Appendix 3-4

Gucha Migori River Basin Integrated Flood Management Plan

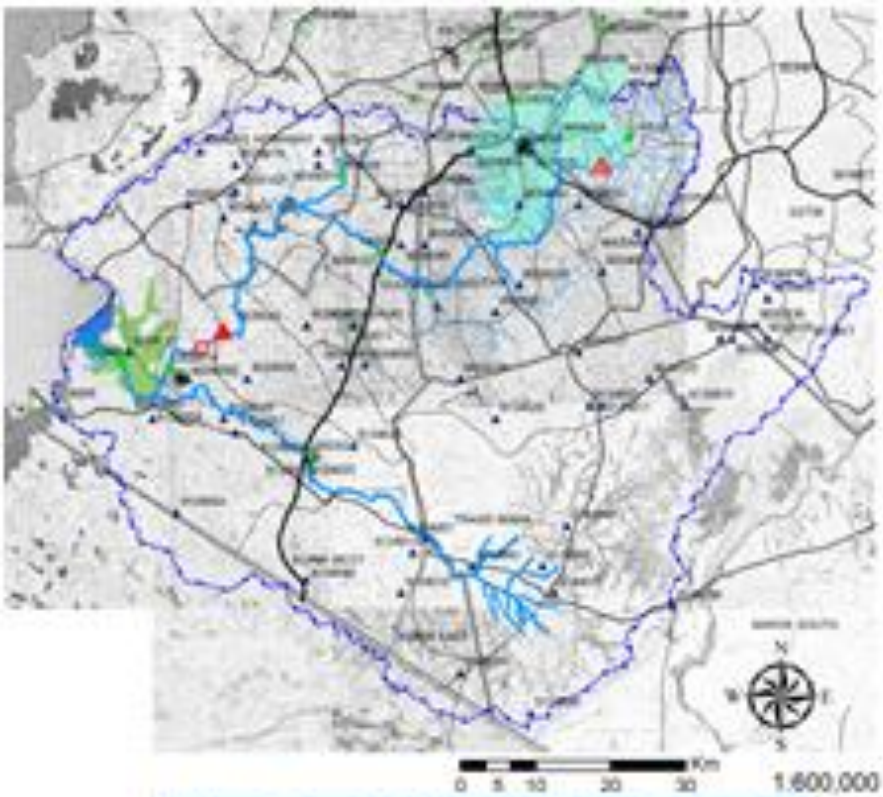
REPUBLIC OF KENYA
PROJECT ON CAPACITY DEVELOPMENT
FOR
EFFECTIVE FLOOD MANAGEMENT IN FLOOD PRONE AREA

GUCHA MIGORI RIVER BASIN INTEGRATED FLOOD MANAGEMENT PLAN -ZERO DRAFT-

JULY 2014
WRMA and JICA

NEWJEC

Name of the River	The Gucha Migori River
River system	The Gucha River and the Migori River
River length	149 km
Catchment Area	6,900 Km2
Annual discharge	58 m3/s
Location	South- western corner of the Lake Victoria basin in westem Kenya
Head Waters	The Gucha river: In the highlands around Keroka in Nyamira county, which rise up to nearly 3,000 m.amsl at Kiatonyora peak. The Migori River: In Chepalungu forest, at altitudes around 2,000 m.asml.



The Gucha Migori River Basin

Republic of Kenya
Project on Capacity Development for Effective Flood Management in Flood Prone Area

Gucha Migori River Basin Integrated Flood Management Plan
- Draft -

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POLICY OF RIVER BASIN FLOOD MANAGEMENT PLAN (DRAFT)

POLICY OF FLOOD MANAGEMENT IN THE RELEVANT RIVER BASIN (DRAFT)

The Gucha Migori river basin is a vast expansive river basin that consist of two river system i.e. River Gucha system and R. Migori System. These two rivers merge at a confluence in Sango area in Central Kadem Location in Nyatike district to become the wide R. Gucha Migori. The river thereafter flows and pours its water in Lake Victoria. R. Gucha has its source in Nyamira County in the Kisii highlands while R. Migori has its source in Narok County specifically in Emuria Dikiri district.

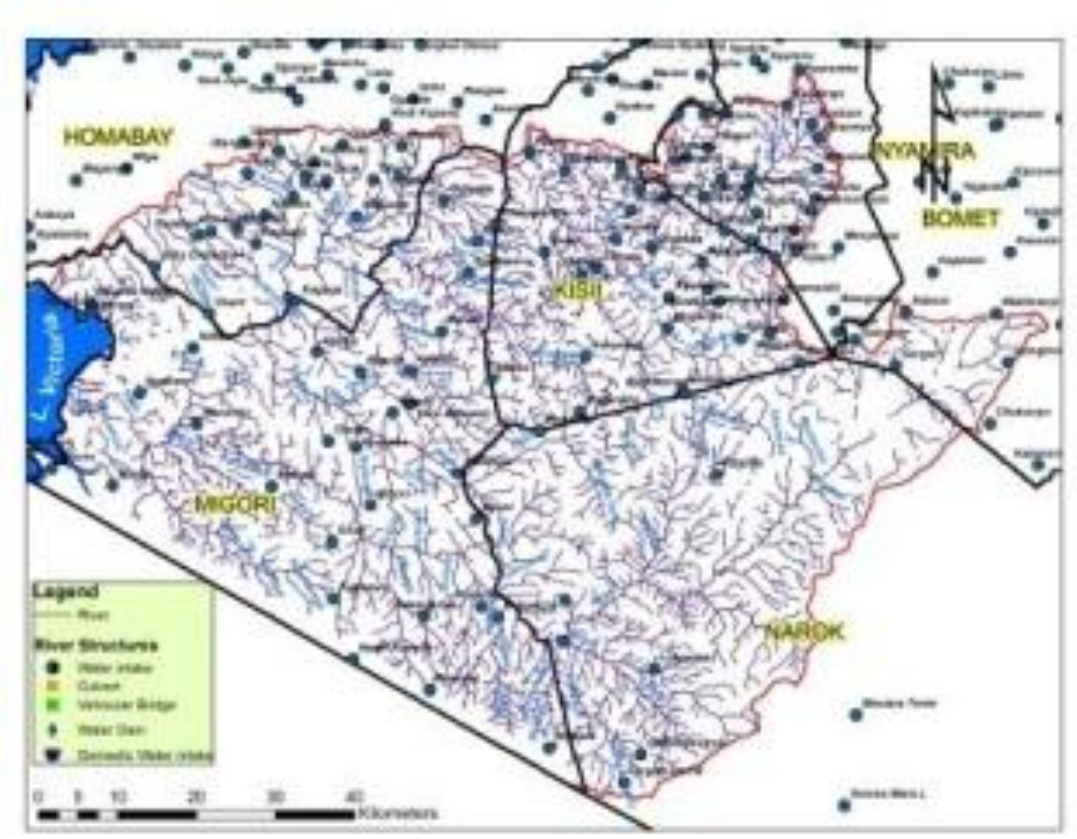


Figure 0.1 Counties wherein Gucha Migori River Basin lies

The Gucha Migori river basin belongings to the jurisdiction of WRMA-LVSC Southern Shoreline Sub Regional Office (SRO) concerning the general water resource management flood management inclusive flood management. Then, LOGUMI WRUA, Ongoche WRUA (Nyatike district), Nyangweta WRUA (Kenyenya district), Middile Gucha WRUA (Gucha district), Nyarwaba WRUA (Nyamarambe district), Chirichiro WRUA (Masaba district), Nyamache WRUA (Nyamache district), Kenyamware WRUA (Nyamira district) Upper Magor WRUA (Emuria Dikiri district) are established within the Gucha Migori river basin. In the flood plane of R. Gucha Migori there is the LOGUMI WRUA that is located within the Lower Gucha Migori Sub-catchment and implements grass-roots water management in

collarroboration with WRMA.

The principal flood damages are destruction of houses, enforcement of longterm evacuation, heavy losses of crops in the farmlands, contamination of water resources by polluted water diffusion, growing worse sanitary conditions and impassable roads and longer period of flood waater inundation of the villages within the flood prone areas etc.

The reason why floods occur is a result of heavy rains in the upstream that leads to heavy surface run-off water to flow into both R. Gucha and R. Migori systems. The surface run-off water erodes soil as it flows into the river leading to heavy sedimentation of the river channel as the water flows downstream. The heavy sediments are deposited downstream leading to shallow river channel in the downstream and with heavy and at a high spead river flows downstream the water overflows its banks leading to floods. On the other hand the flood plain area also experience flash floods from the neighbouring hills within the Lower Gucha Migori Sub-catchment. The flash floods lead to damage of houses and losses of properties, crops and livestock. The measures against floods will be important because the numbers of affected by floods with flood inundation of more than two months are more than three thousand (3000) every year.

