH, Annual Health Sector Performance Report (2004/2005), HIV prevalence rates were reported to be between 6-7% in Eastern Uganda (See Figure 10.15).

**Figure 10.15: HIV infection prevalence rates (%) at antenatal sentinel sites**




*(Source: STD/HIV/AIDS Surveillance Report, Ministry of Health, June 2003)*

### 10.2.8 Food security and nutrition

Hunger reduction and achieving food security and nutrition are primary development goals for Kenya. The Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC) recognizes the role of human capital and emphasizes good nutrition as critical to human development and overall productivity (KIHBS 2005/06). A nutritional assessment was based on the concept that in a well nourished population, children's weight and height at a given age will follow a predictable statistical distribution.

#### *a) Rural Food Poverty*

According to the Kenya Integrated Household and Budget Survey of 2005, the rural food poverty line was estimated at Ksh.988.00 per month per adult equivalent. The main measures of food poverty used were: the 'Headcount Index' which measures the prevalence of poverty and how far below the poverty line each unit is; the 'Income gap', the average of

the poverty gaps expressed as a fraction of the poverty line; and the 'Severity of Poverty' or coefficient of variation of expenditure distribution of the poor.

A common class of poverty measure is the Foster, Greer and Thobecke (FGT), P(α) which is a poverty sensitivity indicator (KIHBS, 2005/2006). The FGT has three different poverty indices:

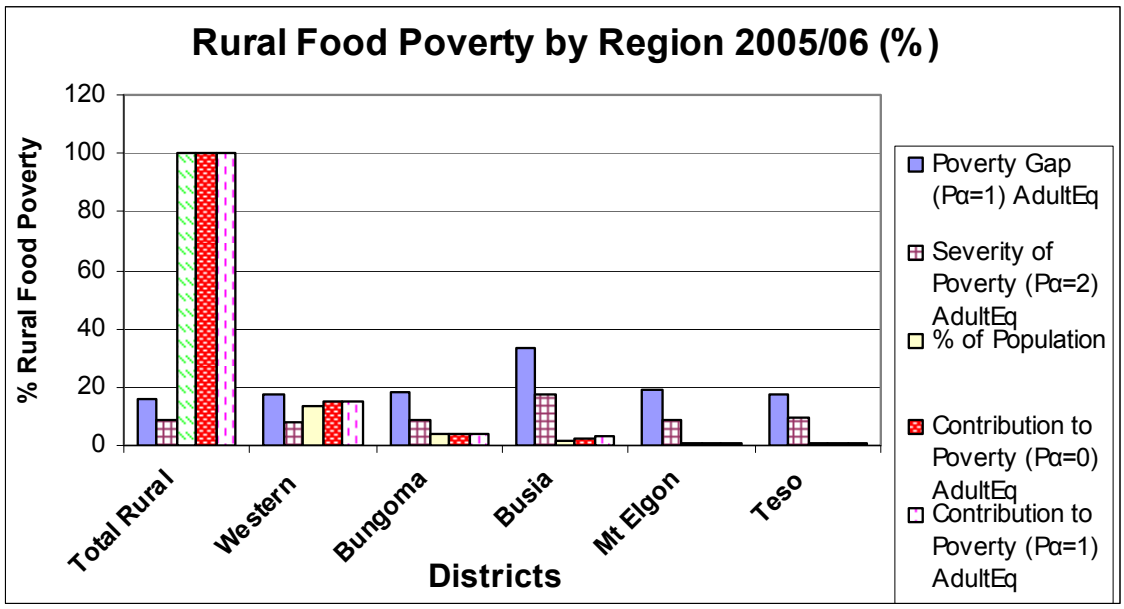
a) The Poverty Headcount Index, P(α)=0, measures the incidence of poverty and is the most basic measure of poverty.

b) The Poverty Gap Index, P(α)=1, measures the depth of poverty. It provides information on how much poorer the poor people are relative to the poverty line.

c) The Poverty Severity Index, P(α)=2, shows how severe the poverty levels are. It can be used to assess the impact of policies and programs that aim to reach the poorest of the poor.

For the SMM catchment in Kenya comprising the original four districts of Bungoma, Busia, Teso and Mt. Elgon, the depth and severity of food poverty using food expenditure per adult equivalent is presented in Figure 10.16. The figure also shows the contribution to the national poverty measures by each district. For example, in the Bungoma district its share of population expressed in adult equivalents was 3.7%, its share of population below poverty line was 3.7% and its share in the depth of poverty (income-gap ratio) was 4.1%. In general, if a region's contribution to the particular measure of poverty is larger than its population share, it implies that its poverty index is higher than the national mean.

**Figure 10.16: Rural food poverty (food poverty line = KShs. 988.00/month)**

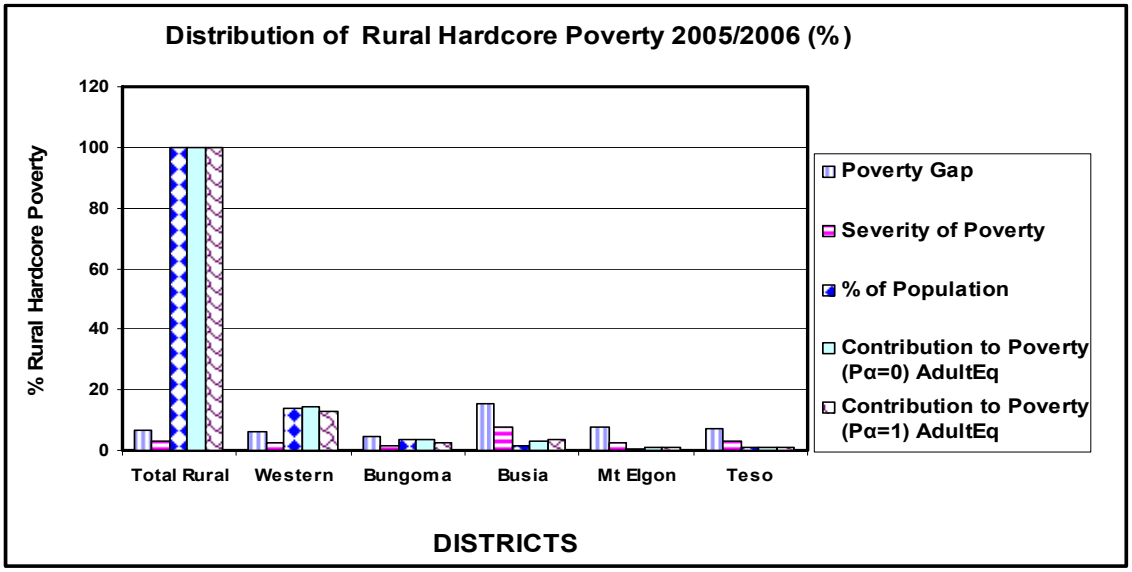



*Source: KIHBS 2005/06, Basic Report on Well-Being in Kenya*

### *b) Rural Hard Core Poverty*

An individual is defined as hard core poor if he/she has consumption levels that inadequate to meet basic food needs alone (even if he/she were able to forego all non food consumption). The total rural hardcore poverty was estimated at 21.9% while for the western province it was 23.2%. The total rural poverty gap was 6.9% while for the western province was 6.4%. The rural hard core poverty levels in the SMM catchment districts relative to national and provincial levels are presented in Figure 10.17.

**Figure 10.17: Rural hard core poverty (hard core poverty line = KSh. 988/month)**




*Source: KIHBS 2005/06, Basic Report on Well-Being in Kenya*

Nutritional status is the result of complex interactions between food consumption and the overall health care. Poor nutritional status is one of the most important health and welfare problems facing Kenya today and afflicts the most vulnerable groups, namely, women and children. At the individual level, inadequate or inappropriate feeding patterns lead to malnutrition. Numerous socioeconomic and cultural factors influence nutritional patterns.

Nutrition plays a pivotal role in optimal infant development. Poor breastfeeding and infant nutrition have adverse consequences, which in turn impacts mental and physical development of children. Breastfeeding is nearly universal in Kenya at 97%.. The median duration of breastfeeding is 20 months, similar to the duration documented in the 1993 and 1998 KDHSs.

The 2003 KDHS data indicate that supplementary feeding of children begins early. For example, among newborns less than two months of age, 45% are receiving supplementary foods or liquids other than water. The median duration of exclusive breastfeeding is estimated at less than one month. Bottle-feeding is common in Kenya; 27% of children under

six months are bottle fed. Nevertheless, use of infant formula milk is minimal; only 5% of children below six months receive commercially produced infant formula.

Survey data show that the nutritional status of children under five has improved only slightly in the past few years. At the national level, 30% of children under five are stunted (low height-for-age), while 6% of children are wasted (low weight-for-height) and 20% are underweight (low weight-for-age).

According to the Ministry of Health Performance Status Report 2003-2004, children with malnutrition ranged between 7% and 17%, and stunted growth was between 2.4% and 13.8% by province. Table 10.9 shows the percentage of children underweight, percentage with stunted growth, and percentage of malnutrition within the SMM catchment districts from 2002-2004.

| | 2002 | | | 2003 | | | 2004 | | |
|---|---|---|---|---|---|---|---|---|---|
| **District** | **Under - Weight** | **Total** | **%** | **Under weight** | **Total** | **%** | **Under weight** | **Total** | **%** |
| Bungoma | NR* | NR | **NR** | 6478 | 100,400 | **6.45** | 6501 | 107,301 | **6.06** |
| Busia | NR | NR | **NR** | 4613 | 73,512 | **6.28** | 7,292 | 113,602 | **6.42** |
| Mt. Elgon | NR | NR | **NR** | 425 | 16,663 | **2.55** | 919 | 26,447 | **3.47** |
| Teso | NR | NR | **NR** | 3111 | 36,678 | **8.48** | 4057 | 49,992 | **8.12** |
| **Percentage of children with stunted growth from 2002 – 2004** | | | | | | | | | |
| | **2002** | | | **2003** | | | **2004** | | |
| **District** | **Stunted** | **Total** | **%** | **Stunted** | **Total** | **%** | **Stunted** | **Total** | **%** |
| Bungoma | NR | NR | | 640 | 19026 | **3.4** | 912 | 22112 | **4.1** |
| Busia | NR | NR | | 448 | 31505 | **1.4** | 1267 | 39,808 | **3.2** |
| Mt. Elgon | 196 | 3632 | **5.4** | 53 | 3939 | **1.3** | 190 | 6385 | **3.0** |
| Teso | NR | NR | | 560 | 9119 | **6.1** | 890 | 7838 | **11.4** |
| **Percentage of children with malnutrition from 2002 – 2004** | | | | | | | | | |
| | **2002** | | | **2003** | | | **2004** | | |
| **District** | **Mal-nutrition** | **New Attendants** | **%** | **Malnutrition** | **New Attendants** | **%** | **Malnutrition** | **New Attendants** | **%** |
| Bungoma | NR | NR | NR | | | | | | |
| Busia | NR | NR | NR | 4329 | 19026 | **23** | 4721 | 22112 | **21** |
| Mt. Elgon | 310 | 3632 | **9** | 186 | 3939 | **5** | 636 | 6385 | **11** |
| Teso | NR | NR | **NR** | NR | NR | NR | 1787 | 7838 | **23** |

**Table 10.10: Percent underweight/malnourished children (2002-2004) –Kenya**

NR* indicates No Record; *Source: Ministry of Health, Report on the Performance Status, 2003/2004*

In Uganda the nutritional status, especially for children and women, is generally poor and has been identified as a major case of anaemia, protein energy deficiency, iodine deficiency disorders and Vitamin A disorders. Malnutrition places children at increased risk of illness and death, and it has been shown to impair mental development. Under the 2006 UDHS, one in three households was sampled for height and weight. The data were used to compute three summary indices of nutritional status: height-for-age; weight for-height; and weight-for-age. These three indices are expressed as standard deviations from the median for the international reference population recommended by the World Health Organization. Children who fall more than two standard deviations below (-2 SD) the reference median are regarded as undernourished, while those who fall more than three standard deviations below (-3 SD) the reference median are severely undernourished. Table 10.10 shows the nutritional status of children under the age of 5 in Eastern Uganda (Kapchorwa, Mbale, Pallisa, Sironko, Tororo, Kaberamaido, Katakwi, Kumi) and East Central Uganda (Bugiri, Busia, Iganga, Jinja, Kamuli, Mayuge).

**Table 10.11: Nutritional status of children (UDHS, 2006)**

**Percentage of children under five years classified as malnourished according to three indices: height-for-age, weight-for-height, and weight-for-age, by region, Uganda 2006**

| | **Height-for-age** | | **Weight-for-height** | | **Weight-for-age** | | Number of children |
|---|---|---|---|---|---|---|---|
| Region | % below – 3 SD | % below – 2 SD | % below – 3 SD | % below – 2 SD | % below – 3 SD | % below – 2 SD | |
| East Central | 8.2 | 30.3 | 1.8 | 9.3 | 7.0 | 27.1 | 308 |
| Eastern | 8.9 | 29.0 | 0.0 | 2.2 | 2.6 | 16.4 | 406 |

*SD – Standard deviation*

Children whose height-for-age is below minus two standard deviations from the median are considered stunted or short for their age. Stunting is the outcome of inadequate nutrition over an extended period and is also affected by chronic illness. Twenty nine to

thirty percent of children under five are short for their age; 8-9% are severely stunted. Children whose weight-for-height is below minus two standard deviations from the median are considered wasted or thin. Wasting represents inadequate nutrition immediately prior to the survey, and typically is the result of recent illness, especially diarrhoea, or of a rapid deterioration in food supplies. Within the Uganda SMM catchment, 2-9% of children were wasted at the time of the survey. Children whose weight-for-age is below minus two standard deviations from the median are considered underweight. This measure reflects the effects of both acute and chronic under-nutrition. Almost one in three children was underweight in the Bugiri and Busia districts.

The Tororo Maternal and Child Health Baseline Survey (1996) showed that: 44.4% of boys and 25% of girls under five were stunted, and 28.8% of boys and 21% of girls were underweight. The Buhehe Sub-county had the highest levels of stunting and underweight. According to the Busia State of Environment Report 2004/2005, rapid nutrition assessment showed Lunyo and Masaba Sub-counties have many cases of child malnutrition. The Buisa Health Department also reported that Protein Energy Malnutrition is among the leading causes of morbidity and mortality among children under age five.

## 10.3 Gender issues

### 10.3.1 Participation of women and youth in development activities

Gender refers to attitudes, characteristics, rites and values that are determined, shaped and perpetuated by society. Women's contribution in sustaining the economy is enormous. Women provide almost all the labor for the agricultural sector which is the backbone of the SMM area. Women also do most of the domestic chores. Many households are headed by females due to the high migration rates in search of employment.

Women form the bulk of small scale traders and they also organize groups to implement community programs and to generate income. Despite their contribution and their large number, women have not attained gender parity in decision making and resource control.

In the Bukusu and Tachoni culture (Bungoma district), women are to a great extent subordinates to men and therefore are dependent. Women have less decision making power

and lack access to information. Access and control of family resources is greatly biased in favor of men. The outcome of the gender analysis tool (Participatory Rural Appraisal) conducted by the government and NGO's revealed that men devote approximately 8 hours to work while women devote about 13.

The disparities in gender access to information have been identified as a major cause of slow economic growth in the districts. Gender imbalances should be addressed in projects and programmes that aim to boost productivity through family based initiatives.

In some areas, like in the Bungoma district, women groups organize with the micro-credit financial institutions to access loans to start income generating activities. These businesses include posho mills, retail, selling new clothes and horticulture. Some of the problems faced by women are lack of technical skills and knowledge. Most women need skills in record keeping, leaderships, marketing and entrepreneurship.

The rural youth participate in various activities, like cereal and horticulture farming, keeping poultry and small livestock, boda boda (taxis) business, tree nursery/agro-forestry, and HIV/AIDS campaigns through mobile theatres (poems, skits, walks), fish farming.

# 11.0 Trade, Industry, and Macro-economic Development

The chapter focuses on the formal and informal trading between Kenya and Uganda. Industries and commodities in the Sio-Malaba-Malakisi (SMM) catchment are also highlighted.

## 11.1 Trade

Within East Africa, Kenya and Uganda have healthy trading arrangements comprising both exports and imports. Table 11.1 shows Kenyan exports to and imports from Uganda for the period 2001 to 2005. Exports to Uganda grew at the rate of 65% annually from Kenya shillings 24.2 billion in 2000 to 42.5 billion in 2005. Major exports to Uganda include petroleum products, plastic articles, medicinal products, agricultural products, livestock products, fisheries products, non-agricultural household goods, farm inputs, wood and timber products, clothes, textiles and construction materials.

**Table 11.1: Exports and imports to and from Uganda, 2001 – 2005 ($x10^3$)**

| | **2001** | **2002** | **2003** | **2004** | **2005** |
|---|---|---|---|---|---|
| **EXPORTS ($)** | 30,040 | 31,280 | 30,668 | 37,059 | 42,545 |
| **IMPORTS ($)** | 683 | 664 | 1,038 | 1,009 | 1,389 |

*Source: CBS Economic Survey, 2006*

In the SMM catchment, there is continuous movement of goods across the Sio River, the Malaba River, and the Lwakhakha River. Transactions across the Eastern Uganda border not recorded by the Uganda authorities were estimated in the Informal Cross Border Trade (ICBT) Survey conducted from August 2004 to December 2005. Border post data from Busia, Malaba and Lwakhakha are considered representative of informal trade transactions of poor people

living near the borders. Plate 11.1 illustrates that informal trade commodities are transported mainly by cyclists and trucks.

**Plate 11.1: Informal cross border trade in Busia, Uganda-Kenya (UBOS, 2006)**

The study was designed to estimate unrecorded trade, including commodity types, trade patterns, net balance and gross contribution to international merchandise statistics. The study showed that among Uganda's neighbors, Kenya is the main informal trading partner with a total estimate of US$ 42.8 million and a trade surplus of US$ 16.7 million. Table 11.2 is a summary from the ICBT report 2006 and gives the informal trade by product category, export value, import value and Kenyan trade balance.

**Table 11.2: ICBT exports and imports by commodity type and value (2005)**

| **Commodity** | **Exports** | | **Imports** | |
|---|---|---|---|---|
| | Value US $ | % Share | Value US $ | % Share |
| **Maize** | 7,717,952 | 26.0 | 45,903 | 0.4 |
| **Beans** | 7,202,421 | 24.2 | 5,927 | 0.0 |
| **Sugar** | 103,151 | 0.3 | 199,311 | 1.5 |
| **Other grains** | 1,437,102 | 4.8 | 50,148 | 0.4 |

| | | | | |
|---|---|---|---|---|
| **Bananas** | 1,549,127 | 5.2 | 40,013 | 0.3 |
| **Other agricultural commodities** | 3,247,924 | 10.9 | 726,152 | 5.6 |
| **Fish** | 2,394,577 | 8.1 | 40,985 | 0.3 |
| **Industrial Products** | 6,037,230 | 20.3 | 11,904,547 | 91.3 |
| **Other Products** | 51,412 | 0.2 | 28,164 | 0.2 |
| **Total** | **29,740,896** | | **13,041,150** | |

The table shows that Uganda earned over US$ 29 million from informal exports from August 2004 to December 2005 and imported goods worth US$ 13 million. Although Uganda registered a surplus of agricultural exports to Kenya, it recorded a trade deficit of nearly US$ 6.0 million on industrial product imports. These findings reveal that Uganda has a comparative advantage in agricultural products exports. The commonly traded agricultural commodities were maize, beans, other grains, bananas and fish. However, the unofficial exports of maize and beans to Kenya have food security and policy implications. Studies (Ackello-Ogutu, 1997) have shown that despite the Ugandan production advantage, these food exports fetch low commodity prices at the border. Moreover, the eastern region districts often experienced food shortages during the off-season leading to starvation.

Exports and import data by border station and the corresponding values are shown in Table 11.3. Among the border posts monitored, Busia was the busiest with a percentage share of 42.7 percent and 45.3 percent for exports and imports, respectively, of all informal trade volume in Uganda. Most of the exported products through Busia were agricultural commodities like maize, beans, potatoes and millet.

**Table 11.3: Informal exports and imports by Uganda border stations**

| Station | Export Value | % Share | Import Value | % Share |
|---|---|---|---|---|
| **Busia** | 23,931,245 | 42.7 | 8,490,327 | 45.3 |
| **Malaba** | 4,346,699 | 7.8 | 3,719,971 | 19.9 |
| **Lwakhakha** | 620,880 | 1.1 | 395,518 | 2.1 |

During 2005, informal exports and imports were estimated at US$ 200.3 million and US$ 65.9 million, respectively. Meanwhile official/formal exports and imports were US $ 810.9 million and US $ 2.054 billion, respectively. Overall, the informal and formal export earnings combined generated US$ 1.01 billion compared to import expenditures of US$ 2.12 billion, resulting in a trade deficit of US$ 1.11 billion. In 2005, the informal trade sector recorded a surplus of US$ 134.4 million. Among Uganda's neighbours, Kenya was the main informal trading partner with a trade surplus of US $ 62.8 million. In comparative terms, informal exports to Kenya amounted to US$ 107.0 million compared to official exports of US$ 72.4 million.

## 11.2 Industry

In the SMM catchment, there are various industrial activities, but the full potential is not utilized. In the Bungoma district, industrial development t is low with major industries being those established in the 1970's. The two large industries are PanPaper Mills and Nzoia Sugar Company. PanPaper Mills is the only large scale pulp and paper factory in Kenya and is located in the Webuye Township of the Bungoma district. (Webuye is the headquarters of the newly created Bungoma East district). Other industrial activities include the British American Tobacco (BAT) and the Mastermind Processing Tobacco centers in Teso district, the Teso Sugar Company (jaggery), small coffee pulping factories, jaggeries, bakeries, and murram quarries for road construction. There are various small and medium scale enterprises (MSE) scattered throughout the districts such as furniture workshops, metal workshops, tailoring, and brick making which are run by individual entrepreneurs.

### 11.2.1 Contribution of industry to the economy

In the Bungoma district, the industry sector is the main income generator and employs a large section of the population. The existing agro-based industries, like Nzoia Sugar and Webuye PanPaper Mills, will continue to play an important role in the district's economy through continued employment and the use of local materials.

In addition to providing employment, the industrial sector provides revenue to the local Authority for local infrastructure development. Industry also creates farm incomes and ensures food security. This income enables parents to pay for education, health and other essential services. There are 51 urban and market areas in the Bungoma district that provide trade and businesses centers. A large number of licensed businesses provide a revenue base that can be used for further development of these centres.

The informal trade across the Ugandan border has flourished and has resulted in a wide range of goods and services in the area. The sector also allows traders to acquire credit and expand their businesses. The small scale industries or 'Jua Kali' are one of the most important sectors in SMM catchment.

# 12.0 Basin Development and Investment Strategy

The proposed Investment Strategy consists of eight strategic intervention measures designed to address the most critical water related socio-economic issues and challenges in the SMM catchment to ensure sustainable water resources management and development. These eight measures are based on a comprehensive analysis of the critical SMM water resources issues and were developed through a participatory stakeholder consultative process. It is envisioned that the Investment Strategy will be periodically reviewed to take into consideration other emerging issues and developments in the catchment.

The total cost of the proposed intervention measures is estimated at US$ 240 million. The proposed strategic intervention measures are discussed below:

## 12.1 Creation of an enabling environment

**Objective:** To create the necessary enabling environment for effective implementation of activities outlined in the SMM Investment Strategy by fast-tracking implementation of the proposed SMM Policy, Legal, and Institutional framework.

**Justification:** One of the main challenges to sustainable integrated water resources management and development in the SMM catchment is the lack of a comprehensive cooperative framework for the joint planning and implementation of water related development activities by communities in the two countries. Activities in the catchment are currently planned with a local or national focus without considering the catchment as one whole. The disjoint water resources planning and management processes have significantly contributed to the current degradation of the catchment and have resulted in conflicts between upstream and downstream water users. Further more, there is no formal mechanism for resolution of transboundary water resources issues and conflicts, which has fostered hostile relationships between some upstream and downstream communities in the two countries. For

example, the conflict over water pollution in the Malaba River in Uganda could have been addressed before it reached the current crisis level had there been a formal communication and negotiation mechanism through which stakeholders from Malaba-Kenya and Malaba-Uganda could come together to discuss the pollution issue and identify a satisfactory solution to address it.

It is against this background that Uganda and Kenya initiated the project on the development of a comprehensive Cooperative Framework for the sustainable management and development of the SMM water resources. Fast tracking the process of negotiation and implementation of the proposed SMM Policy, Legal, and Institutional Framework is therefore a key perquisite to the successful implementation of the development activities outlined in the SMM Investment Strategy. Among others, this process will involve the following steps:

(i) Formal negotiation and adoption of the SMM Policy, Legal, and Institutional Framework by the two countries; This framework is discussed in a separate project report;

(ii) Signing and ratification of the relevant legal instruments to give effect to the SMM Cooperation Framework;

(iii) Establishment of the necessary SMM policy organs;

(iv) Establishment of a fully functional SMM Secretariat (including recruitment of technical and support staff and procurement of necessary equipment).

**Specific Follow-up Actions:** It is recommended that the existing SMM PMU serves as the transitional entity to coordinate and facilitate the above process. This also implies that the current SMM policy organs will continue to give guidance to the process until the new SMM institutional arrangement comes into effect. Specifically, the above process could evolve as follows:

(i) The SMM PMU should circulate the SMM Policy, Legal, and Institutional Framework report to the two countries and shortly afterwards convene an RPSC meeting to discuss the final report recommendations and agree on the way forward.

(ii) It is therefore envisioned that the first milestone of the negotiation process will be consensus by the two governments on the preferred SMM Framework option based on the Consultant's recommendations. The two governments, through the relevant SMM and NELSAP organs, shall discuss the SMM Framework options proposed by the Consultant and agree on the most appropriate option to be adopted.

(iii) Following agreement on a specific SMM Framework option, the two governments shall submit a formal joint proposal outlining the main elements of the proposed Cooperative Framework to the appropriate regional entity (NBI or EAC) for consideration and approval.

(iv) The regional entity shall, upon approval of the proposal, authorize and guide the process for operationalization of the SMM Cooperative Framework, including the drafting, signing and ratification of the relevant legal instruments. The exact form that this process will take and the pace at which it will proceed will depend on the internal bureaucratic processes of the regional entity (EAC or NBI) in which the SMM Framework will be anchored.

(v) Upon signing and ratification of the necessary legal instruments, the two governments shall proceed to establish the necessary permanent SMM institutional organs.

## 12.2 Human and institutional capacity development

**Objective:** To strengthen the capacity for integrated water resources management and development in the SMM catchment through implementation of the proposed SMM Capacity Building Plan.

**Justification:** One of the key prerequisites for sustainable water resources management and development in the SMM catchment is availability of adequate technical and financial capacity to plan, implement, and monitor water resources management and development activities. Following a comprehensive situation analysis conducted as part of the study, it was discovered that most stakeholder groups at the national and local levels did not have adequate technical and financial capacity to effectively implement their mandates. The lack of adequate qualified and skilled personnel has significantly undermined the performance of both national

and local level institutions in both countries. This, coupled with inadequate facilities and equipment such as computers, vehicles, monitoring equipment, etc., and persistent financial constraints, has undermined the ability of most institutions to implement their mandates and has led to poor service delivery.

Effective implementation of the proposed SMM Investment Strategy will require institutions and stakeholders with adequate technical capacity, experience, and awareness of IWRM principles and practices. The need for a comprehensive SMM capacity building plan cannot, therefore, be overemphasized. Details of the proposed capacity building intervention measures are contained in the SMM Capacity Building Plan, which was developed as part of this study. The plan will therefore form the basis for implementation of this specific intervention measure.

## 12.3 Increase water supply and sanitation coverage

**Objective:** To ensure access to safe and reliable water supply and sanitation services for all SMM riparians through construction of appropriate water supply and sanitation facilities and establishment of effective operation and maintenance mechanisms and resources.