Therefore the important point of the flood management policy in relevant river basin shall be mitigation against the impacts of flood damage which include disruption of the daily livelihood and lack of a hospitable and safe evacuation place moreover enlightment schemes that will make it easier,quicker and faster life-skills in recovery from the flood damages.

In the course of drawing up the flood management plan, the appropriate combination of structural and non-structural measures or the view point of “Self-help”, “Mutual support” and “Public assistance” should be considered. And also consensus building among the stakeholders through the participation of WRUA or communities should be implemented

WRUA and communities implement the distribution, evolution, maintenance of structural measures and non-structural measures with initiative.

WRUA and communities shall work together from the period of project planning so that incubate their ownership

The scoping period of this plan is 5 years from 2013 to 2018, the contents of plan will be revised properly in necessity.

THE ROLE AND RESPONSIBILITY OF WRMA

Main constituent of this plan is WRMA. WRMA should assist WRUA to make it possible for it to build realizable tasks in to the Sub-Catchment Management Plan (SCMP) by itself. In addition, WRMA provide the technical assistance to implement the countermeasures against flooding matters.

Concerning the tasks that WRUA has no initiative, WRMA shall precede the implementation of tasks while coordinating it with relevant stakeholders.

RIVER BASIN COMMITTEE

Flood management cannot achieve the objectives without the cooperation of various stakeholders within the river basin.

Some river basins are divided by plural sub catchment such as upper stream, lower stream, left bank and right bank.

According to this condition, WRMA shall establish "Integrated Flood Management River Basin Committee" in order to share the information concerning flood management and coordinate in river basin unit.

The stakeholders in the relevant river basin preferable to participate in the committee are listed below.

Table 1 The Stakeholders in Gucha Migori River Basin

No	Organization	Remarks
1	WRUAs within Gucha Migori River Basin	One representative from each of the nine WRUAs
2	Provincial Administration	District Commissioner, Nyatike district
3	Ministry of State for Special Programmes	Active in providing humanitarian assistance to disaster victims in Lower Gucha Migori area
4	CFMOs within LOGUMI SC	One representative from each CFMO
5	Ministry of Water and Irrigation	Migori County Director for Water
6	Heads of Evacuation Places (Nyora and Kabuto Primary Schools)	One representatives from the two schools that act as evacuation places
7	Ministry of Agriculture	Nyamira County Director and District Agricultural Officer Nyatike
8	Ministry of Forestry	Narok County Director
9	Ministry Of Education	District Education Officer Nyatike
10	Kenya Meteorological Department	Contact Person at National Level
11	Lake Basin Development Authority (LBDA)	Representative from Kerian Sub-regional Office
12	National Environmental Management Authority	Migori County Director
13	Blue Cross	One representative
14	Kenya Red Cross	Representative from Migori Branch
15	World Vision	Representative from Regional Office
16	CAAC	CAAC member
17	Fishermen	One representative
18	Farmers	One representative
19	Environment/Natural Resources Management CBOs	Environment representative
20	Religious Group	One each from downstream, midstream and upstream
21	Kenya Forest Service	CAAC member
22	Department of Social Services	Registers WRUAs and other social welfare groups
22	Kenya National Chamber of Commerce and Industry	Gucha Migori chapter
23	Catholic Diocese of Gucha Migori	One representative
24	WRMA	HQ, RO, SRO

In the committee, exchanging of opinions between the relevant stakeholders, approval of flood management plan, consensus building, discussion of role sharing and activity evaluation etc. shall be done

Committee members shall be discussing about the following themes once in every some

months for the time being.

Tabel 1 The Schedule of Integrated Flood Management Committee Meeting(Draft)

	Discussion Themes	Remarks
1st Meeting	・Information sharing on current situation and problems in flooding ・Discussion on conceivable flood measures	Held on 18th Dec. 2013
2nd Meeting	Cause & Effect of floods in Gucha Migori	Held on 27th Feb. 2014
3rd Meeting	Draft IFMP and building consensus on the draft IFMP	Tentative date 10th April 2014
4th Meeting	Methods of incorporating the IFMP into the SCMP, CMS, county government strategic plans	Tentative date 22nd May 2014
5th Meeting	Prioritization of countermeasures and identifying avenues for funding the implementation	Tentative date 26th June 2014

ENVIRONMENTAL AND SOCIAL CONSIDERATIONSONS

On planning the flood measures project, the appropriate environmental and social consideration shall be done based on Kenyan regal code “Environmental Management and Coordination Act (EMCA) 1999”.

OUTLINE OF GUCHA MIGORI RIVER BASIN

Gucha Migori River Basin is located at the northern part of the piedmont of Mt. Kenya in the central part of the Republic of Kenya.

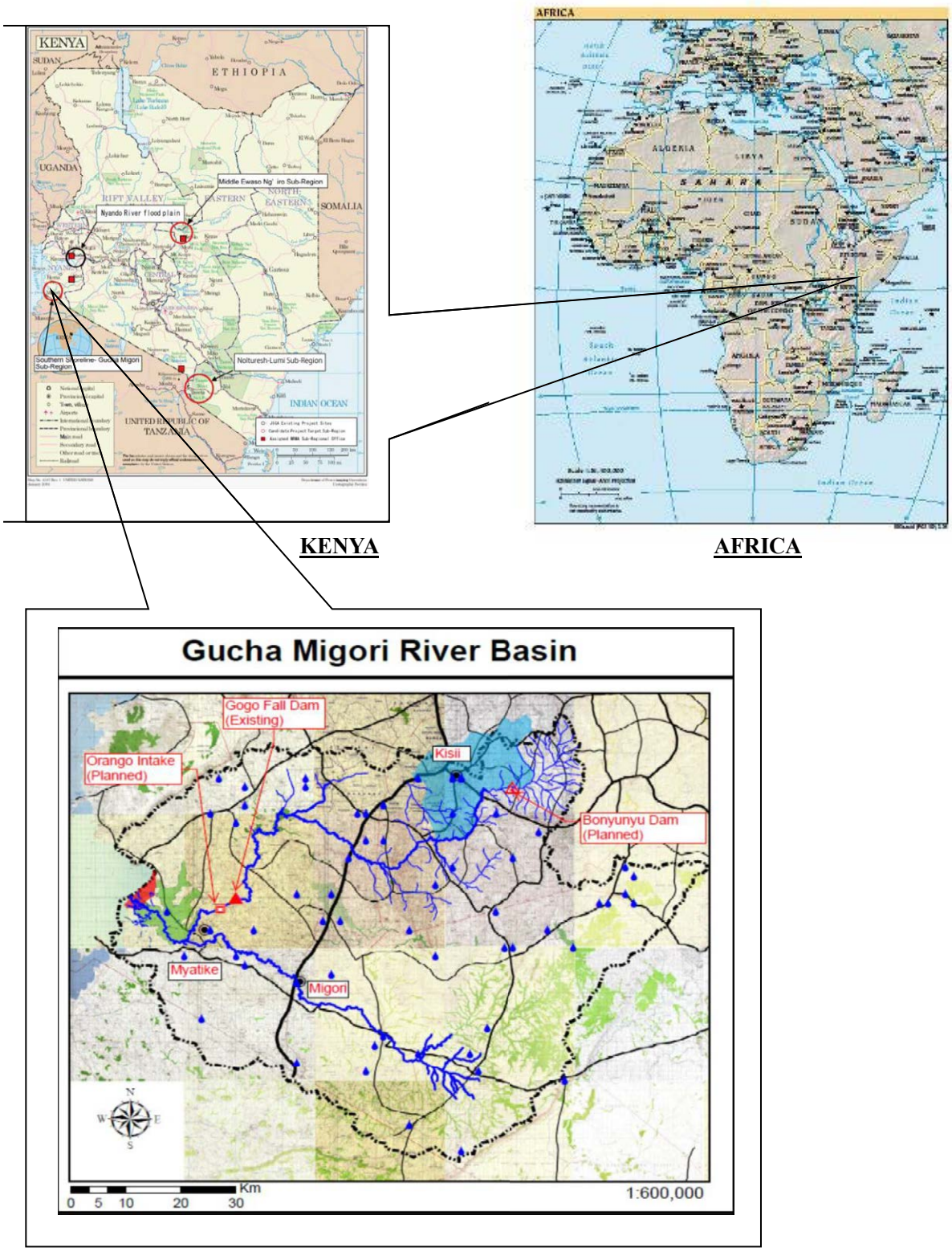


Figure 0.1 Records of Flood Damage in the Gucha Migori River Basin

Natural Conditions

1.1.1 Background

Wikipedei the Free Encyclopedia explains concerning R. Gucha as follows: Gucha River, referred to River Kuja by Luo community starts from the highlands of Kiabonyoru in Nyamira county passing through the heart of Gucha District running west through Migori Town where its Joined by other smaller rivers then into Lake Victoria. Streams, as it runs across the Gusii Land come together and one of them being Mogonga River, known by every Kisii of its deadly effects it leaves behind when it floods. Mogonga and Gucha are almost equal in size and they meet just 1 mile before entering into Ogembo Town Center.