**Justification:** Provision of safe drinking water and basic sanitation is crucial to the preservation of human health, especially of children. Households with improved access to safe water and sanitation services suffer less morbidity and mortality from water-related diseases, spend less of their income on health related issues, and are more productive. Water-related diseases are the most common causes of illness and death among the poor rural communities in the SMM catchment. Diarrhoeal diseases (cholera & dysentery) are among the major killer diseases of young children, accounting for about 20% of all infant deaths. For example, data from a health survey conducted in Uganda in 2006 (UDHS, 2006) showed that 26% of the children under age five, reported severe diarrhoea. Similarly, in Kenya, water borne and water related diseases are among the top ten causes of outpatient morbidity (MoH, 2006).

Further more, access of girls and women to improved safe water and sanitation services would improve their educational and development opportunities, as this would safeguard their privacy, prolong their school enrolment, and relieve the burden of having to walk long distances to fetch water.

The current water supply and sanitation coverage in most SMM districts is low, especially in Uganda (Table 12.1). There is, therefore need for urgent investment in water supply and sanitation facilities in the catchment to reduce the current instances of water-related diseases and deaths. This intervention measure is in line with the national water sector objectives and targets in the two countries and will contribute towards the realization of the water and sanitation MDG targets in the two countries. This intervention measure will address both rural and urban water supply and sanitation needs.

**Table 12.1: Water supply and sanitation coverage in the SMM districts**

| District | Safe Water Coverage (%) | Sanitation Coverage (%) |
|---|---|---|
| Bududa | 45 | 43 |
| Manafwa | 42 | 43 |
| Tororo | 52 | 69 |
| Busia | 63 | 82 |
| Butaleja | 48 | 63 |
| Bugiri | 35 | 20 |
| Namutumba | 52 | 80 |
| Bungoma North | 92 | 72 |
| Mt. Elgon | 82 | 60 |
| Bungoma South | 93 | 70 |
| Teso | 81 | 80 |
| Bungoma East | 90 | 70 |
| Busia | 82 | 90 |
| Bungoma West | 93 | 70 |

## 12.4 Enhance household incomes

**Objective:** To increase household incomes through implementation of income generating activities identified, planned, implemented, and managed by the local communities themselves.

**Justification:** Most of the households in the SMM catchment depend on subsistence agriculture characterized by very low productivity and high labour intensity. This level of activity is inadequate to generate sufficient output to meet the basic needs of the households (shelter, food, water, health and education). This is reflected in the high poverty levels in the catchment (30% to 66%). As expected, local communities will do what they can to meet their

short term survival needs regardless if this is at the expense of the environment. There is, therefore, a critical need to support the local communities to diversify their economic activities and enhance their household income. This diversification will help relieve the pressure on the land and water resources and begin to reverse the environmental degradation.

This measure will include the following interventions:

i) Promotion of value addition to agricultural produce by supporting the establishment of rural based agro-processing industries;

ii) Reduction of post-harvest losses by supporting the establishment of appropriate post-harvest storage facilities;

iii) Increased access to markets by farmers by supporting the development of rural infrastructure that targets rural feeder roads and markets;

iv) Increased access to loan facilities for viable commercial agricultural activities by supporting stronger rural based micro-finance and credit facilities and facilitating the formation of cooperative and savings societies;

v) Promotion of non-agricultural income generating activities such as carpentry, poultry, bee keeping, and tourism.

## 12.5 Promote integrated and sustainable watershed management

**Objective:** To reverse the ongoing environmental degradation and restore the ecological integrity of the SMM catchment.

**Justification:** The SMM catchment is experiencing serious degradation of its water resources quantity and quality as a result of several reasons. These include the over-abstraction of surface water in some SMM regions, unsustainable land use changes, soil erosion, encroachment on river riparian lands and wetlands, flash floods of increasing intensity, increased sediment loads, and siltation of water courses and water storage facilities. In addition, poorly controlled effluent discharges from industry and sewage outfalls, and the

excessive nutrient and agrochemical pollution from non-point sources have negatively impacted surface water and groundwater resource quality.

The high population pressure in the SMM catchment has led to excessive land fragmentation and has pushed farming activities into marginal areas (i.e., steep hill slopes) that are more vulnerable to soil erosion and nutrient loss. In addition, there is increased encroachment of ecologically fragile areas such as wetlands, riverbanks, lake shores, and protected forests for farming purposes. As a result, the catchment is experiencing (a) increased soil erosion and sediment loads in rivers and lakes; (b) drying up of streams and rivers due to increased flush floods and reduction of base flow; (c) destruction of ecological biodiversity due to loss of habitat for flora and fauna.

The forests in the catchment are faced with extensive degradation due to illegal logging, charcoal burning, illegal settlements, and encroachment for agricultural activities. For example, in most of the lower SMM catchment, natural forests have been cleared to create open areas for agricultural and livestock grazing activities. Most forests in the Malaba and Mpologoma river catchment have been degraded and are now replaced by Phragmites and other grass types, bushes, and thickets.

This measure will include the following interventions:

(i) Reverse catchment degradation through implementation of a catchment-wide tree planting, agro-forestry, and river bank protection program.

(ii) Promote sustainable integrated water and land management through implementation of a catchment-wide soil and water conservation program.

(iii) Implementation of a catchment-wide wetlands mapping, classification, and conservation program.

(iv) Development of community-based wetlands management strategies and plans.

(v) Sensitisation of local communities on sustainable utilization and management of wetlands resources.

## 12.6 Enhance agricultural production

**Objective:** To increase agricultural production and ensure food security in the SMM catchment.

**Justification:** Agriculture is the major economic activity in the SMM catchment contributing about 70% of the total output and employing about 85% of the population. SMM agricultural activities are mostly rain fed. Farming systems are largely traditional, with very little small and large scale commercial farming. The traditional farming system is characterized by highly fragmented small size farms that are intensively cultivated through out the year, inadequate and improper use of fertilizers, and use of low yielding seed varieties that are prone to diseases and vulnerable to droughts.

This measure will include the following interventions:

(i) Sensitization, training, and adoption of good agricultural practices; and use of improved high-yielding crop varieties.

(ii) Promotion of small-scale supplementary irrigation through sensitisation, field training, and practical on-site demonstrations.

(iii) Increased access to agricultural extension and advisory services through strengthening of existing extension services.

(iv) Reduction of post-harvest losses through provision of technical and financial support for construction of appropriate community based storage facilities.

(v) Promotion of small-scale irrigation infrastructure through technical and financial support.

(vi) Promotion and training in the use of efficient water use irrigation technologies and methods.

(vii) Sensitization, training, and adoption of good livestock practices such as zero grazing, disease control, and keeping of disease resistant breeds.

(viii) Promotion of the establishment of rural based diary and beef processing industries, and skins, hides, and leather tanning industries.

(ix) Support of development of livestock water supply infrastructure such as Valley Dams and Tanks to control nomadism and the spread of cattle diseases.

## 12.7 Enhance fisheries management

**Objective:** To strengthen the fisheries sector and increase fish production and consumption in the SMM catchment.

**Justification:** Fishing is a major socio-economic activity and source of food and livelihood for communities living close to rivers and lakes. Over the years, fish resources in the lakes and rivers in the SMM catchment have declined as a result of the use of destructive fishing methods, destruction of breeding grounds along the shores, wetland drainage, water pollution, and over-fishing.

Aquaculture is not well developed in the SMM catchment despite its significant potential. It was vibrant in the 1940-1970s, but has stagnated mainly due to poor fish farming practices. Aquaculture presents a viable investment opportunity to boost the lucrative but declining fishery industry. It can also be used to intensify commercial trout farming in the catchment for the local tourist industry and export markets.

There are also high prospects for commercial trout farming in the Mt. Elgon districts both in Kenya and Uganda. A significant trout market exists in the hotel and tourism industries where trout is a delicacy and the most expensive fish available in East Africa.

This measure will include the following interventions:

(i) Promote aquaculture as an alternative source of income and protein through sensitisation, training, and provision of incentives to organized groups interested in engaging in aquaculture activities.

(ii) Support the development of a catchment-wide hatcheries development program to produce adequate fish fries to support the aquaculture industry.

(iii) Promote Trout Fisheries production as a delicacy and alternative source of income for the Mt. Elgon communities.

(iv) Support BMUs through training and sensitisation in sustainable fishing methods.

## 12.8 Strengthen water resources planning and management

**Objective:** To strengthen the water resources planning and management processes in the SMM catchment.

**Justification:** The water resources monitoring network in the SMM catchment has deteriorated and can no longer support adequate water resources assessments. Water resources monitoring has not been systematic over the years and consequently, the data available is not adequate to infer hydrological changes that have occurred in the recent past as a result of catchment degradation, pollution, and climate. This creates uncertainty in water resources planning and increases investment risks. Water resources data collection in the catchment is irregular and uncoordinated. The database is characterized by data gaps due to poor operation and maintenance of gauging stations by the relevant agencies.

Currently there is no formal mechanism for data sharing and information exchange between agencies in the two countries. This makes it difficult to carry out cooperative catchment-wide water resources assessments by agencies of the two countries. In addition, there is also a problem of incompatible data collection, processing, quality control, and storage procedures and standards. This makes it difficult to share and compare data collected in Uganda with that collected in Kenya. There are inadequate information and decision support tools and qualified stuff to engage in comprehensive water resources assessments.

This measure will include the following interventions:

(i) Rehabilitation and expansion of the water resources monitoring network (hydrometeorological, hydrogeological, and water quality).

(ii) Development of compatible water resources Databases, Management and Information Systems, and Decision Support Tools.

(iii) Development of uniform data collection, quality control, storage, analysis, and dissemination procedures, standards, and formats.

(iv) Support for groundwater, surface water, and water quality assessment and mapping, including assessments pertaining to climate and demand change.

(v) Establishment of an SMM Hydro-informatics Center to coordinate water resources data collection, processing, and analysis activities.

## 12.9 Proposed development programs and projects

Based on the above proposed strategic intervention measures, a number of projects will be formulated to address both transboundary and local water resources management and development issues. Care will be taken in developing these projects to ensure that they are consistent with the overall local and central government development plans in both countries, and that they complement other ongoing initiatives in the catchment to avoid duplication and wastage of resources. The project planning and development process will encourage the participation of all stakeholders to ensure ownership and the development of a shared vision.

A summary of the broad project themes and components is given in the matrix below.

**Table 12.2: Development projects**

| Component | Potential Project | Project Goal/Objective | Benefit/Impact | Estimated Project Cost (Million US$) |
|---|---|---|---|---|
| Creation of Enabling Environment | Support to SMM transitional Secretariat/PMU | Facilitate coordination of transitional activities of the SMM PMU. | Ensure continuity of SMM initiative pending formation of permanent SMM framework | 2.0 |
| | SMM Cooperative Framework Project | Support and facilitate the process of negotiation, consensus building, adoption and implementation of the proposed SMM Policy, Legal and Institutional Framework. | Permanent SMM Framework established as a basis for future cooperation on SMM issues. | 1.0 |
| Human and Institutional Capacity Building | SMM Capacity Building Project | Strengthen the human and institutional capacity of all SMM stakeholder institutions and groups to effectively participate in the management and development of the SMM water resources as per the proposed SMM Capacity Building, Stakeholder Participation, and Gender Mainstreaming Plans. | Increased efficiency of implementation of SMM water related activities with effective participation of all stakeholders. | 6.0 |

| | | | | | |
|---|---|---|---|---|---|
| Water Supply and Sanitation | SMM Rural Water Supply and Sanitation Project | (i)<br><br><br><br><br><br>(ii)<br><br><br>(iii)<br><br><br>(iv)<br><br><br><br><br><br>(v) | Increase access to potable water in rural communities through development of adequate water sources based on a demand driven approach and using appropriate technologies such as borehole drilling, protection of springs and wells, development of Gravity Flow Schemes, and construction of valley Dams and Tanks.<br>Increase access to improved sanitation services through construction of appropriate sanitation facilities in public areas such as schools, markets, hospitals, and barracks.<br>Increase rural household sanitation coverage through development and promotion of appropriate and affordable household sanitation technologies.<br>Promotion of local community participation in the operation and maintenance of rural water supply and sanitation facilities through provision of training and technical support to Private Operators, Water Services Providers, Water Users Associations and Sanitation Committees.<br>Sensitization of rural communities on household sanitation, hygiene, and public health. | Increased safe water and sanitation coverage.<br><br>Reduction in water related diseases and deaths.<br><br>Increased population productivity due to reduced disease burden and health related expenses.<br><br>Improved water quality due to reduction of pollution from improper sanitation facilities and practices.<br><br>Improved educational and development opportunities for girls and women by improving their privacy and enrollment in schools and relieving them of the burden of fetching water over long distances. | 40.0 |
| | SMM Urban Water Supply and Sanitation Project | (i)<br><br>(ii)<br><br><br>(iii)<br><br><br><br><br> | Increase access to potable water in urban areas through provision of adequate and reliable water supplies.<br>Increase access to improved sanitation in major towns through rehabilitation and expansion of existing sewerage systems and construction of new systems where they are lacking.<br>Promotion of private sector participation in the operation and maintenance of urban water supply and sewerage systems through provision of training and technical support to Private Operators and Water Services Providers. | | 70.0 |

| | | | | | |
|---|---|---|---|---|---|
| | SMM Urban Storm Water Drainage and Solid Waste Management Project | (i)<br><br><br>(ii)<br><br><br>(iii) | Improve storm water drainage in major towns through rehabilitation and construction of adequate storm water drainage systems.<br>Improve solid waste management in major towns through provision of adequate solid waste collection, management and disposal facilities.<br>Promotion of private sector participation in solid waste management through provision of training in appropriate technologies and technical support to private solid waste management services providers. | Reduction of urban flooding due to improved drainage.<br><br>Improved water quality due to reduction in pollution from improper solid waste disposal. | 40.0 |
| Catchment/Watershed Management | SMM Integrated Watershed Management Project | (i)<br><br><br>(ii) | Reverse catchment degradation through implementation of a catchment-wide tree planting, agro-forestry, and river bank protection program.<br>Promote sustainable integrated water and land management through implementation of a catchment-wide soil and water conservation program. | Improved water quality due to reduction in pollution from soil erosion.<br>Reduction in flash floods and land slides due to increased vegetation cover. | 8.0 |
| | SMM Wetlands Management Project | (i)<br><br>(ii)<br><br>(iii) | Implementation of a catchment-wide wetlands mapping, classification, and conservation program.<br>Development of community-based wetlands management strategies and plans.<br>Sensitization of local communities on sustainable utilization and management of wetlands resources. | Improved water quality and reduction in floods due to enhanced buffering capacity of wetlands.<br><br>Increased household income from sustainable exploitation of wetland products. | 2.5 |

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|---|---|---|---|---|
| House-hold Income Enhancement | SMM Integrated Rural Development Project | (i) Increase revenue from agricultural products through provision of technical and financial support for development of rural-based agro-processing industries.<br>(ii) Increase household incomes through provision of financial and technical support for implementation of community based income-generating projects (identified, planned, implemented and managed by communities themselves).<br>(iii) Increase access to markets for agricultural produce through improved rural road networks and market infrastructure.<br>(iv) Increase access to micro-finance credit services through sensitizing farmers on how to access and leverage these services to procure farm inputs and increase their production.<br>(v) Promotion and facilitation of formation of Cooperative Societies to enable farmers to jointly market their produce and avoid exploitation by middle men.<br>(vi) Promote rural electrification to support rural agro-processing industries through supporting feasibility studies for mini-hydropower schemes, expansion of the transmission grid, and assessment of the potential of other renewable sources of energy such as solar power, bio-gas, and wind. | Increased farm productivity and household income.<br><br>Reduction in pressure on the catchment's water and land resources due to alternative sources of income.<br><br>Increased employment opportunities due to establishment of rural based industries and financial institutions.<br><br>Better communication and rapid urbanization due to improved rural infrastructure. | 30.0 |
| | SMM Community-based Eco-tourism Project | Promote and support the development of eco-tourism in the catchment as an environmentally friendly alternative source of income to the local communities. | Increased household income and employment opportunities due to thriving tourism industry.<br>Reduction in pressure on the catchment water and land resources due to alternative sources of income. | 2.0 |

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|---|---|---|---|---|
| | SMM HIV/AIDS Control Project | Support a catchment-wide HIV/Aids control program through:<br>(i) Support HIV/Aids awareness campaigns to minimize new infections;<br>(ii) Strengthening Voluntary Counseling and Testing services (VCT);<br>(iii) Provision of free or subsidized Anti Retroviral (ARV) drugs to the HIV/Aids patients;<br>(iv) Support the development and adoption of policies that are against segregation of HIV/Aids victims in places of work and in local communities; and<br>(v) Support NGOs/CBOs that care for HIV/Aids orphans in the catchment. | Reduction in HIV infection rates in the catchment.<br><br>Improved livelihoods for HIV/AIDS patients and orphans in the catchment. | 1.5 |
| Enhanced Agricultural and Livestock Production | SMM Agricultural Development Project | Increase agricultural productivity through:<br>(i) Sensitization, training, and adoption of good agricultural practices; and use of improved high-yielding crop varieties.<br>(ii) Promotion of small-scale supplementary irrigation through sensitization, field training, and practical on-site demonstrations.<br>(iii) Increased access to agricultural extension and advisory services through strengthening of existing extension services.<br>(iv) Reduction of post-harvest losses through provision of technical and financial support for construction of appropriate community based storage facilities. | Increased farm productivity and household income.<br><br>Improved water quality due to reduction in pollution resulting from poor agricultural practices. | 8.0 |
| | SMM Small-holder Irrigation Development Project | (i) Promote and support the development of small-scale irrigation infrastructure through technical and financial support.<br>(ii) Promote the adoption and train in the use of efficient water use irrigation technologies and methods. | Increased water availability to downstream users due to adoption of efficient irrigation water use practices.<br>Increased farm productivity and household income. | 12.0 |

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|---|---|---|---|---|
| | SMM Livestock Development Project | Increase livestock production through:<br>(i) Sensitization, training and adoption of good livestock practices such as zero grazing, disease control, and keeping of disease resistant breeds.<br>(ii) Promote and facilitate the establishment of rural based diary and beef processing industries, and skins, hides, and leather tanning industries.<br>(iii) Support the development of livestock water supply infrastructure such as Valley dams and Tanks to control nomadism and spread of cattle diseases. | Increased household income and protein uptake due to increased livestock production.<br><br>Increased employment opportunities due to thriving livestock industry. | 5.0 |
| Sustainable Fisheries Management | SMM Fisheries Management Project | (i) Promote aquaculture as an alternative source of income and fisheries source through sensitization, training and provision of incentives to organized groups interested in engaging in aquaculture activities.<br>(ii) Support the development of a catchment-wide Hatcheries development program to produce adequate fish fries to support the aquaculture industry in the catchment.<br>(iii) Promote Trout Fisheries production as a delicacy and alternative source of income for the Mt. Elgon communities.<br>(iv) Support BMUs through training and sensitization in sustainable fishing methods. | Increased household income and protein uptake due to increased fisheries production.<br><br>Increased employment opportunities due to thriving fisheries industry. | 6.0 |

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|---|---|---|---|---|---|
| Water Resources Monitoring and Assessment | SMM Water Resources Monitoring and Assessment Project | (i)<br><br><br>(ii)<br><br><br>(iii)<br><br><br>(iv)<br><br>(v) | Rehabilitation and expansion of the water resources monitoring network (hydrometeorological, hydrogeological, and water quality).<br>Development of compatible water resources Databases, Management Information Systems and Decision Support Tools.<br>Development of uniform data collection, quality control, storage, analysis, and dissemination procedures, standards and formats.<br>Undertake groundwater, surface water, and water quality assessment and mapping.<br>Establishment of an SMM Hydroinformatics Center to coordinate water resources data collection, processing, and analysis activities. | Improved and efficient water resources planning, management and development based on adequate and reliable data and information | 5.0 |
| | SMM Climate Change Assessment Project | (i)<br><br>(ii)<br><br>(iii) | Assessment of the vulnerability of the SMM water resources to climate and demand change;<br>Assessment of current and future climate change impacts on the water resources of the SMM catchment;<br>Recommendation of potential SMM mitigation and adaptation measures to climate and demand change. | Sustainable management and development of the SMM water resources. | 1.0 |
| **TOTAL** | | | | | **240.0** |

Several specific projects that fall under the above project themes have also been identified during the stakeholder consultative process. The titles and estimated costs of these projects are listed in Table 12.3. A detailed description of these projects can be found in the Investment Strategy Report.

**Table 12.3: Specific development projects**

| COMPONENT | PROJECT TITLE | ESTIMATED COST ($ Mill.) |
|---|---|---|
| Water Supply and Sanitation | **Project 1:** Water Supply for Kapsakwony Town and Kaptama Trading Centres in Mt.Elgon District | 3.0 |
| | **Project 2:** Rehabilitation and Extension of Chesikaki Water Supply | 1.0 |
| | **Project 3:** Extension of Old Kibichori Water Supply | 0.5 |
| | **Project 4:** Rehabilitation and Extension of Tororo Gravity Flow Scheme | 3.5 |
| | **Project 5:** SMM Urban Sanitation Project | 18.0 |
| | **Project 5b:** Namutumba Water Supply Project | 4.0 |
| | **Project 6:** SMM Rural Water Supply and Sanitation Project | 50.0 |
| | **Project 7: :** Water Supply for Butaleja Town Council | 2.0 |
| | **Sub-total** | **82.0** |
| Enhanced Agricultural Production | **Project 8:** Busia Irrigation and Drainage Project | 2.0 |
| | **Project 9:** Chesikaki Irrigation and Drainage Project | 0.2 |
| | **Project 10:** Strengthening of Extension Services in the SMM Catchment | 2.0 |
| | **Project 11:** Mt.Elgon Trout Fisheries Development Project | 0.5 |
| | **Project 12:** SMM Aquaculture Development Project | 2.0 |
| | **Project 13:** Enhancement of Fisheries Productivity in SMM Water Bodies | 2.5 |
| | **Project 14:** SMM Fish Hatchery Development Project | 10.0 |
| | **Project 15:** Rehabilitation of Doho Rice Irrigation and Drainage Project in Butaleja Dictrict | 2.5 |
| | **Sub-total** | **21.7** |
| Integrated Watershed Management | **Project 16:** SMM Afforestation Project | 10.0 |
| | **Project 17:** SMM Soil and Water Conservation Project | 8.0 |
| | **Project 18:**SMM Wetlands Conservation and Management Project | 5.0 |
| | **Project 19:** Strengthening the SMM Water Resources Monitoring Network | 0.5 |
| | **Project 20:** SMM Water Resources Assessment Project | 5.0 |
| | **Project 21:** SMM Flood Control and Early Warning Project | 10.0 |
| | **Project 22:** Bugiri Water Resources Mgt. Project | 10.0 |
| | **Sub-total** | **48.5** |
| | **TOTAL** | **152.2** |

## 12.10 Implementation strategy

### 12.10.1 Project planning and development

Given the broad scope of the proposed intervention measures and the significant financial resources required for their implementation, projects under the SMM Investment Strategy are likely to span a long time period. Furthermore, though comprehensive, the Strategy is not intended to provide an exhaustive list of all possible development projects in the catchment. Rather, the Investment Strategy provides a broad conceptual framework for planning and development of investment projects. Planning, prioritization, and development of final area specific investment projects will be carried out in a participatory manner following a "bottom-up" approach. To the extent possible, the existing national and local government planning processes will be used to ensure effective stakeholder participation in the project identification and development process. This process is envisioned to involve the following steps:

(i) **Local Government/District Level Planning Process** – The local governments, with facilitation from the SMM Secretariat and National level agencies, will be responsible for identification and prioritization of water related development activities in their areas of jurisdiction. This process will involve extensive consultation and participation of all key stakeholders in the districts including NGOs/CBOs, women and youth groups, religious organizations, media, and local communities. Proposals from all district level stakeholders will be synthesized into a consolidated and prioritized SMM development strategy for the district.

(ii) **National Level Planning Process** – The District SMM development strategies will subsequently be discussed and further prioritized at the national level to ensure consistency with overall government development plans for the different sectors. To facilitate the national level discussions, a National Working Group (NWG) will be established in both countries comprising of representatives from districts and relevant national agencies. The NWG, with facilitation from the SMM Secretariat, will review and synthesize the district level inputs into an SMM National Development Strategy.

(iii) **Catchment-wide Planning Process** – The two SMM National Development Strategies will then be discussed, harmonized, and prioritized by a Catchment Working Group (CWG) into an SMM Development/Investment Strategy, which will then be submitted to the relevant SMM Policy organs (SMM TAC and COM) for approval and subsequent implementation. The CWG will comprise of representatives from different stakeholder agencies seconded by their respective governments (i.e., National Agencies, Local Governments, NGOs, Educational Institutions, Private Sector, and possibly other entities).

### 12.10.2 Project implementation process

Recognizing that all required funds may not be immediately available, the activities will be prioritized to begin with those that are most likely to have quick and critical catchment impact. The plan will therefore be implemented in phases, with the scope of activities in each phase determined according to the available financial resources. Table 12.4 shows a potential implementation phasing of the intervention measures.

The projects will be divided into two broad categories, i.e., nationally implemented projects and regionally implemented projects.

**(1) Nationally Implemented Projects**

In order to avoid duplication, projects that have already been identified as part of the national and local government development programs shall be implemented at that level and shall not be part of the regional project portfolio. The projects will be planned, funded, and implemented through existing national and bilateral funding mechanisms in the two countries. Projects that are part of the investment strategy but will be implemented under the existing national and local government development programs include:

(i) The rural water supply and sanitation projects;

(ii) The urban water supply and sanitation projects;

(iii) The urban storm water drainage and solid waste management projects;

(iv) The small-holder irrigation development projects;

(v) The livestock development projects; and

(vi) SMM Integrated Rural Development Project.

The main reason why the above projects have been included in the SMM Investment Strategy is to highlight their importance for the sustainable and integrated management of the catchment, and to build a case for their urgent prioritization by the two countries and potential development partners under the existing bilateral funding mechanisms.

**(2) Regionally Implemented Projects**

Regionally implemented projects will comprise of the following types:

(i) Projects of transboundary nature which should be undertaken *concurrently* by both countries in order to ensure that critical transboundary issues (such as pollution, soil erosion, and others) are addressed; and/or

(ii) Projects that may not be transboundary in nature but which are deemed to be critical for the entire or significant part of the catchment (because of their widespread impacts), and the implementation of which at a regional level would be more efficient and effective due to economies of scale.

The regionally implemented projects will include the following:

(i) Support to SMM transitional Secretariat/PMU;

(ii) SMM Cooperative Framework Project;

(iii) SMM Capacity Building Project;

(iv) SMM Water Resources Monitoring and Assessment Project;

(v) SMM Integrated Watershed Management Project;

(vi) SMM Climate Change Assessment Project;

(vii) SMM Wetlands Management Project;

(viii) SMM Community-based Eco-tourism Project;

(ix) SMM Fisheries Management Project.

Planning and implementation of the regional projects will be undertaken jointly by stakeholders from the two countries. Activities under these projects will be implemented concurrently in the two countries under the coordination of a regional project management unit (SMM Secretariat).

### 12.10.3 Implementation roles and responsibilities

**(a) Regional Level**

**SMM Policy Organs** will be responsible for provision of overall policy guidance for implementation of the planned projects; review and approval of the planned projects; mobilization of the required financial resources; and overall monitoring and evaluation of the performance of the SMM projects.

**SMM Secretariat** will be responsible for ensuring the effective and timely implementation of the directives of the SMM policy organs; coordination of mobilization, disbursement and accountability for financial resources; coordination of project monitoring and evaluation; coordination of timely preparation and submission of project work plans, budgets and reports; collection and dissemination of relevant data and information to different stakeholder groups; coordination of regional training and capacity building activities; and facilitation of regional meetings and workshops.

**(b) National Level**

At national level, several ministries, line departments, and non-governmental organizations will be involved in the planning and implementation of different thematic SMM projects as follows:

(i) **Ministries of Finance** will play a lead role in the mobilization, budgeting and allocation of funds to different sectors and will also coordinate donor inputs (through budget support). The Ministries will also ensure that SMM project expenditures conform to the overall national medium-term expenditure frameworks of the respective governments.

(ii) **Ministries Responsible for Water** will have the overall responsibility for setting national policies and standards, and priorities for water resources management and development. They will ensure that all the planned SMM water resources management and development projects are consistent with the national priorities and development objectives. They will also coordinate and liaise with other sector agencies (Ministries responsible for Agriculture, Health, Tourism, among others) in the implementation of cross-sectoral activities in the SMM catchment.