It further explains concerning Migori town as follows: Its elevation is roughly 1500 meters above sea level (asl.) at Kakrao descending by 100 m asl. into the Migori river. The different peaks near the town are a little over 1550 m asl.

The graphic description of the Gucha Migori based on a study carried out in 1976 is as indicated in the figure 2.2 below:

Source: Preliminary Report No. 14 Agricultural University Wageningen Netherlands
Training Project in Pedology Kisii, Kenya

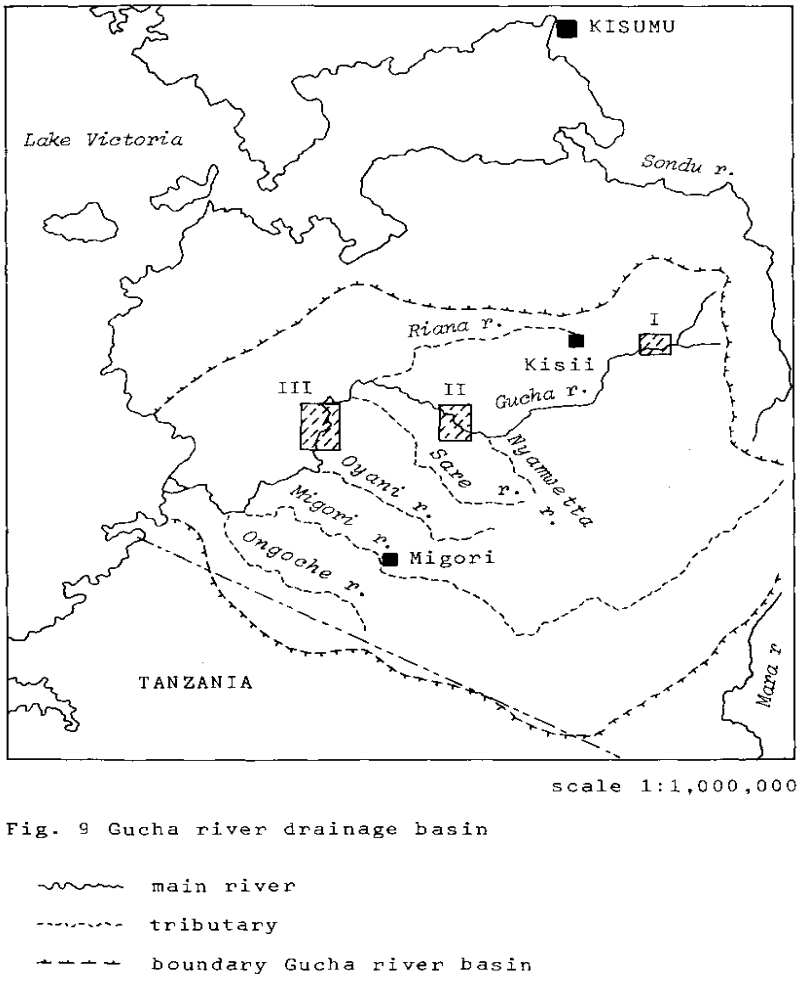


Figure 0.2 Gucha Migori River Basin Map as at 1976

1.1.2 Topography , Vegetation and Soil

(1) Topography, Geology and Vegetation

Gucha-Migori River Basin cuts across five counties i.e. Nyamira County, Kisii County, Narok County, Homa Bay County and Migori County. The Gucha-Migori River Basin is therefore located on the south-western corner of the Lake Victoria Basin in western Kenya. The R. Gucha has its source in the of Nyamira county, which rise up to nearly 3,000 m.amsl at Kiabonyoro peak GPS location Altitude1653M South 00034'07.6" East 034058'50.3".

The Migori River has its source in Chepalungu forest, at altitudes of around 2,000 m.amsl, and drains a large area west of the Sirian Escarpment which shields the Maasai Mara to the east. The two rivers together have a catchment area which spans over 6,900 km² in Nyamira, Kisii, Migori and a section in the western-most Narok counties. At the confluence of R. Gucha and R. Migori near Macalder Mines, about 30 km from their mouth on Lake Victoria the mean annual runoffs (MAR) of the Gucha and Migori rivers are estimated at 1,083 and 609 Mm^3/year respectively. At the outflow to Lake Victoria the MAR is estimated at 1,884 Mm^3/year. Figure 1.2.[1]

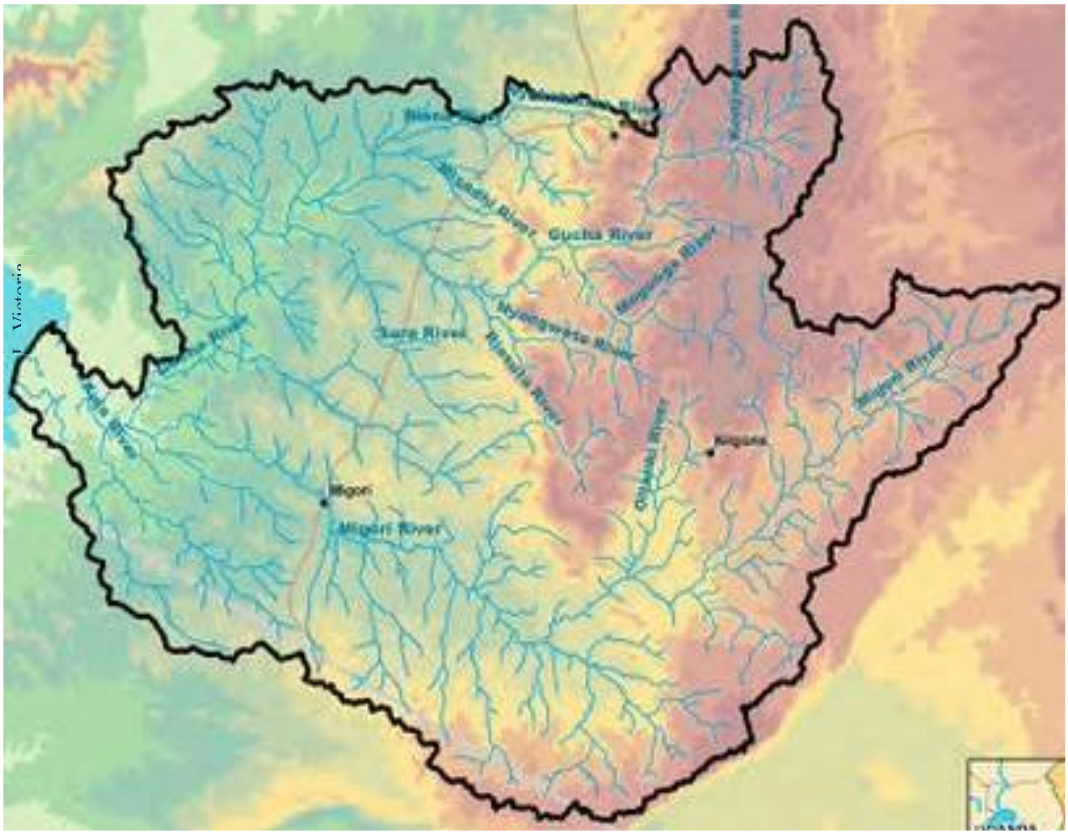


Figure 0.3 Gucha Migori River Basin Map

Source: Identification of Multipurpose Water Resources Development Project in Gucha Migori River Basin In Kenya: Final Strategy Report

[1] Identification of Multipurpose Water Resources Development Project in Gucha Migori River Basin in Kenya: Final Strategy Report

The geology of the Gucha catchment consists mainly of old Bukoban system rocks which are of Palaeozoic age. Those within the catchment are represented by the Kisii series. A narrow belt of Precambrian and Kavirondian systems of rock occur in the lower western parts of the catchment. The Bukoban system consists of a broad north-south belt of acidic volcanics with a narrow belt of quartzite and escarpments. On the far western andsoutheastern parts of the catchment is found a quartzitic belt which is sandwiched by a broad belt of basalt. Kisii soapstones within the central parts of of the catchment are derived from the basalt by hydrothermal activity. Post-Kavirondian conglomerates, grits and sandstones are predominant in some parts of the catchment such as Wanjare-South Mugirango. Most of the western parts lie within the rhyolite and tuff belt. Western parts that border the South Nyanza district are predominantly covered by porphyritic and non-porphyritic felsite and andésite.