(iii) **National Water Supply and Sanitation Agencies** – In Uganda, the Directorate of Water Development (DWD) is the lead agency responsible for coordinating and regulating all water supply and sanitation activities and providing support services to local Governments and other service providers. DWD will offer technical support and guidance to the SMM districts in the implementation of water supply and sanitation projects in rural areas, small towns, and rural growth centers. The National Water and Sewerage Corporation (NWSC) will play a lead role in the rehabilitation of existing water supplies, construction of new water supplies, and operation and maintenance of all water and sewerage services in the major towns in the Ugandan part of the SMM catchment.

In Kenya, the Lake Victoria North Water Service Board is the lead agency responsible for water supply in the SMM Kenyan districts. The Board will contract independent water service providers to provide water and sanitation services to specific areas in the SMM catchment. The water service providers shall be autonomous bodies such as water companies formed by the Local Authorities as Public or Private companies. In cases where competent Water Service Providers are not available or the production of bulk water supply through state schemes is limited, the National Water Conservation and Pipeline Corporation will act as a fall back organization.

(iv) **Water Resources Management Agencies** – In Kenya, the Water Resources Management Authority (WRMA) is responsible for the sustainable management of the country's water resources. Therefore, WRMA will be the lead agency in the implementation of all water resources management project activities in the Kenyan part of the SMM catchment. The Catchment Area Advisory Committee for the Lake Victoria North Catchment Area will

play a key advisory role in all project activities related to conservation, use, and allocation of water resources in the SMM catchment. At the local level, Water Resources Users Associations (WRUAs) will play a major role in all project activities related to the management and utilization of the water resources within their localities. The WRUAs will also serve as fora for resolution of conflicts arising from competing water uses in their localities.

In Uganda, the Directorate of Water Resources Management (DWRM) is the lead agency responsible for water resources management. DWRM will play a lead role in the implementation of all water resources management project activities in the Ugandan part of the SMM catchment.

**(c) Local Level**

At the local level, local governments, NGOs, CBOs, several special interest groups, and local communities will be involved in the planning and implementation of different SMM projects as follows:

(i) **Local Governments –** In Uganda, districts are empowered by the Local Governments Act (1997) to take responsibility for the provision of water supply and sanitation services. They receive grant funding from the central government and also mobilize local resources for implementing rural WSS programs and to support small town WSS. District Water and Sanitation Committees (DWSC) will oversee and provide effective coordination of water sector activities in the respective SMM Local Governments.

(ii) **Private Sector –** Private Sector firms will undertake design and construction of water supply infrastructure under contract to local and central government. Private hand pump mechanics and scheme attendants will provide maintenance services to water users in rural and peri-urban areas. Private operators will manage piped water services in the majority of small towns with piped water.

(iii) **NGOs and CBOs -** Non-Government Organizations (NGOs) and Community Based Organizations (CBOs) will be actively involved in the provision of water and sanitation services through construction of facilities, community mobilization, training of

communities and local Governments, hygiene promotion, as well as advocacy and lobbying.

(iv) **Local Communities –** The beneficiary communities will be responsible for demanding improved water supply and sanitation services from their leaders. They will also be actively involved in the planning, implementation, and management of community water supply and sanitation facilities. Local communities will also be required to make cash and in-kind contributions (land, labor, and materials, among others) towards implementation of water and sanitation projects in their areas to ensure ownership and collective responsibility. Upon construction of a water source, a Water Users Committee (WUC) will be established to take responsibility for its operation and maintenance.

**Table 12.4: Phased implementation of investment plan**

| PROJECT | PHASE 1 (2009-2010) | PHASE 2 (2011-2015) | PHASE 3 (2016-2020) |
|---|---|---|---|
| Support to SMM transitional Secretariat/PMU | | | |
| SMM Cooperative Framework Project | | | |
| SMM Capacity Building Project | | | |
| SMM Rural Water Supply and Sanitation Project | | | |
| SMM Urban Water Supply and Sanitation Project | | | |
| SMM Urban Storm Water Drainage and Solid Waste Management Project | | | |
| SMM Integrated Watershed Management Project | | | |
| SMM Wetlands Management Project | | | |
| SMM Integrated Rural Development Project | | | |
| SMM Community-based Eco-tourism Project | | | |
| SMM Agricultural Development Project | | | |
| SMM Small-holder Irrigation Development Project | | | |
| SMM Livestock Development Project | | | |
| SMM Fisheries Management Project | | | |
| SMM Water Resources Monitoring and Assessment Project | | | |

Phase 1 of the Investment Strategy is aimed at establishing the necessary enabling environment (Policy, Legal, and Institutional Framework) and capacity for implementation of the investment projects. It is envisioned that the proposed SMM Policy, Legal, and Institutional Framework will be discussed, negotiated, and implemented during Phase 1. Implementation of the proposed SMM Capacity Building Plan will also commence during the same phase, and, depending on availability of financial resources, feasibility studies for the investment projects will also be undertaken. Results of the feasibility studies will be helpful in mobilizing the necessary financial resources for implementation of the investment projects. It is also recommended that the SMM Water Resources Monitoring and Assessment Project commences during Phase 1 to ensure availability of adequate and reliable data for effective planning, design, and implementation of the investment projects of subsequent phases.

Phases 2 and 3 of the Strategy will be focused on implementation of the investment projects. It is assumed that the funds for implementation of Phase 2 activities will be secured during Phase 1 and those for implementation of Phase 3 activities will be secured during Phase 2. It is also envisioned that all relevant organs of the permanent SMM Institutional Framework, including the SMM Trust Fund, will have been established by the end of Phase 1.

### 12.10.4 Mobilization of financial resources

The mobilization of the required financial resources to implement the Investment Strategy will be a major undertaking. It is envisioned that the established NBI fundraising mechanisms will be used in raising the required financial resources. Sources of funding will include development partners as well as contributions from the beneficiary countries.

Mobilization of financial resources for implementation of Phase 1 transboundary activities should commence as soon as possible to ensure timely activity implementation. The SMM PMU/NEL CU will coordinate with the governments of Kenya and Uganda in mobilizing financial resources necessary for Phase 1 pending establishment of the permanent SMM Institutional Framework. The PMU should approach current development partners under the NBI/NELSAP framework to solicit additional financial support to supplement government inputs.

**Existing funding mechanisms**

Most of the central and local government institutions in both countries depend on government appropriations to fund their activities. Government appropriations are usually inadequate due to limited revenues and several competing needs in other sectors.

The LGs/LAs have very low local revenues the collection of which is inefficient and is mainly done in the second half of the financial year. Hence, activities planned for implementation in the first half of the year are hardly executed. The major cause of this problem is the general poverty in the community, negative attitudes of taxpayers, and political interference. In addition, central government transfers are inadequate, pegged to specific activities, and are not released on time thus impacting negatively on planning and implementation of activities in the LGs/LAs.

Community contributions to support the water sector cannot be over emphasized since a major source of finance is envisaged to be the fees for services rendered. Further, contributions can be in the form of provision of labor, land for construction of water tanks, time, and other resources which can help to improve the linkage between the ministry, water sector regulators, and water service providers. As such, increasing the involvement of the community in this process is critical to the success of water sector reforms, especially in urban slums and rural areas.

The private sector also has an important role to play, especially in improving efficiency, strengthening commercial discipline through competition and autonomy of management, and gradually raising equity financing to help deliver services to underserved areas.

***Uganda:***

The Poverty Eradication Action Plan (PEAP) is the overall national planning framework aimed at guiding public action to eradicate poverty. Thus, all the sectors of government have to develop their detailed plans within the framework of PEAP. In line with the PEAP objectives, the Ministry of Finance sets up a Medium Term Expenditure Framework (MTEF) within which the budgets of all sectors are developed. The MTEF sets budget ceilings for funding to all sectors of the economy. Besides water sector funds directly channelled through the MWE, additional funding is channelled through the Ministry of Education for school sanitation, and the Ministry of Health for hygiene and sanitation, as well as local government development program funds

used for water and sanitation. Additional resources are invested directly in the sector by some bilateral agencies, the private sector, and NGOs without going through central government. Money from NGOs mainly goes directly to communities, although some funds may be channelled through the district. Examples of such funds are those from Water Aid, SNV, and Lutheran World Federation.

The water sector in Uganda, being one of the key priority sectors, has benefited significantly from the Poverty Action Fund (PAF) to which government has committed significant resources for the Poverty Eradication Action Program (PEAP). Despite significant increase in government's funding for the water sector activities over the past ten years, the sector is still heavily dependent on donor funding. For example in the FY 2005/2006, budget allocations by GoU and donors were 29% and 71% respectively. The key development partners in the water sector include DANIDA, World Bank, EU, France (AFD), Germany (GTZ/KFW), Austria, SIDA, UNICEF, DfID, the Netherlands, and Japan (JICA). Donors base their funding decisions on PEAP objectives and use funding mechanisms preferred and set by government most preferably general budget support, budget support earmarked for the Poverty Action Fund, sector budget support, basket funding, and project aid.

Government is committed to funding most of the sector activities through locally generated resources as the economy improves. Under the Sector Wide Approach (SWAP) framework, government and most development partners have agreed to finance the water sector through general budget support. This funding mechanism gives government a high degree of flexibility in allocating both local and donor financial resources according to the national priorities and development objectives. Whilst the SWAP framework does not explicitly stipulate financing through budget support, the current funding trends show that the primary instrument for sector financing over the medium and long-term will be budget support directly to the local governments as conditional grants for implementation of specific water supply and sanitation activities.

***Rural Water Supply and Sanitation Sub-sector*** - Funding for rural water supply and sanitation activities is provided to the local governments by the central government as unconditional, conditional, and equalization grants. The unconditional grants cater for the local government

staff salaries and operational costs, while the conditional grants are for the actual delivery of water supply and sanitation services agreed upon between the different local governments and the sector ministry (MWLE). The equalization grants are special funds meant for the least developed local governments, with inadequate revenue sources and where service levels are still very low. Based on the experience from the above funding mechanism, the government has developed a Fiscal Decentralization Strategy (FDS) aimed at streamlining the transfer of funds to the local governments using two systems: (1) Recurrent Transfer System (RTS) for recurrent expenditures, and (2) a Development Transfer System (DTS) for all development activities.

The sector guidelines for the conditional grant now recommend up to 10% of the grant to be used for sanitation and hygiene education.

***Urban Water Supply and Sanitation Sub-sector*** – Funding for the small towns water supply and sanitation development activities is still project based, though the central government provides the local governments with conditional grants for operation and maintenance of the systems. Government is also in the process of establishing a joint small towns development funding mechanism, where all government and donor funds are pooled for the development of all the small towns water supply and sanitation systems in the country. In the long-term, funding for small towns water supply and sanitation development activities will be made available through budget support. The development funds for large towns are channelled directly to NWSC as government loans or grants.

***Water Resources Management Sub-sector*** – Funding for water resources management activities is program based channelled directly as support to the sub-sector. However, there are still a few project based funding arrangements (e.g., LVEMP, MLKF, and NBWRP), which are expected to phase out as the program based funding takes root. Though the Directorate of Water Resources Management charges water user fees, these funds are remitted to the national treasury and cannot be used directly to finance water resources management activities.

***Water for Production Sub-sector*** – The government through annual recurrent and development budget allocations by the Ministry of Finance wholly funds activities under the water for production sub-sector.

***Kenya:***

Water supply and sanitation activities in Kenya are financed through the Water Services Trust Fund. The main sources of funds for the Trust Fund are government budgetary appropriations, through the National Parliament, and from development partners such as the World Bank, JICA, UNICEF, DFID, KFW, SIDA, ADF and DANIDA. The Trust Fund is managed by a Board of Trustees.

Under this framework, local communities develop water supply and sanitation project proposals with the assistance of a Support Organization (SO) and forward their project proposals through the relevant Water Service Board to the WSTF.

The Government is also financing urban water supply and sanitation development through a state corporation "the National Water Conservation and Pipeline Corporation (NWC&PC)". The role of the National Water Conservation and Pipeline Corporation is the development and supply of bulk water resources. The corporation is also the reserve operator of water supply systems as part of government social obligations.

Water resources management activities are supposed to be funded through revenues generated by WRMA through charging water user fees. Currently, due to the small number of registered water users, the revenue generated from water user fees is not sufficient to fund all WRMA activities. This also affects the operations of the catchment and sub-catchment offices.

Strategies for mobilizing extra-budgetary resources have been proposed in the Water Sector Strategic Plan. These include a coordinated approach to external sourcing of funds, especially from development partners; and the development of innovative funding strategies, including promotion of enhanced investment by the private sector, sensitizing citizens on the need to pay for water services, and improving revenue collection.

***Funding for regional projects:***

Funds for implementation of regional projects are often jointly mobilized by the participating countries and usually include contributions from the beneficiary countries, to meet the recurrent expenditures, and a significant contribution from external support agencies in the form of grants

or loans to finance development projects. Infrastructure development projects are often funded using loans whereas environmental/natural resources management projects are often funded through grants. Resources mobilization is usually coordinated by the regional entity under whose auspices the project was conceived, e.g., EAC, LVFO, LVBC, NBI, UN-HABITAT, FAO, and other organizations.

Some of these regional entities have established specific Trust Funds to administer funds for implementation of regional initiatives. Examples of such Trust Funds include the Nile Basin Trust Fund, for implementation of projects under the NBI, the proposed Mt. Elgon Trust Fund and the Lake Victoria Trust Fund and Development Fund. Under this funding mechanism, projects are jointly prepared and implemented by the beneficiary countries using the regionally sourced funds.

If the countries decide to anchor the SMM cooperative framework under the LVBC/EAC then resources for implementation of the SMM regional projects will be mobilized as part of the overall Lake Victoria recurrent and development funds. These funds will be managed through the two proposed Lake Victoria funds, i.e., the Lake Victoria Trust Fund for management of the recurrent funds and the Lake Victoria Development Fund for management of the development funds. In addition, since the upstream part of the SMM is part of the Mt. Elgon ecosystem, some of the SMM activities in these areas will benefit from funds from the proposed Mt. Elgon Trust Fund. Furthermore, since the SMM catchment is part of the Nile Basin, part of the funds for implementation of the SMM activities will also come from the Nile Basin Trust Fund based on a memorandum of understanding with the LVBC.

On the contrary, if the countries choose to anchor the SMM cooperative framework under the NBI, then most of the funding for the SMM regional projects will be mobilized as part of the overall Nile Basin development funds which will be administered through the existing Nile Basin Trust Fund.

### 12.10.5 Coordination mechanism

SMM stakeholder agencies will be responsible for implementation of the proposed activities as an integral part of their existing development programs. The role of the SMM PMU/Secretariat

will be to coordinate and facilitate the different stakeholder agencies in implementation of the activities.

Overall oversight for implementation of Phase 1 activities will be provided by the existing SMM/NELSAP policy organs (RPSCs, NELTAC, and NELCOM) pending establishment of the permanent SMM Institutional Framework. Oversight for Phase 2 and 3 activities will be provided by the relevant policy organs established under the permanent SMM Institutional Framework. Reporting on the progress of implementation of Phase 1 activities will be undertaken as part of the routine reporting that the SMM Secretariat/PMU conducts to the relevant SMM Policy organs. Reporting on the progress of implementation of Phase 2 and 3 activities will be undertaken in accordance to the reporting guidelines established under the permanent SMM Institutional Framework.

### 12.10.6 Monitoring and evaluation

Monitoring and evaluation of Phase I activity progress will be undertaken as per the existing SMM/NELSAP project monitoring and evaluation guidelines. Monitoring and evaluation of Phase 2 and 3 activities will be undertaken in accordance to the guidelines that will be established by the permanent SMM Institutional Framework.

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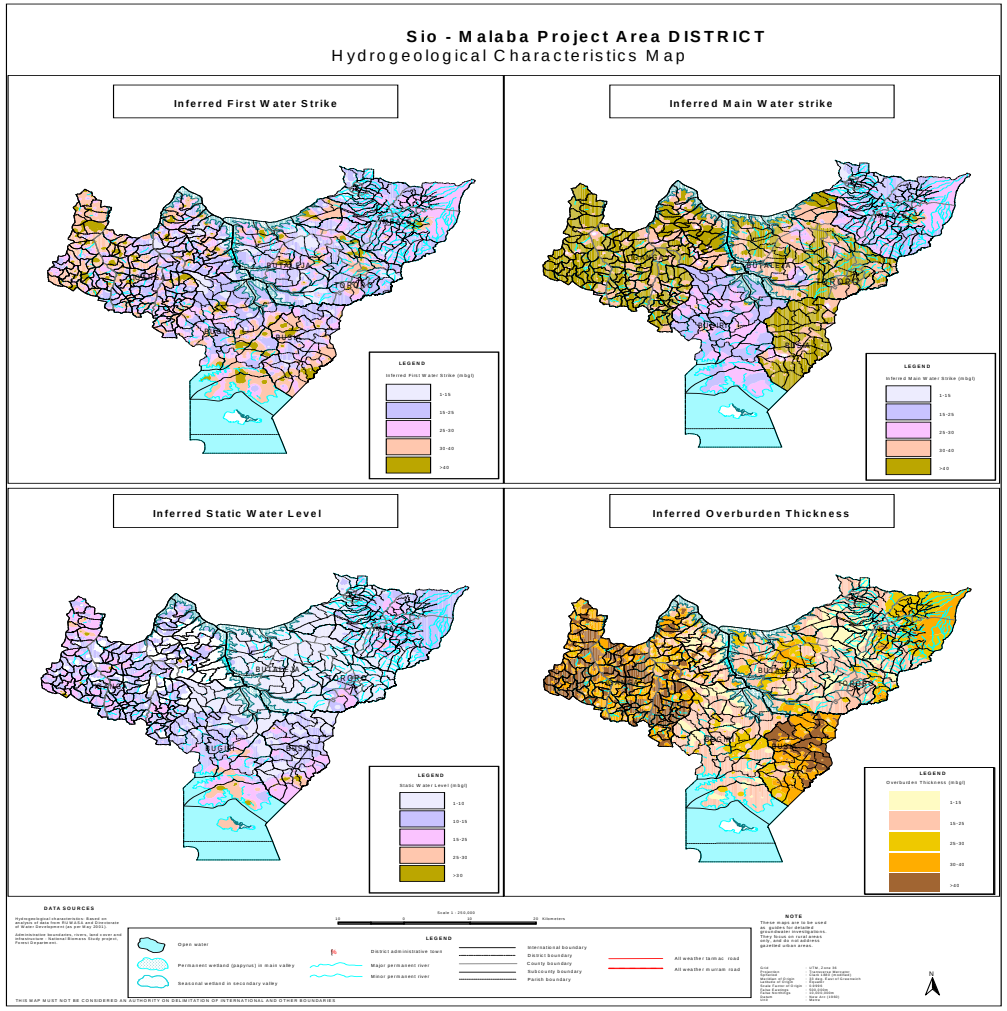
# Appendices

# Appendix 1: Geological Characteristics Map - Uganda



# Appendix 2: Urban and Rural Water Supplies in SMM Districts-Kenya

| URBAN AREAS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DISTRICT** | **Water supply Name** | **Structure Type** | **Year started** | **Completion year** | **Funding Agency** | **Cost at Inception (KShs.)** | **Actual cost (KShs.)** | **Average system production,($m^3$/day)** | **Typical population served (2006)** | **Typical water per capita consumption, (l/p/day)** | **Non Domestic Demand %** | **Typical UFW(%)** | **Design life(yrs)** | **Status (2006)** |
| **Bungoma** | Bungoma w/s | | | | | | | 2,045 | 50,000 | 40.9 | | 59 | 20 | |
| | Kimilili w/s | | | | | | | 2,241 | 30,000 | 74.7 | | 63 | 20 | |
| | | | | | | | | | | | | | | |
| **Busia** | Busia Mundika w/s | Government River | 1979 | 1986 | MWI/ FINNIDA | 17,000,000 | 10,050,000 | 1508 | 18000 | 83.8 | | | 20 | |
| | Nambale w/s | Government Borehole | 1953 | | FINNIDA MOW 1/LA | 1,000,000 | 12,400,000 | 256 | 7000 | 36.6 | | | 20 | Operational |
| | | | | | | | | | | | | | | |
| **Mt. Elgon** | Elgon East w/s | | | | | | | | 10,000 | | | | 20 | |
| | | | | | | | | | | | | | | |
| **Teso** | Malaba Kocholia w/s | | | | | | | | 20,000 | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| **RURAL AREAS** | | | | | | | | | | | | | | |
| **District** | **Water supply (w/s)** | | | | | | | **Average system production, $m^3$/day** | **Current population served (2006)** | **Typical water per capita consumption** | **Non Domestic Demand %** | **Typical UFW(%)** | **Design life(yrs)** | |
| | | | | | | | | | | | | | | |
| **Bungoma** | Chwele w/s | | | | | | | 12 | 3,500 | 3.3 | | | | |
| | Kibichori Bokoli w/s | | | | | | | 1,771 | 30,000 | 59.0 | | | | |
| | Old Kibichori w/s,Chwele/Central Division | | | | | | | | 9,000 | | | | | On-going/Operational |
| | Kibabii w/s | | | | | | | | 1000 | | | | | On-going |
| | Lwakhakha-Lwaandanyi-Cheptais w/s | | | | | | | | 37,000 | | | | | On-going |
| | Ngoli w/s, Sirisia Division | | | | | | | | | | | | | On-going |
| | Ndivisi/Makusilwa w/s | | | | | | | | | | | | | On-going |
| | Muchi/Milo w/s, Webuye Division | | | | | | | | | | | | | On-going |
| | Namwela/Chesabiti w/s, Sirisia Division | | | | | | | | | | | | | On-going |
| | Lukhuna w/s, Tongaren Division | | | | | | | | | | | | | On-going |
| | Mateka w/s, Bumula Division | | | | | | | | | | | | | On-going |
| | Ndalu w/s, Tongaren Division | | | | | | | | | | | | | |
| | Bungoma Rural w/s, Kanduyi Division | | | | | | | | | | | | | Proposed |
| | Sikhendu/Kamukunywa w/s, Kimilili Division | | | | | | | | | | | | | Proposed |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Little Nzoia West,Tongaren Division | | | | | | | | | | | | | Proposed |
| | Naitiri water project, Tongaren Division | | | | | | | | | | | | | Proposed |
| | Khasoko w/s, Bumula Division | | | | | | | | | | | | | |
| | Maeni w/s | | | | | | | | 1,600 | | | | | |
| | | | | | | | | | | | | | | |
| **Busia** | Munana w/s | Dam Government | 1963 | 1966 | LA/CIDA/ FINNIDA/ MOW I/ ACTION CDF | 2,000,000.00 | 1,800,000 | 1,405 | 4,000 | 351.3 | | 10 | | |
| | Busia Hills w/s | Government (Lake Victoria) | 1976 | 1978 | LA/CIDA/ FINNIDA/ MOW I/ ACTION AID | 4,000,000.00 | 3,000,000 | | 12,000 | | | | | Operational |
| | Port Victoria w/s | | | | | | | | 15,000 | | | | | |
| | Butula w/s | | | | | | | | 6,000 | | | | | |
| | Budwongi w/s | | | | | | | | 6,000 | | | | | |
| | Funyula Bumala w/s | | | | | | | 47 | 10,000 | 4.7 | | 39 | | |
| | Ejinja w/s | | | | | | | | 3,000 | | | | | |
| | Bujumba Burinda w/s | | | | | | | | 4,000 | | | | | |
| | | | | | | | | | | | | | | |
| **Mt. Elgon** | Chesikaki w/s | | | | | | | 2,926 | 15,000 | 195.07 | | 25 | | |
| | Chepkube w/s | | | | | | | | 5,000 | | | | | |
| | Cheseker w/s | | | | | | | | 5,000 | | | | | |
| | Kopsiro w/s | | | | | | | | 6,000 | | | | | |
| | Kutere- Kipsabula w/s | | | | | | | | 2,000 | | | | | |
| | Toywondet w/s | | | | | | | | 3,000 | | | | | |
| | Kipnyokos w/s | | | | | | | | 4,000 | | | | | |
| | | | | | | | | | | | | | | |
| **Teso** | Amukura Hills(Lukolis) w/s | | | | | | | 5,194 | | | | | | |
| | Apegei w/s | | | | | | | | 1,500 | | | | | |
| | Obekai w/s | | | | | | | | 1,500 | | | | | |
| | Amagoro w/s | | | | | | | | 2,300 | | | | | |
| | Angurai Water Project,Angurai Division | | | | | | | | | | | | | On-going |
| | Malaba-Kocholia Water Project, Amagoro Division | | | | | | | | | | | | | On-going |
| | | | | | | | | | | | | | | On-going |
| | Proposed | | | | | | | | | | | | | Proposed |
| | Lwandanyi-Angurai Division | | | | | | | | | | | | | Proposed |
| | Angurai Dam Water Project, Angurai Division | | | | | | | | | | | | | Proposed |
| | Adungosi w/s | | | | | | | | | | | | | Proposed |

# Appendix 3: Rural Water Supply Projects- Uganda

### Rural Water Supply Projects by District (Rural Water Reform, 2002)

| Districts | Estimated Population 2000 | Estimated Population 2015 | Current % Population Served | Population Served, 2000 | Population expected to be Served by 2015 |
|---|---|---|---|---|---|
| Mbale | 885,280 | 1,290,404 | 34% | 300,995 | 989,409 |
| Bugiri | 303,009 | 397,860 | 23% | 69,692 | 328,168 |
| Iganga | 869,515 | 1,141,464 | 29% | 252,159 | 889,304 |
| Pallisa | 473,611 | 670,962 | 14% | 66,306 | 604,656 |
| Busia | 164,745 | 230,914 | 30% | 49,424 | 181,490 |
| Tororo | 506,661 | 724,370 | 41% | 207,731 | 516,639 |
| **Total Rural Population** | 3,202,821 | 4,455,974 | | 946,307 | 3,509,666 |

**Rural Sanitation Investment Requirements (Rural water & Sanitation Component**

**Strategic Investment Plan Action, July 2000)**

| District | Capital Investment ($) | | Programme Investment ($) | | Total Investment ($) | |
|---|---|---|---|---|---|---|
| | 2005 | 2015 | 2005 | 2015 | 2005 | 2015 |
| Mbale | 450,382 | 233,209 | 315,268 | 163,246 | 765,650 | 396,455 |
| Bugiri | 148,835 | 69,099 | 104,185 | 48,369 | 253,020 | 117,468 |
| Iganga | 452,991 | 250,484 | 317,094 | 175,339 | 770,085 | 425,822 |
| Pallisa | 260,466 | 164,110 | 182,326 | 114,877 | 442,792 | 278,987 |
| Busia | 96,562 | 69,099 | 67,594 | 48,369 | 164,156 | 117,468 |
| Tororo | 264,392 | 146,835 | 185,074 | 102,785 | 449,466 | 249,620 |
| **Total Program** | **1,673,628** | **932,836** | **1,171,541** | **652,985** | **2,845,169** | **1,585,820** |

## Summary of Required Rural Water Supply Investments to 2015

| District | Rehab. | Point Sources | Rural Growth Centres | Gravity Flow Schemes | Valley Tanks/ Dams | Other Sources (rainwater) | District Monitoring & Accounting | User Contribution | District/ Sub-county Contributions | Total Investment |
|---|---|---|---|---|---|---|---|---|---|---|
| Mbale | 361,802 | 19,481,165 | 8,705,346 | 911,025 | - | - | 883,780 | 387,057 | 1,546,615 | 30,343,119 |
| Bugiri | 152,900 | 9,335,559 | 2,579,362 | - | - | - | 362,035 | 169,844 | 633,561 | 12,429,856 |
| Iganga | 650,900 | 26,451,036 | 9,350,187 | - | - | - | 1,093,564 | 533,294 | 1,913,736 | 37,545,687 |
| Pallisa | 131,639 | 16,450,931 | 5,803,564 | - | - | - | 671,584 | 321,559 | 1,175,272 | 23,057,718 |
| Busia | 94,207 | 4,696,741 | 2,579,362 | - | - | - | 221,109 | 109,028 | 386,941 | 7,591,420 |
| Tororo | 628,647 | 17,117,561 | 5,481,144 | - | - | - | 696,821 | 340,616 | 1,219,436 | 23,924,172 |
| **Total** | **2,020,095** | **93,532,993** | **34,498,965** | **911,025** | | | **3,928,893** | **1,861,398** | **6,875,561** | **134,891,972** |