The Gucha River rises from an elevation of 1500M at its confluence with Gucha-Migori to 1800M in the Kisii uplands which in some parts rise up to an altitude of 3000M. The main watershed of the Gucha River occurs within the Kisii uplands which are above the sub-Miocene erosion surface (Pulfrey, 1960).[2]

To understand the slope in the river basin, the basin has been divided into three slope units as follows: a) upstream slope unit, mistream slope unit and downstream slope units. These slope units have different slope gradient and slope form depending on the location. The slope gradient is in percentage (%) while the slope form is the profile curvecature. The slope gradient in Gucha Migori varies from 0-5% to 5%-10% in the downstream with slope form of concave, 10-15% to 20-25% in the midstream with slope form of convex but irregular and 25% to over 40% in the upstream with slope form of convex in most parts.

Land use characteristics of Gucha Migori River Basin are shown on Figure 0.4. In the upstream areas there are extensive agricultural activities. The land in the upstream is arable leading to deforestation. In Kisii highlands the population is huge compared to the available land. In the upstream especially in the Kisii highlands Eucalyptus trees have been extensively been planted. There is heavy brick-making in Nyamira district due to the nature of the soil in the area. In Transmara there has been a shift from livestock keeping to commercial agriculture that has led to heavy deforestation. Most of the forests in Transmara are owned by individuals who engage in charcoal production. The forest cover in Transmara district is mainly indigeneous trees. In the midstream of Gucha Migori River Basin, the land is arable and there is heavy investment in sugarcane and tobacco farming. In the midstream the trees are conserved in the hilltops. In the downstream the land is fertile and arable but the climate is semi-arid and vegetation cover is mainly savanna grasslands.

2) Soil Erosion in Gucha Migori River Basin

Soil erosion is a serious problem in the Gucha catchment, bank and channel erosion are partly

[2] Impact of hydrological and land use processes on the quality of water in the Gucha catchment, southwestern Kenya

responsible for the sediments transported by the river. In addition cultivation in areas adjacent the river also contributes to the observed sediment transport rates. Other factors in sediment production are untarmacked and feeder access roads (Omari, 1986). The average suspended sediment concentration is 325.5 ppm while the total sediment transport rate is 0.4 x 106 t year"1 (Ongwenyi, 1979).[3]

The following figures indicate:

i) The Longitudinal Profile for the R. Gucha Migori is as indicated in the Figure 2.3

ii) Landuse map in the river basin is indicated in Figure 2.4.

[3] Impact of hydrological and land use processes on the quality of water in the Gucha catchment, southwestern Kenya

Source: Preliminary Report No. 14 Agricultural University Wageningen Netherlands Training Project in Pedology Kisii, Kenya