*Source: Rural Water & Sanitation Component Strategic Investment Plan Action, 2000-2015 (July 2000)*

## Inventory of Water Supply Facilities in Uganda Districts of the SMM

| Districts | Data update | Protected Springs. | | Deep BH. | | Shallow wells | | Dug wells | | Rain Water Tanks 6.3M³ | | Rain Water Tanks 10M³ | | Rain Water Tanks 24M³ | | GFS Taps | | RGCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fn | N Fn | Fn | N Fn | Fn | N Fn | Fn | N Fn | | | | | | | Fn | N Fn | |
| BUGIRI | Jun-07 | 142 | 41 | 235 | 46 | 109 | 31 | - | - | - | - | 48 | 22 | 6 | - | - | - | - |
| BUSIA | Jun-07 | 185 | - | 287 | 23 | 3 | - | 30 | - | - | - | 39 | - | - | - | - | - | - |
| NAMUTUMBA | Jun-06 | 41 | - | 248 | 14 | 133 | - | 106 | 23 | 2 | - | 21 | - | - | - | - | - | - |
| MANAFWA | Jun-05 | 302 | 42 | 102 | 10 | 5 | - | - | - | - | - | 23 | - | - | - | 68 | 10 | - |
| BUDUDA | Jun-07 | 198 | 65 | 16 | 2 | - | - | - | - | - | - | 10 | - | - | - | 58 | 9 | - |
| PALLISA | Jun-07 | 112 | 22 | 386 | 46 | 71 | 19 | - | - | - | - | - | - | - | - | - | - | - |
| BUTALEJA | Jun-07 | 7 | 9 | 232 | 26 | 16 | 19 | - | - | - | - | 3 | - | - | - | - | - | - |
| TORORO | Jun-07 | 229 | 16 | 543 | 27 | - | - | 29 | 6 | - | - | - | - | - | - | - | - | 3 |

# Appendix 4: Proposed and On-going Irrigation Projects in SMM-Kenya

BUSIA DISTRICT

| Division | Location | Constituency | Name of project | Project objectives | Activitiy | Start date | End date | Status | Cost |
|---|---|---|---|---|---|---|---|---|---|
| Funyula | Nangosia | Funyula | Munana irrigation scheme | Food security through irrigation | Civil works | Jun-05 | Jun-07 | Ongoing 70% complete | 2 M |
| Budalangi | Bunyala North | Budalangi | Sisenye irrigation scheme | " | " | Jun-06 | Jun-07 | On going 20% complete | 12 M |
| Budalangi | Bunyala Central | Budalangi | Nandi kinya irrigation project | " | " | Jun-06 | Jun-08 | On going 10% complete | 5.7 M |
| Budalangi | Bunyala Central | Budalangi | Mudembi irrigation project | " | " | Aug-04 | Jun-07 | Ongoing 70% complete | 2.5 M |
| Butula | Marachi central | Butula | Ibanda IP | Food security Employment Creation | WUA formation & civil works | June 2007 | June 2008 | New | 3.6M |
| Budalangi | Bunyala north | Budalangi | Sirisia IP | " | " | July 2007 | June 2008 | New | 9.4M |
| Funyula | Agemga | Funyula | Businda IP | " | " | July 2007 | June 2009 | New | 30M |
| Butula | Marachi central | Butula | Irana IP | " | " | July 2008 | June 2009 | New | 4M |
| Budalangi | Bunyala East | Budalangi | Igigo IP | " | " | July 2008 | June 2009 | New | 15M |
| Butula | Marachi central | Butula | Mudasi IP | " | " | July 2009 | June 2010 | New | 4.5M |
| Funyula | Nanguba | Funyula | Namasali IP | " | " | July 2009 | June 2010 | New | 12M |

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|---|---|---|---|---|---|---|---|---|---|
| Budalangi | Bunyala East | Budalangi | Budalangi IP | " | " | July 2010 | June 2011 | New | 25M |
| Township | Township | Nambale | Muyenje IP & drainage | " | " | July 2010 | June 2011 | New | 8M |
| Funyula | Agenga | Funyula | Sifuyo IP & Drainage | " | " | July 2011 | June 2012 | New | 12M |
| Matayos | Bukhayo West | Nambale | Budokoyi Ip | " | " | June 2011 | June 2012 | New | 15M |
| MT ELGON DISTRICT | | | | | | | | | |
| Kopsiro | Kapkateny | Mt.Elgon | Chebich phase 1 | Irrigate 20 ha | WUA formation and civil works. | 2006 | 2008 | On-going -20% | |
| Kopsiro | Kapkateny | Mt. Elgon | Mashanga | Irrigate 40ha | Prelim investiga-tions | Feb 2006/7 | Jun-09 | On-going | 8.0 M |
| Kopsiro | Kapkateny | Mt. Elgon | Terem | Irrigate 40ha | Prelimin investiga-tions. | Feb. 2006/2007 | 2011 | On-going | 8.0 M |
| Cheptais | Cheptais | Mt.Elgon | Chesikaki | Irrigate 30ha | Prelimin investiga-tions | June 2005/6 | - | Stalled | 6.0 M |
| Cheptais | Chepkube | Mt. Elgon | Chebwek | Irrigate 30ha | Start investiga-tions | June 2005/6 | - | Stalled | 6.0 M |
| Kopsiro | Kapkateny | Mt Elgon | Chebich phase 2 | -Irrigate 25 ha | WUA formation and civil works | June 2008/9 | June 2010/11 | On going | 4.0 M |
| Kopsiro | Kapkateny | Mt Elgon | Mashanga | -Irrigate 40 ha. | Detailed designs and civil works | July 2008/9 | 2010/11 | Proposed | |
| Kopsiro | Kapkateny | Mt Elgon | Terem | -Irrigate 40 ha. | Detailed designs and civil works | July 2007/8 | Dec 2011/12 | On going | 8.0 M |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Kapsokwony | Chemoge | MT Elgon | Kamusinga/ Kamutiong' | Irrigate 30ha | | May 2005/6 | June 2009 | On-going | 6.0 M |
| Amukura | Kaliwa | Amagoro | Obekai IP | Irrig horticulture | WUA formation & civil works | July 05 | June 06 | Ongoing | 1.7M |
| Amukura | Akoret | Amagoro | Akapijan | Drainage | Design,WUA formation & civil works | July 05 | June 06 | Ongoing | 1.8M |
| BUNGOMA DISTRICT | | | | | | | | | |
| **Division** | **Location** | **Constituency** | **Name of project** | **Project objectives** | **Activities** | **Start date** | **End date** | **Status** | |
| Kimilili | Maeni | Kimilili | Sosio-Marofo Irrigation Project | Irrigation/drainage- 20 ha | WUA formation, designs and civil works | 2008 | 2009 | New | |
| Bumula | Kabula | Bumula | Syoya Irrigation Project | Irrigation 20 ha | WUA formation, designs and civil works | 2009 | 2010 | - | |
| Kanduyi | East Bukusu | Kanduyi | Wacheka Irrigation Project | Irrigation 30Ha | WUA formation, designs and civil works | 2010 | 2011 | - | |
| TESO DISTRICT | | | | | | | | | |
| Amukura | Kaliwa | Amagoro | Obekai IP | Irrig horticulture | WUA formation & civil works | July 05 | June 06 | Ongoing | |
| Amukura | Akoret | Amagoro | Akapijan | Drainage | Design,WUA formation & civil works | July 05 | June 06 | Ongoing | |
| Angurai | Amagoro | Amagoro | Changara Dam | Dam rehabilitation and irrigation | WUA formation, Design and civil works | July 08 | June 09 | Silted | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Chakol | Amagoro | Amagoro | Eluu Drainage | Drainage and fish farming | WUA formation and civil works | July 07 | June 08 | New | 4.5 M |
| Amagoro | Amoni | Amagoro | Amoni | Drainage, flood control, fish farming | WUA formation and civil works | July 08 | June 09 | New | 230M |
| Amukura | Akoret | Amagoro | Akoret | Irrig (Hort | | July 08 | June 09 | New | 3M |

# Appendix 5: Sio-Malaba-Malakisi Water Permits (Kenya)

| NO. | PERMIT-NO. | RIVER | TRIBUTARY | NAME | DOMESTIC NF | PUBLIC NF | INDUSTRIAL NF | HYDROPOWER FF | GENERAL IRRIG. FF | MINOR IRRIG. FF | OTHER NF | OTHER FF | RETURN FLOW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **11722** | Bukhakhala Stream | | Eliakim Mungala | 4 | | | | | 9.08 | | | |
| 2 | **4589** | Bumwayo Stream | | Elgon Nyanza (Join Board W/Suppies) | | | | | | | | | |
| 3 | **9708** | Khanyangu | | Busia County Council | 5 | | | | | | | | |
| 4 | **26402** | L. Victoria | | Gabriel mbindah | | | | | | | | | |
| 5 | **7998** | Malikisi | | African District Council | 1.682 | | | | | 10.318 | | | |
| 6 | **24155** | Mulelekwe | Spring | Lambert Ogude Omolo | | | | 5154.5 | | | | | 5154.5 |
| 7 | **24156** | Mulelekwe | Nyadhowe | Lambert Ogunde Omolo | | | | | | | 4.5 | | 4.5 |
| 8 | **7252** | Namboboto | | Busia County Council (Namboboto Dam) | 9.2 | | | | | 40.91 | | | |
| 9 | **28073** | Nzoia | Bujumba | Benedict Richard Okumu | 16 | | | 318 | | 0.91 | | | 318 |
| 10 | **3974** | Raboki | | Central Nyanza African District Council | | | 4000 | | | | | | |
| 11 | **23978** | Sango | Pade | Pascal Wandera Pade | 9.9 | | | | | | | | |
| 12 | **18415** | Sango | | Stephen Malingu | 13.63 | | | | | 5 | | | |
| 13 | **20418** | Sio | Mamulwe | Basil Munyamo Obare | 197.3 | | 90 | | 60 | | | | |
| 14 | **21440** | Sio | Butula Springs | Busia Count Council | | | | | | | | | |
| 15 | **24636** | Sio | | Dir. of Water Dev. (Bumala Funyula W/Project) | 92.3 | | 9.1 | | 45.4 | | | | |
| 16 | **999965** | Sio | Suongo | Dir. of Water Dev. (Munana W/Supply) | 6 | | | | 23 | | | | |
| 17 | **999964** | Sio | | Dir. of Water Dev. (Mundika W/Supply) | 5 | | | | | | 0.41 | | |
| 18 | **20409** | Sio | Sirare Spring | Ekesa Orodi | | | | 176724 | | | | | 176724 |
| 19 | **17867** | Sio | Namwitsula | Forest Dept.(Namwichula Tree Nursery) | 16.4 | | | | | | | | |
| 20 | **28079** | Sio | Nyakhobi | George William Mudibo | 96 | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | **24245** | Sio | | Nathaniel Ouma Nambakha | 0.91 | | | 95 | | 14 | | | 95 |
| 22 | **22833** | Sio | Isevero Stream | Robert Mutaliko Abura | 25 | | 2 | | | | | | |
| 23 | **29140** | Soi | Namaterem | Namaterema Comm. W/Project | 1.15 | | | 11.5 | | | | | 11.5 |
| 24 | **8116** | Wakhungu | | Busia County Council | | | 90 | | | | | | |
| 25 | **11158** | Wakhungu | | The Director of Water Development | | | | | | 40.91 | | | |
| 26 | **9650** | Wamunya | Spring | Dir.of Water Dev.(Funyula Trading Centre) | 22.6 | | | | | | | | |
| 27 | **29229** | Wamunya | Namundiri | Onana Funyula Community W. Users Society | 5.9 | | | | | | | | |
| 28 | **15740** | Yafwa | | Busia County Council | | 255.7 | | | | | | | |
| | **TOTAL** | | | | **527.972** | **255.7** | **4191.1** | **182303** | **128.4** | **121.13** | **4.91** | **0** | **182307.5** |
| | | **1AD - MALAKISI RIVER SYSTEM** | | | | | | | | | | | |
| 1 | **20423** | Chakol | Engoote Spring | Okadapau Engoote | | | | | | | | | |
| 2 | **8062** | Cilamery Stream | | The Mill Catholic Mission Trustees | 15.9 | | | | | 18.2 | | | |
| 3 | **18166** | Kangatuny Dam | | Chelelemuk Water Project | 28.6 | | | | | | | | |
| 4 | **999961** | Kangatuny Dam | | Chelemuk W/Project | 49 | | | | 200 | | | | |
| 5 | **9646** | Kolanya Stream | | Bungoma County Council | 5.9 | | | | | 5 | | | |
| 6 | **9649** | Likolis Stream | | Busia County Cooouncil | 77.24 | | | | | | | | |
| 7 | **7997** | Malakisi | | African District Council , Elgon Nyanza | | | | | | | | | |
| 8 | **22446** | Malakisi | | Chemondi F.C. Society | | | | | 26.9 | | | | |
| 9 | **22198** | Malakisi | | Dir. of Water Dev. (Malaba-Kocholia W/Supply) | 767.03 | 102.27 | | | | | | | |
| 10 | **2413** | Malakisi | | East African Railways and Horbours | | | | | | | | | |
| 11 | **28137** | Malakisi | | Jiwa's Bakery | | | | | | | | | |
| 12 | **18165** | Malakisi | | Kocholia Water Development Committee | 1.36 | | | 13.636 | | | | | |
| 13 | **999963** | Malakisi | | St. Joseph's Kocholia | 9 | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | **9648** | Malikisi | Spring | Busia County Council | 1.3 | | | | | | | | |
| 15 | **9709** | Malikisi | | Busia County Council (Kocholia Health Centre) | 6.27 | | | | 45.45 | | | | |
| 16 | **19746** | Nakhwana | Spring | Kimaeti Water Scheme | | | | | 1636 | | | | |
| 17 | **19684** | Okame | Alupe | Alupe Agricultural Resarch Station | 22 | | | | | | | | |
| 18 | **20424** | Walatsi | Omonya Stream | Albert Atsiano Ooki | | | | | | | | | |
| 19 | **20236** | Walatsi | | Dindi Linus Odanga | 111.3 | | | | | | | | |
| 20 | **20246** | Walatsi | Namakhokha | Francis Oundo | | | 113.58 | | | | | | |
| | **TOTAL** | | | | **1094.9** | **102.27** | **113.58** | **13.636** | **1908.35** | **23.2** | **0** | **0** | |
| | | **1AA - MALABA RIVER SYSTEM** | | | | | | | | | | | |
| 1 | **4897** | Chamasiri Stream | | Busia County Council | 9.08 | | | | | | | | |
| 2 | **4993** | Charangara Stream | | Bungoma County Council | 10.4 | | | 448.2 | | 31.4 | | | 448.2 |
| 3 | **5140** | Kangatuny | | Busia County Council | 13.6 | | 27.3 | 363.5 | | | | | 363.5 |
| 4 | **17381** | Kasinga | Moding Spring | County Council of Busia | 30.68 | | | 3068 | | | | | 3068 |
| | | | | (Moding Water Scheme) | | | | | | | | | |
| 5 | **14327** | Lwakhakha | Sit | Chepkube Coffee Growers Co-op. Society Ltd | | | | | | | | | |
| 6 | **999971** | Madiviva Spring | | Bukhalarire Secondary School | 45 | | | 450 | 227.2 | | | | |
| 7 | **18593** | Malaba | Ecor Stream | Amukura Mission | | | | | 2057 | | | | |
| 8 | **22540** | Malaba | | Kenya Railways Corporation | 12.26 | | 24.52 | | | | | | |
| 9 | **999962** | Malaba | | Magharibi Hotel | 9 | | | | | | | | |
| 10 | **24952** | Malaba | | Martha Wangui Gachigi | | | | | 412.54 | | | | |
| 11 | **5156** | Meno | | Bungoma County Council | 13.6 | | | | | | | | |
| 12 | **5136** | Meno Stream | | Bungoma County Council | | | | 2.8 | 689.886 | | | | 2.8 |
| | **TOTAL** | | | | **143.62** | **0** | **51.82** | **4332.5** | **3386.626** | **31.4** | **0** | **0** | |