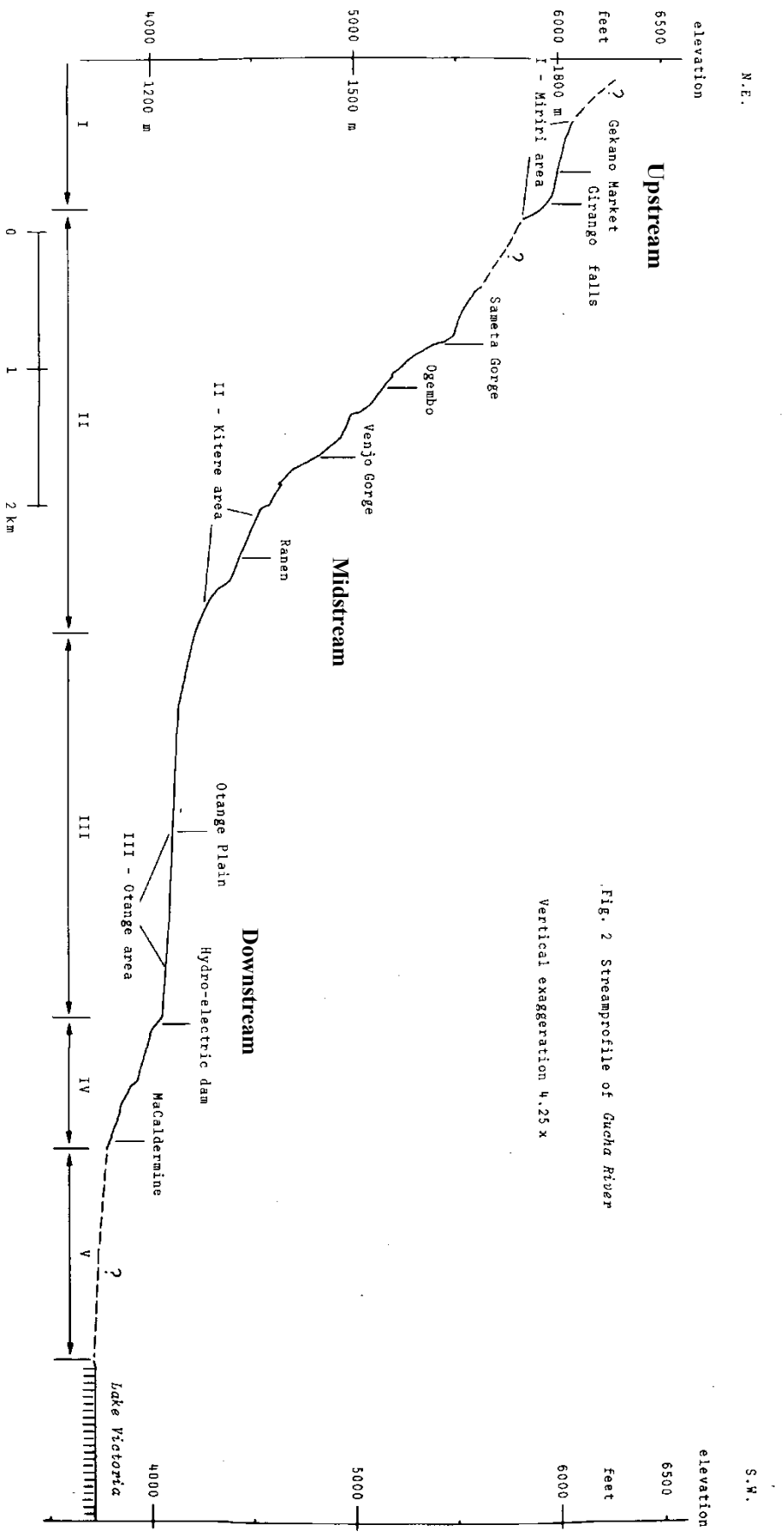


Figure 0.4 Longitidunal Profile for Gucha Migori River

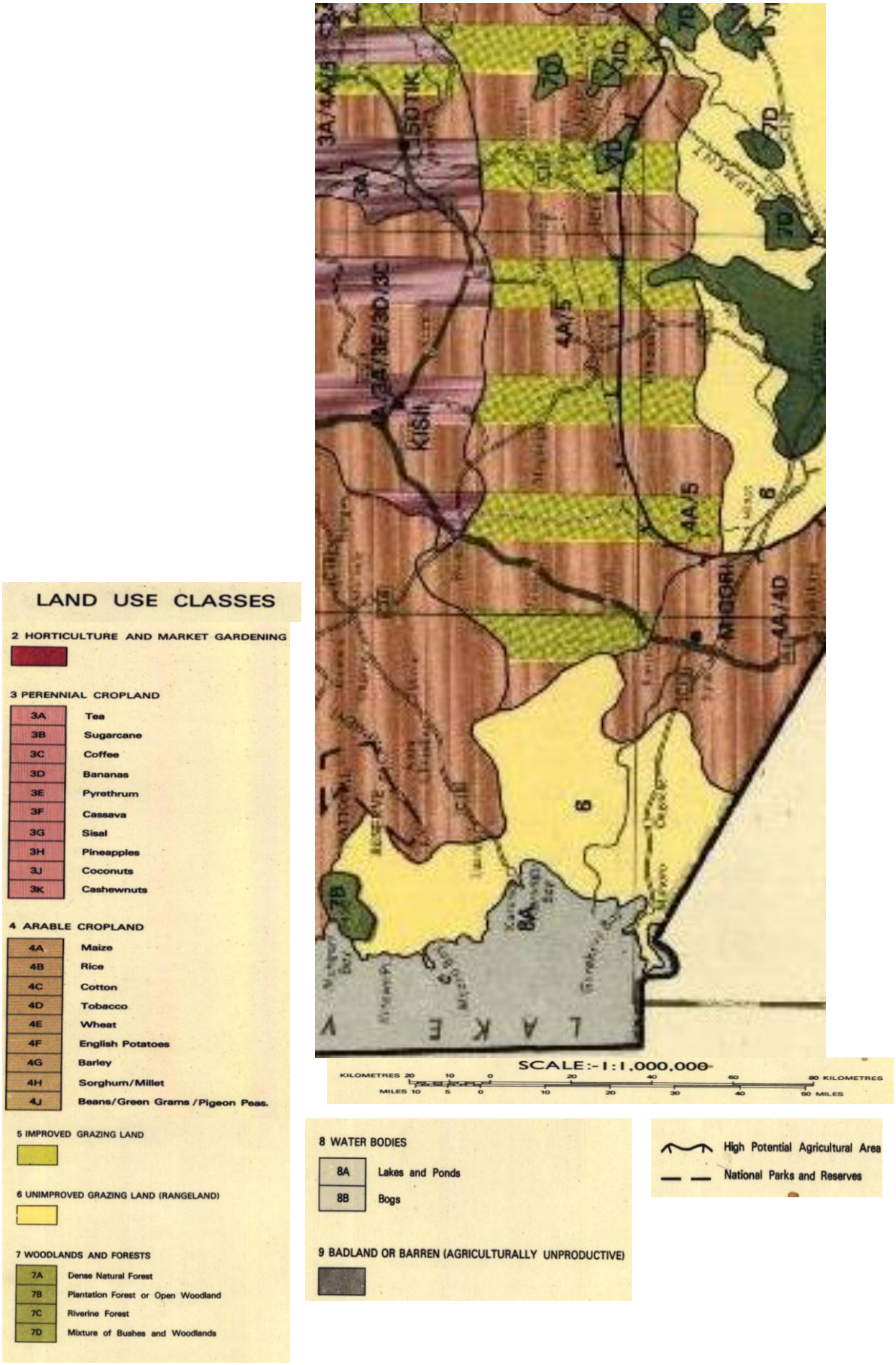


Figure 0.5 Distribution Map of Topographic Slope of Gucha Migori River Basin

(2) Soil

Soil Distribution Map of Gucha Migori River Basin is as per Figure 2.5. The upstream of Gucha system consist of the fertile reddish volcanic loamy soils that cover most parts of Kisii and Nyamira highlands. The upstream of Migori system consist of fertile alluvial grayish clay soil. The midstream area is mainly covered by fertile grayish clay soil and some areas area sandy. The downstream is covered by grayish clay soil in some parts, while other parts are covered by black cotton soil and near the river it is characterized by clay soil and sandy soil.

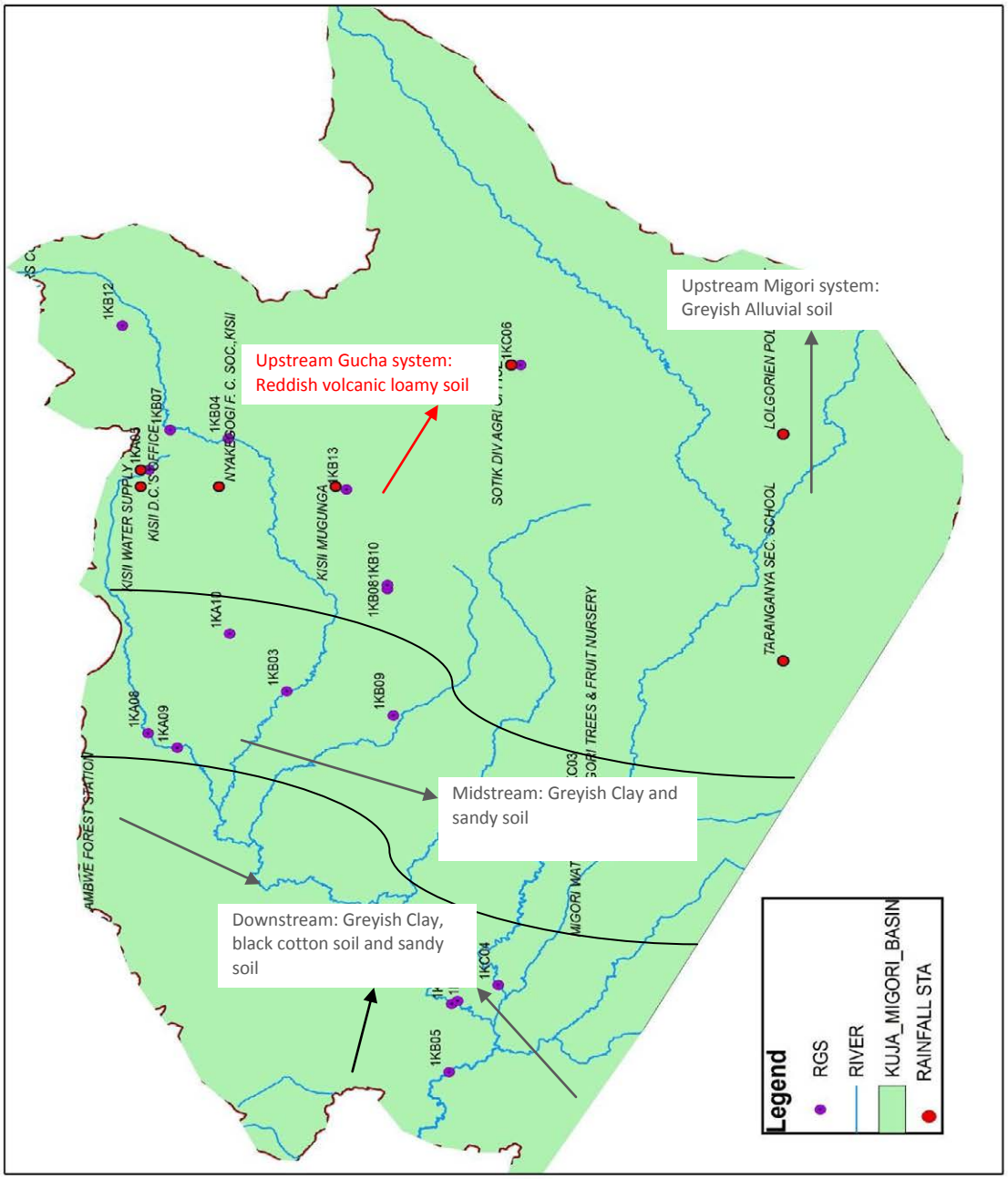


Figure 0.6 Soil Distribution Map (Soil texture)

1.1.3 River Characteristics

(1) Riverbed Materials

The R. Gucha Migori is a river that forms after two big rivers join together to drain its water into Lake Victoria. It is wide with some places like Sango having a width of approximately one hundred and twenty metres (120M). It is imperative therefore to highlight the river bed materials from the source to the Lake. The table 2.1 below therefore indicate the riverbed materials for both R. Gucha and R. Migoriand R. Gucha Migori after the confluence.

Table 2.1 Location and Riverbed Materials in R. Gucha Migori

SN	Place	River Name and features	Riverbed Material
1	Getengerine in Kiabonyoru, Nyamira District (This area is where the source of R. Gucha is located)	R.Gucha (at the source)	Pebbles and water is very clean
2	Magombo in Kenyerere in Nyamira District	R. Gucha	Rocks and water is very clean
3	Rigwero in Nyamira District	R. Kanyamware a tributary of R. Gucha	Rocky riverbed, water not clean and cattle treads noted on the riverbanks
4	Gekano-Kanyamwere boundary. (There is a confluence of R. Gekano; R. Kanyamware and R. Gucha)	Confluence of R. Gekano and R. Kanyamware all joining into R. Gucha	Pebbles, soil sediments riverbed, water is brown in colour and riverbank erosion noted
5	Kianwarimu-Gekano bridge	R. Gucha	Pebbles, soil sediments riverbed, water is brown in colour and riverbank erosion noted
6	Gekano area in Nyamira district	R. Gucha	Soil sediment with few pebbles riverbed, water is brown in colour and the riverbank erosion is pronounced
7	Esani bridge in Esani area boundary of Manga and Boribari District. The place experiences floods during rainy season	R. Gucha	Soil sediment (sandy) and pebbles riverbed, water is brown in colour and the riverbank erosion is pronounced
8	Kegati Water plant in Kisii Town (Water suppy plant for Kisii)	R. Gucha	Rocky and soil sedimentation riverbed and water is brown in colour after the intake
9	Ogembo Bridge in Gucha District	R. Gucha	Rocky and soil sedimentation riverbed and water is not clean
10	Sare Bridge in Awendo Town	R. Sare a tributary of R. Gucha	Rocky and sandy riverbed; overgrown vegetation on some parts of the river channel water is brown in colour
11	Oyani Bridge in Awendo town	R. Oyani a tributary of R. Gucha	Rocky and sandy riverbed; run-off surface water from surrounding hill flow into river channel and water in the river is brown in colour
12	Gogo Kengen, Nyatike District. (A hydroelectric generation planted established during colonial era)	R. Gucha	Rocky and sandy riverbed
13	Daraja Aego, Nyatike District	R. Gucha	Rocky and sandy riverbed and wooden logs in the river channel

14	Sango area in Nyatike district. (This is where the confluence of R. Gucha and R. Migori is located)	R. Gucha Migori	Rocky and sandy riverbed; Sediment deposits that has led to gold mining when the water levels of the river reduces
15	Wath Onger (This is Lower Gucha Migori Area)	R. Gucha Migori	Rocky and sandy riverbed and wooden logs in the river channel
16	Onyinjo Area	R. Onyinjo a seasonal river that flows into R. Gucha	Rocky riverbed with overgrown vegetation in some parts of the river channels
17	Mirogi	R. Mirogi that flows into R. Gucha	Rocky riverbed water is dirty and in some places the water seems stagnant
18	Oljoposei Area in Transmara District	R. Oljoposei draining into R. Migori	Rocky and pebble riverbed and the river channel is narrow
19	Kaposorwa in Transmara District	R. Moiguiet	Soil sedimentation riverbed, narrow channel and watering point for livestock
20	Kapng'eno area in Transmara District (this is where the confluence of R. Moiguiet and R. Migori is located)	R. Moiguiet joining R. Migori	Confluence of two rivers and velocity of both rivers is high, natural indigenous trees noticeable and soil sedimentation riverbed
21	Magor bridge in Transmara East district	R. Migori	Soil sedimentation riverbed, water levels low during dry season and very high during rainy season
22	Esoit-Naibor area	R. Migori	Rocky riverbed and wooden logs noticeable in the river channel
23	Mikei area in Nyatike District	R. Migori	Rocky and sandy riverbed and community people use different points for gold ore washing
24	Enoosaen area in Keyian division Transmara District	R. Enoosaen a tributary of R. Migori	Rocky and sandy materials. Lots of car washing activities within the river channel
25	Enoosaen area in Keyian division Transmara District	R. Enoosaen a tributary of R. Migori	Pebbles and sand alluvial materials
26	ASTU, Indiyano Sub-location Transmara District	R. Remo a tributary of R. Migori	Rocky, pebbles and sand alluvial materials.
27	Ndiri area Transmara District	R. Ndiri a seasonal river and tributary of R. Migori	Rocky, pebbles and alluvial soil sediments materials. Water at some points the flow is very slow almost stagnant
28	Transmara-Kuria boundary bridge	R. Migori	Rocky and sand alluvial materials.
29	Nyeikute village, Komanga Sub-location in Kuria-Kihancha District	R. Nyogoto a tributary of R. Migori	Rocky and sand alluvial materials.
30	Daraja ya Masaba area boundary of Nthiange and Masaba sub-locations in Kuria District	R. Bungenech a tributary of R. Migori	Rocky and sand alluvial materials.
31	Hibwa Area in Kuria District. (This is where a conluence of R. Bosara and R. Nyandara is and thus forming R. Hibwaa)	R. Hibwaa a tributary of R. Migori and starts at the confluence of R. Bosara and R. Nyandara (both sources are in Tanzania)	Rocky, pebbles and sand alluvial materials.
32	Ragane Area near the boundary of Kuria and Migori districts	R. Ragena a tributary of R. Migori	Rocky and pebbles materials.

33	Migori Bridge in Migori Town	R. Migori	Rocky and sand alluvial materials.
34	Nyasare Estate in Migori town	R. Nyasare a tributary of R. Migori	Rocky, pebbles and sand alluvial materials.
35	R. Migori at Nyasare area in Migori town	R. Migori	Rocky and sand alluvial materials.
36	Nyamure in Magina area in Migori town	R. Nyagugo also known as R. Nyamure about 100M to R. Migori	Rocky, pebbles and sand alluvial materials.
37	Kakrao area	R. Nyasarara that drains into R. Migori	Rocky, pebbles and sand alluvial materials and is crystal in colour.
38	Othatcho location near othatcho hills	R. Othatcho (spring) that drains into R. Migori	Pebbles and soil sediment materials and is crystal clear
39	Eko area, Ajego Sub-location, Othatcho location	R. Eko a tributary of R. Migori	Rocky and soil sediment materials
40	Nyarogi Sub-location, Othatcho location	R. Nyakonya a tributary of R. Migori	Rocky and soil sediment materials
41	Kadem south - Othatcho locations boundary	R. Owich a seasonal river and a tributary of R. Migori	Rocky and soil sediment materials
42	Mikei area in Nyatike District here after the R. Migori moves towards confluence with R. Gucha at Sango area in Lower Gucha Migori SC	R. Migori	Rocky and sandy riverbed and community people use different points for gold ore washing

Source JICA Project Team

(2) River Structures

River Gucha Migori has two river systems i.e. River Gucha system and R. Migori system. Along these two systems there are various river structures constructed therein along the river or besides the river in the two river system.

The pictures in table 2.2 below are divided in the respective river system and indicate the river structures and riverbed materials along R. Gucha Migori from the upstream, midstream and downstream.

Table 2.2 Pictures of the River Structures along R. Gucha Migori

River Gucha System: Upstream	
	
Description : R. Gucha at its source in Getengerine village in Kiabonyoru and community members use it for domestic use	Description : R. Gucha at its source in Getengerine village in Kiabonyoru,Nyamira District the river channel is narrow
	
Description : Magombo in Kenyerere in Nyamira District the water in the river channel is colourless and clean with rocky riverbed	Description : Magombo in Kenyerere in Nyamira District the river structure is a culvert constructed for purposes of road transport
	
Description : R. Kanyamwere a tributary of R. Gucha located in Rigwero area in Nyamira District, the river water starts changing colour and the riverbed material is rocky	Description : R. Kanyamwere a tributary of R. Gucha located in Rigwero area in Nyamira District, the river acts as watering point for livestock and thereis a vehicular bridge

	
Description : Confluence point at Gekano-Kanyamware boundary where R. Gekano and R. Kanyamware join and both drain into R. Gucha. Riverbed material is pebbles and soil sediments and there is riverbank erosion	Description : Gekano-Kanyamware boundary the river structure is a seventeen metre (17M) concrete vehicular bridge that links two sub-locations and there are brick making works by community members just 20M from the river
	
Description : Kianwarimu-Gekano area where the water is light brown greyish in colour and the riverbed material is pebbles and soil sediments and there is riverbank erosion	Description : Kianwarimu-Gekano area here there is a twenty metre (20M) steel footbridge constructed and blue gum trees are planted in the riparian areas
	
Description : R. Gucha widens at Gekano area in Nyamira district as it flows downstream riverbed material is soil sediments with few traces of pebbles	Description :Gekano area in Nyamira district where there is a river structure a drainage canal dug by community members to channel water from their nearby hills into the river channel

	
Description : Esani area boundary of Manga and Boribari Districtriver structure includes a vehicular bridge constructed on the murram road that links Manga and Boribari	Description : Community member from Esani explains how the drainage canal was dug and now it protects the bridge from being flooded but the nearby school still get affected by floods during rainy seasons
	
Description: Kegati area in Kisii Town the river water is brown in colour and riverbed material is rocky and soil sediment there is minimal riverbank erosion	Description : Kegati area in Kisii Town the river structure includes water intake that supplies Kisii town
	
Description : Kegati area in Kisii Town the river structure includes vehicular bridge that KisiiNarok road passes over the R. Gucha	Description : Kegati area in Kisii Town the water flows downstream and there is vegetation cover in the riparian areas

	
Description :Ogembo town in Gucha District the river water is brown in colour and riverbed material is rocky and soil sediment there is minimal riverbank erosion	Description :Ogembo town in Gucha District the river structure includes vehicular bridge that KisiiKilgorisroad passes over the R. Gucha
	
Description : Ogembo town in Gucha District the river structure includes the gabion works used to reinforce the vehicular bridge that KisiiKilgoris road passes over the R. Gucha	Description : Ogembo town in Gucha District the river structure includes the under construction footbridge that will give pedestrian easy access to the market stalls

River Gucha System: Midstream

	
Description : Sare bridge in Awendo town R. Sare a tributary of R. Gucha. The river water is brown in colour and riverbed material is rocky and sandy there is minimal riverbank erosion	Description :Sare bridge in Awendo town the river structure includes the gabion works used to reinforce the vehicular bridge that KisiiMigori road passes over the R. Sare

	
Description : Oyani bridge where R. Oyani a tributary of R. Gucha passes under. The river water is brown in colour and riverbed material is rocky and sandy there is minimal riverbank erosion	Description : Oyani bridge inear Awendo town the river structure includes the gabion works used to reinforce the vehicular bridge that KisiiMigori road passes over the R. Oyani and their debris in river channel
	
Description : Onyinjo bridge where seasonal R. Onyinjo a tributary of R. Gucha passes under. There are overgrown vegetation within the river channel and the riverbed material is rocky	Description : Mirogi bridge the river structure includes the vehicular bridge that Sori-Rongo road passes over the R. Mirogi in which the water is greyish in colour and some point stagnant and riverbed material is rocky

River Gucha System: Downstream

	
Description : GogoKenGenGogoin Nyatike district R. Gucha flows downstream and the water colour is brownish and the riverbed material is rocky and soil sediments	Description : GogoKenGenGogo Hydroelectric plant on R. Gucha. River Structures include dam, water intake and footbridge. The dam is silted