**NN - Normal Flow**
**FF - Flood Flow**

# Appendix 6: Hospitals/Health Centres in SMM - Kenya

| BUNGOMA DISTRICT | | | | | | |
|---|---|---|---|---|---|---|
| **Health Facility Name** | **Type** | **Ownership** | **Division** | **Location** | **Village** | **Province** |
| Bukembe | Clinic | Community | Kanduyi | Bukembe | Bukembe | Western |
| Bungoma Medical | Clinic | Private | Kanduyi | Bungoma Township | Khalaba | Western |
| Chwele | Clinic | Private | Chwele | Chwele | Chwele | Western |
| Joe Medical | Clinic | Private | Kanduyi | Bungoma Township | Mpeli | Western |
| Kimilili Medical | Clinic | Private | Kimilili | Kimilili | Township | Western |
| Bokoli | Dispensary | GOK | Webuye | Bokoli | Bokoli | Western |
| Bulondo | Dispensary | GOK | Kanduyi | East Bukusu | Namwacha | Western |
| Bungoma GK Prison | Dispensary | GOK | Kanduyi | Bungoma Township | Khalaba | Western |
| Chwele Friends | Dispensary | GOK | Sirisia | Namwela | Namwela | Western |
| Kamuywa ACK | Dispensary | Mission | Tongaren | Kabuyefwe | Kabuyefwe | Western |
| Kaptamai | Dispensary | GOK | Sirisia | Namwela | Namwela | Western |
| Kimaeti | Dispensary | GOK | Bumula | Kamaeti | Kamaeti | Western |
| Kimilili S.D. Hospital | Dispensary | GOK | Kimilili | Kibengei | Township | Western |
| Kirima Dispensary | Dispensary | GOK | Tongaren | Mbakalo | Mbakalo | Western |
| Korosiandet | Dispensary | GOK | Malakisi | Mwandanyi | | Western |
| Machwele Friends | Dispensary | Mission | Bumula | Kamaeti | Kamaeti | Western |
| Makhonge Dispensary | Dispensary | GOK | Kimilili | Kamukuiywa | Makhonge | Western |
| Makutano | Dispensary | GOK | Tongaren | Tongaren | | Western |
| Malakisi BAT | Dispensary | Private | Malakisi | Malakisi | Malakisi | Western |
| Mechimeru | Dispensary | GOK | Kanduyi | East Bukusu | Mechimeru | Western |
| Miendo | Dispensary | GOK | Webuye | Bokoli | Miendo | Western |

| | | | | | | |
|---|---|---|---|---|---|---|
| Mihu | Dispensary | GOK | Ndivisi | Chetatabe | Mihuu | Western |
| Nzoia Sugar | Dispensary | Private | Kanduyi | Bukembe | Bukembe | Western |
| PanPaper Dispensary | Dispensary | Private | Webuye | Webuye | Township | Western |
| SoySambu Dispensary | Dispensary | Mission | Tongaren | Tongaren | Soy Sambu | Western |
| Tamlega | Dispensary | GOK | Malakisi | Malakisi | | Western |
| Bumula | Health Centre | GOK | Bumula | Bumula | Bumula | Western |
| Chwele | Health Centre | GOK | Chwele | Chwele | Chwele | Western |
| Dreamland M Centre | Health centre | Mission | Kimilili | Kibengei | Kaptola | Western |
| Kabubai | Health Centre | Private | Chwele | Mukuyuni | Kabuchai | Western |
| Khasoko ACK | Health Centre | Mission | Bumula | Khasoko | Khasoko | Western |
| Kibabi | Health Centre | Mission | Kanduyi | Bungoma Township | Tutii | Western |
| Kimalewa | Health Centre | GOK | Chwele | Mukuyuni | Kimalewa | Western |
| Malakisi | Health Centre | GOK | Malakisi | Kamaeti | Malakisi | Western |
| Naitiri | Health Centre | GOK | Tongaren | Naitiri | Naitiri | Western |
| Ndalu | Health Centre | GOK | Tongaren | Ndalu | Ndalu | Western |
| Sirisia | Health Centre | GOK | Sirisia | Sirisia | Sirisia | Western |
| St. Damiano | Health Centre | Mission | Kanduyi | Bungoma Township | Mpeli | Western |
| Tongaren | Health Centre | GOK | Tongaren | Tongaren | Tongaren | Western |
| Webuye | Health Centre | GOK | Webuye | Webuye | Township | Western |
| Bungoma District | Hospital | GOK | Kanduyi | Bungoma Township | Khalaba | Western |
| Lugulu Mission | Hospital | Mission | Webuye | Misikhu | Lugulu | Western |
| Lumboka Memorial | Hospital | Private | Kanduyi | Bungoma Township | Khalaba | Western |
| Misikhu | Hospital | Mission | Webuye | Misikhu | Misikhu | Western |

| | | | | | | |
|---|---|---|---|---|---|---|
| Mission | | | | | | |
| Webuye S D | Hospital | GOK | Webuye | Webuye | Township | Western |
| Chetambe | Nursing Home | Private | Webuye | Webuye | Township | Western |
| Elgonview Cottage | Nursing Home | Private | Kanduyi | Bungoma Township | Khalaba | Western |
| Milo | Nursing Home | GOK | Webuye | Webuye | | Western |
| Mumias Road | Nursing Home | Private | Kanduyi | Bungoma Township | Mpeli | Western |
| Webuye | Nursing Home | Private | Webuye | Webuye | Township | Western |
| BUSIA DISTRICT | | | | | | |
| Budalangi | Dispensary | GOK | Budalangi | Bunyala North | Bukhori | Western |
| Matayos Community | Clinic | Private | Matayos | Lwanya | Matayos | Western |
| St. Catherine School | Clinic | Private | Butula | Elukhari | Nyalara | Western |
| Agenga | Dispensary | GOK | Funyula | Agenga | Lukare | Western |
| Buduta | Dispensary | GOK | Funyula | Agenga | Odidi | Western |
| Bujumba | Dispensary | Mission | Butula | Bujumba | Bukhwako | Western |
| Bulwani | Dispensary | GOK | Budalangi | Bunyala South | Bulwani | Western |
| Bumutiru | Dispensary | GOK | Butula | Marachi Central | Bumutiru | Western |
| Burinda | Dispensary | GOK | Butula | Bujumba | Buranga | Western |
| Busembe | Dispensary | GOK | Funyula | Bwiri | Nchasegese | Western |
| Busia GK Prison | Dispensary | GOK | Matayos | Bukhayo West | Bugengi | Western |
| Busibwabo | Dispensary | GOK | Matayos | Busibwabo | Busibwabo | Western |
| Bwaliro | Dispensary | GOK | Butula | Elugulu | Mabanga | Western |
| Igara | Dispensary | GOK | Nambale | Bukhayo North | Igara | Western |
| Khayo | Dispensary | GOK | Nambale | Bukhayo East | Khayo | Western |
| Lupida | Dispensary | GOK | Nambale | Bukhayo North | Lupida | Western |

| | | | | | | |
|---|---|---|---|---|---|---|
| Madende | Dispensary | GOK | Nambale | Bukhayo East | Madende | Western |
| Maduwa | Dispensary | GOK | Budalangi | Bunyala South | Ngereha | Western |
| Malanga | Dispensary | GOK | Nambale | Bukhayo Central | Malanga | Western |
| Munongo | Dispensary | GOK | Matayos | Bukhayo West | Munongo | Western |
| Namboboto | Dispensary | Mission | Funyula | Namboboto | Namboboto | Western |
| Nambuku | Dispensary | GOK | Funyula | Nambuku | Nambuku | Western |
| Nangina | Dispensary | GOK | Funyula | Nangosia | Nangina | Western |
| Rukala | Dispensary | GOK | Budalangi | Bunyala South | Rukala | Western |
| Sirimba | Dispensary | Mission | Budalangi | Bunyala North | Sirimba | Western |
| Sisenye | Dispensary | GOK | Budalangi | Bunyala North | Mwanda | Western |
| Bumala 'A ' | Health Center | GOK | Butula | Bumala | Bumala C | Western |
| Bumala 'B' | Health Center | GOK | Butula | Marachi East | Bumala B | Western |
| Butula Mission | Health Center | Mission | Butula | Elukhari | Nyalara | Western |
| Matayos | Health Center | GOK | Matayos | Nangoma | Mungore | Western |
| Mukhobola | Health Center | GOK | Budalangi | Bunyala South | Sidukuni B | Western |
| Nambale | Health Center | GOK | Nambale | Nambale Town | Makongeni | Western |
| Sio Port | Health Center | GOK | Funyula | Nanguba | Butangasi | Western |
| Busia District | Hospital | GOK | Township | Busia Township | Maduwa | Western |
| Khunyangu SD | Hospital | GOK | Butula | Marachi East | Murumba | Western |
| Nangina | Hospital | Mission | Funyula | Nangosia | Nangina | Western |
| Port Victoria SD | Hospital | GOK | Budalangi | Bunyala North | Marenga | Western |
| Nambale | Nursing Home | Private | Nambale | Nambale Town | Nambale | Western |
| New Busia | Nursing Home | Private | Township | Township | Bulanda | Western |

| | | | | | | |
|---|---|---|---|---|---|---|
| Tanaka | Nursing Home | Private | Township | Busia Township | Burumba | Western |
| MT. ELGON DISTRICT | | | | | | |
| Chepkube | Dispensary | Gok | Cheptai | Chepkube | Chepkube | Western |
| Chesikaki | Dispensary | Gok | Cheptais | Chesikaki | Chesikaki | Western |
| Kaboywo | Dispensary | Gok | Kaptama | Kaboywo | Kaboywo | Western |
| Kamuneru | Dispensary | Gok | Kapsokwony | Kimobo | Kamuneru | Western |
| Kapkateny | Dispensary | Gok | Kopsiro | Kapkateny | Kapkateny | Western |
| Kopsiro | Dispensary | Gok | Kopsiro | Kopsiro | Kopsiro | Western |
| Sacha | Dispensary | Private | Kapsokwony | Kimobo | Sacha | Western |
| Tuikut | Dispensary | Gok. | Cheptais | Tuikut | Tuikut | Western |
| Cheptais | H/Centre | Gok | Cheptais | Cheptais | Cheptais | Western |
| Kaptama | H/Centre | Mission | Kaptama | Kaptama | Kaptama | Western |
| Kipsigon | H/Centre | Mission | Kopsiro | Kipsigon | Kipsigon | Western |
| Mt. Elgon District | Hospital | Gok | Kapsokwony | Mt. Elgon | Kapsokwony | Western |
| TESO DISTRICT | | | | | | |
| Lake View | Clinic | Private | Amagoro | Akadetewai | Akadetewai | Western |
| Machakus | Clinic | Private | Amukura | Akoreet | Machakus | Western |
| St. Jude | Clinic | Private | Amukura | Amukura | Amukura | Western |
| Aboloi | Dispensary | Gok | Angurai | Aboloi | Akachachat | Western |
| Akichelesit | Dispensary | Gok | Angurai | Kakapel | Akichelesit | Western |
| Chemasir | Dispensary | Ack/Comm | Angurai | Kolanya | Chemasir | Western |
| Lukolis | Dispensary | Gok | Amukura | Akoreet | Lukolis | Western |
| Obekai | Dispensary | Gok | Amukura | Kaliwa | Obekai | Western |
| Amukura | H/Centre | Gok | Amukura | Amukura | Amukura | Western |
| Amukura | H/Centre | Mission | Amukura | Amukura | Amukura | Western |
| Angurai | H/Centre | Gok | Angurai | Angurai | Angurai | Western |

| | | | | | | |
|---|---|---|---|---|---|---|
| Kolanya Salvation Army | H/Centre | Mission | Angurai | Kolanya | Kolanya | Western |
| Moding | H/Centre | Gok | Angurai | Moding | Moding | Western |
| St. Mary's Catholic | H/Centre | Mission | Angurai | Angurai | Chelelemuk | Western |
| Alupe S.D.H | Hospital | Gok | Chakol | Angorom | Alupe | Western |
| Teso Dist. (Kocholia) | Hospital | Gok | Amagoro | Kocholia | Kocholia | Western |
| Amagoro | Nursing Home | Private | Amagoro | Amagoro | Amagoro | Western |