	
Description : GogoKenGenGogo Hydroelectric plant on R. Gucha. The water flows at high velocity	Description : GogoKenGenGogo Hydroelectric plant on R. Gucha. The dam is silted leading to vegetation growth in some parts of the dam
	
Description : DarajaAego in Nyatike District, R. Gucha flows downstream and the water colour is brownish and the riverbed material is rocky and soil sediments. The river structure is the vehicular bridge on Migori-WathOnger road	Description : DarajaAego in Nyatike District, R. Gucha flows downstream and the water abstractors using pumps to pump into their lorry thereafter use the water to wash gold ore in the mines
	
Description : Sango area in Nyatike District, the confluence of R. Gucha and R. Migori the water colour is brownish and the riverbed material is rocky, sandy and soil sediments.	Description : Sango area in Nyatike District, the confluence of R. Gucha and R. Migori there is a huge deposit of soil sediments within the river channel which during rainy season is covered by water

	
Description : Sango area in Nyatike District, the confluence of R. Gucha and R. Migori the community members mine gold from the soil sediments deposited within the river channel during low rain seasons	Description : R. Gucha at the downstream where there is riparian encroachment with agricultural activities undertaken almost at the brick of the riverbanks
	
Description : WathOnger R. GuchaMigori flows downstream the water is brownish in colour and the riverbed material is rocky, sandy and soil sediments and in the river structure includes vehicular bridge on WathOnger-Muhuru Bay road	Description : WathOnger R. GuchaMigori flows downstream the water is brownish in colour and the river structure includes WRMA's river gauge station and in the river channel there are wooden logs debris
River Migori System: Upstream	
	
Description : Oljoposei Area in Transmara District, where R. Oljoposei which drains into R. Migori has riverbed material as rocky and pebble riverbed and the river channel is narrow	Description : Oljoposei Area in Transmara District, where R. Oljoposei which drains into R. Migori has river structure of a box culvert and community members use the river for washing their motorcycle

	
Description : Kaposorwa in Transmara District, R. Moiguiet that drains into R. Migori flows through. The riverbed material soil sedimentation	Description : Kaposorwa in Transmara District, R. Moiguiet which drains into R. Migori has river structure of a vehicular bridge and the river is a watering point for livestock
	
Description : Kapng'eno area in Transmara District, R. Moiguiet joins with R. Migori the area is the confluence of two rivers and riverbed material is soil sedimentation rand natural indigenous trees are noticeable	Description : Kapng'eno area in Transmara District, R. Moiguiet joins with R. Migori at this confluence there are no river structures and community members wade through water to cross the river
	
Description : Magor bridge in Transmara East district R. Migori flows through. The riverbed material soil sedimentation water levels are low during dry season and very high during rainy season	Description : Magor bridge in Transmara East district R. Migori flows under this bridge . The river structure is a vehicular steel bridge, there vegetation noted in the river channels

	
Description : Esoit-Naibor area in Transmara District, R. Migori flows downstream riverbed material is rocky riverbed and wooden logs noticeable in the river channel	Description : Esoit-Naibor area in Transmara District, R. Migori flows downstream river structure is a vehicular two compartment bridge
	
Description : Enoosaen area in Keyian in Transmara District, R. Enoosaen that drains into R. Migori flows downstream riverbed material is rocky and sandy	Description : Enoosaen area in Keyian in Transmara District, R. Enoosaen that drains into R. Migori flows downstream river structure is wooden footbridge and there are car washing activities
	
Description : Enoosaen area in Keyian in Transmara District, R. Enoosaen that drains into R. Migori flows downstream riverbed material is rocky and sand alluvial	Description : Enoosaen area in Keyian in Transmara District, R. Enoosaen that drains into R. Migori flows downstream river structure is eight cylindrical culvert of which 2 are blocked

	
Description : ASTU, Indiyano Sub-location Transmara District R. Remo that drains into R. Migori flows downstream riverbed material is rocky, pebbles and sand alluvial	Description : ASTU, Indiyano Sub-location Transmara District R. Remo flows through a river structure a box 3 compartment bridge for vehicular use and 2 cylindrical culvert compartments constructed as one unit
	
Description : Ndiri area in Transmara District, R. Ndiri that drains into R. Migori flows downstream riverbed material is rocky pebbles and alluvial soil	Description : Ndiri area in Transmara District, river structure is a vehicular Bridge; and parts of old structures of the decommissioned bridge and also a watering point for livestock
River Migori System: Midstream	
	
Description : Transmara-Kuria boundary bridge R. Migori flows downstream riverbed material is rocky and sand alluvial and the point acts as a watering point for livestock	Description : Transmara-Kuria boundary bridge R. Migori flows downstream river structure 5 compartments vehicular bridge

	
Description : Nyeikute village, Komanga Sub-location in Kuria-Kihancha District R. Nyogoto a tributary of R. Migori has riverbed material of rocky and sand alluvial	Description : R. Nyogoto a tributary of R. Migori has river structure box culvert for vehicular use; River overflows the bridge and affects the farms nearby
	
Description : Daraja ya Masaba area boundary of Nthiange and Masaba sub-locations in Kuria District R. Bungenech a tributary of R. Migori has riverbed material of rocky and sand alluvial. River catchment is intact with minimal human activities observed	Description : R. Bungenech a tributary of R. Migori has river structure of box culvert on the road that links the two locations i.e. Nthiange and Masaba sub-locations in Kuria District
	
Description : At the confluence of R. Bosara and R. Nyandara is where R. Hibwaa a tributary of R. Migori starts. Riverbed material are rocky, pebbles and sand Rocky, pebbles and sand alluvial	Description : R. Hibwaa has river structure a vehicular bridge and gabions. There are debris blockages on the bridge compartments

	
Description : Ragane Area near the boundary of Kuria and Migori districts. R. Ragane a tributary of R. Migori flows and riverbed material is rocky and pebbles and one of the river structure is the vehicular bridge	Description : R. Ragane a tributary of R. Migori flows and the river structure includes gabion works that reinforces the bridge and drainage canal that drains run-off water into the river channel
	
Description : Migori Bridge in Migori where R. Migori flows and riverbed material is rocky and sandy	Description : R. Migori flows downstream and there is a river structure i.e. bridge constructed above the river channel on an A1 road
	
Description : Nyasare estate in Migori Town: R. Nyasare a tributary of R. Migori and the rriverbed material is rocky, pebbles and sandy	Description : R. Nyasare as it flows downstream it has river structure which is 5 compartment cylindrical culvert and a house is constructed just beside the river

	
Description : On R. Nyasare there is also a run-off water drainage that drains into the river channel	Description : R. Nyasare drains into R. Migori which is about 100 M apart at this point. There are no river structures on R. Migori at this point but there are vegetation growing in the river channel
	
Description : Nyamure in Magina area in Migori Town: R. Nyagugoalso known as R. Nyamure a tributary of R. Migori and the rriverbed material is rocky, pebbles and sandy has river structure a 3 compartment cylindrical culvert and gabions	Description : R. Nyagogo drains into R. Migori which is about 200 M apart at this point. There are no river structures on R. Migori at this point but there are sand harvesting activities and the point acts as a watering point for the livestock
	
Description : Kakrao area in Migori district R. Nyasarara a tributary of R. Migori and the rriverbed material is soil sediments, rocky and pebbles	Description : R. Nyasarara that drains into R. Migori flows downstream river structure is 4 compartment cylindrical culvert of which some are blocked

	
Description : Othatcho location in Migori district R. Othatcho a tributary of R. Migori and the rriverbed material is soil sediments, rocky and pebbles	Description : R. Othatcho drains into R. Migori and has river structure a 1 compartment cylindrical culvert and on its channel there is a natural indentation on the river channel that acts as a reservoir for water during dry season
	
Description : Eko area, Ajego sub-location in Migori district R. Eko a tributary of R. Migori and the rriverbed material is soil sediments and rocky	Description : R. Eko has river structure is a vehicular bridge

River Migori System: Downstream

	
Description : Nyarogi sub-location in Othatcho location R. Nyakonya a tributary of R. Migori and the riverbed material is soil sediments and rocky	Description : R. Nyakonya that drains into R. Migori flows downstream through a river structure a vehicular bridge and on both side of the river there is riparian land encroachment

	
Description : Kadem south - Othatcho locations boundary R. Owich though a seasonal river is a tributary of R. Migori and the rriverbed material is soil sediments and rocky	Description : R. Owich drains into R. Migori aand has river structure which is a 2 compartment cylindrical culvert and water pollution is negligible by evidence of breeding of tadpoles and other marine life
	 
Description : Mikei area in Nyatike district R. Migori flows downstream to join with R. Gucha at Sango. The rriverbed material of R. Migori at this point is rocky and sandy and river structure is the vehicular bridge	Description : Wath Onger R. Gucha Migori flows downstream into the L. Victoria the riverbed material at this point is rocky and sandy and the water is brownish in colour. The river structure is a vehicular bridge and there is a WRMA automated and manual river gauge station

Source JICA Project Team

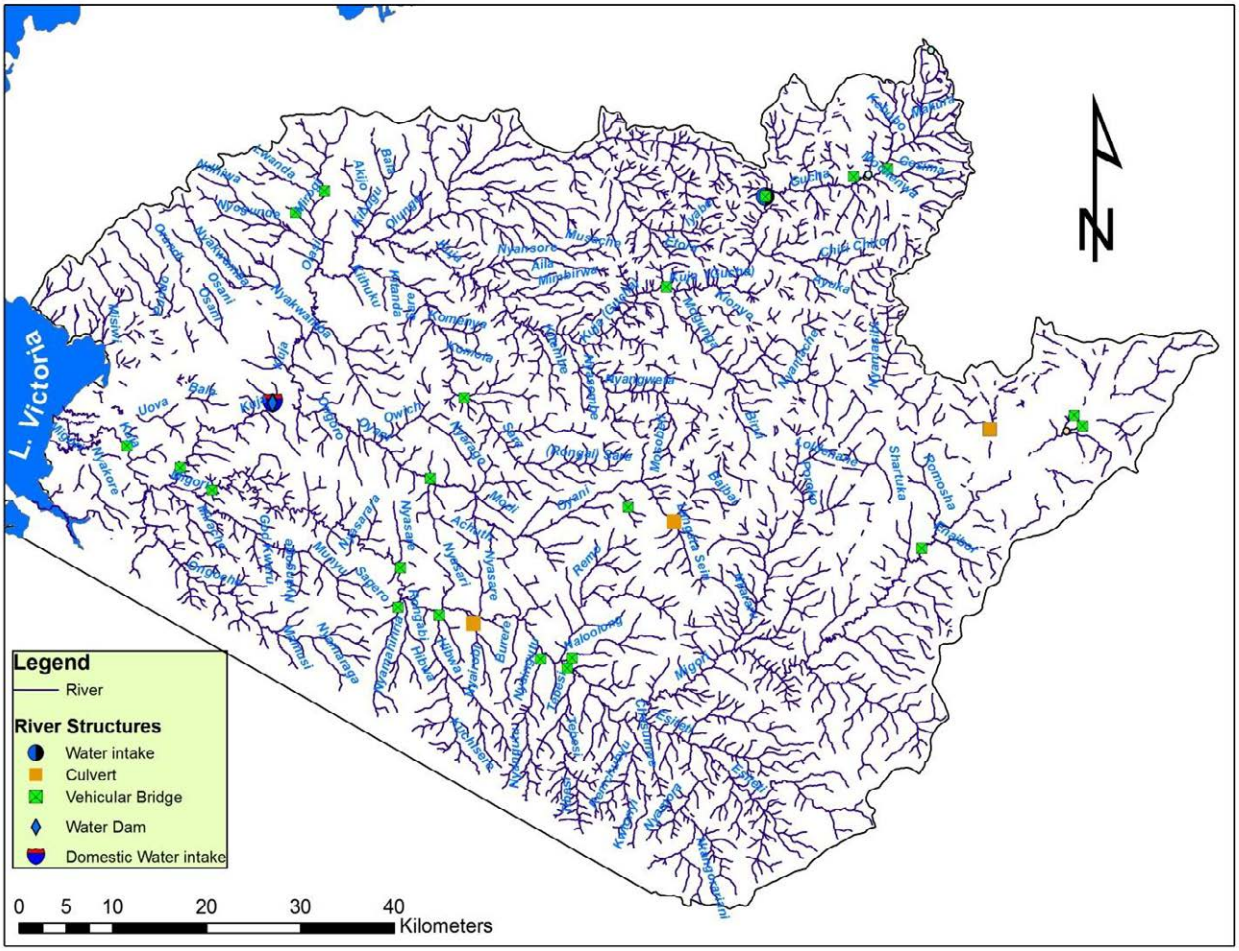


Figure 2.7 Gucha Migori River structures Map

(3) Changing of River Course

River Gucha Migori drains its water into Lake Victoria. The river changed its course in the year 2001-2002 to establish its current channel that flows through Kabuto Nyora villages in Lower Central Kadem. The initial channel was through Aneko village in Aneko location (previously known as West Kadem).

Interviews with community members revealed that before the river changed its course it had changed at least four times eastwards within Aneko bay.

The figure 2.6 shows the river channel on its old course, while figure 2.7 shows google map that indicates the new channel and figure 2.8 shows an updated map that indicates the new channel.

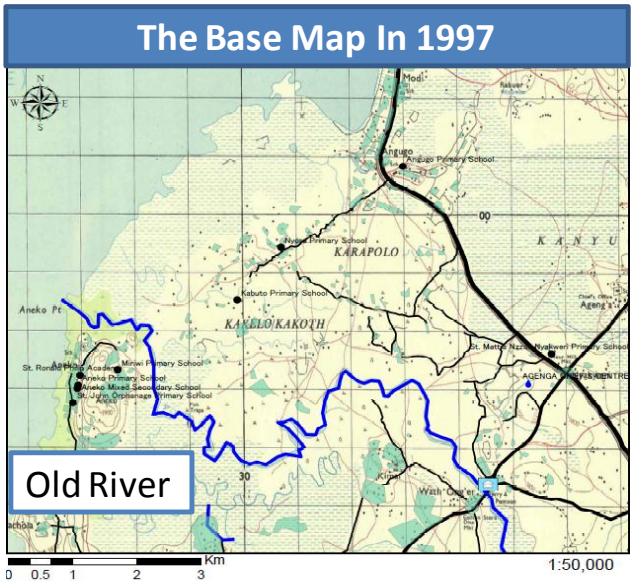


Figure 2.8 Old Map indicating old river channel

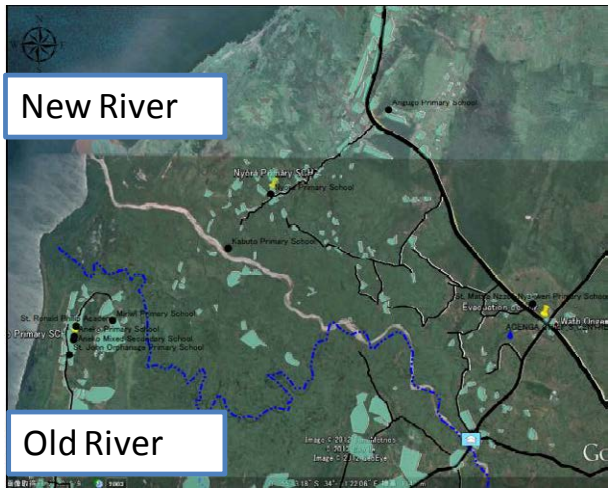


Figure 2.9 Satellite data on google Map indicating the new river channel

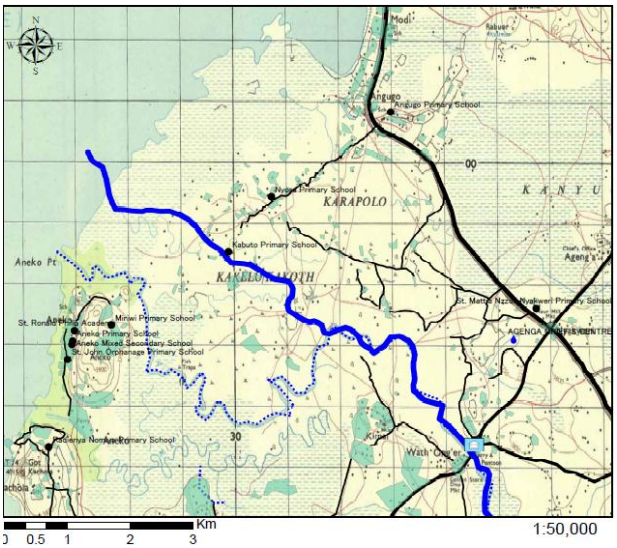


Figure 2.10 New updated Map indicating the new river channel

1.1.4 Hydrology and Meteorology

(1) Feature of Rainfall and Water Level Gauging Station

(a) Gauging Stations

Figure 2.9 shows locations of WRMA rainfall and water level gauging stations. Rainfall gauging stations are indicated in red colour, ● while the water level gauging stations are shown in purple ● colour.

Wath Onger River Gauging Station ID 1KB05 is located in the downstream of R. Gucha Migori i.e. after the two rivers R. Gucha and R. Migori having joined together and becoming a wide R. Gucha Migori.

Gucha Migori River Basin is endowed with river gauging stations strategically placed both on R. Gucha system and R. Migori System.

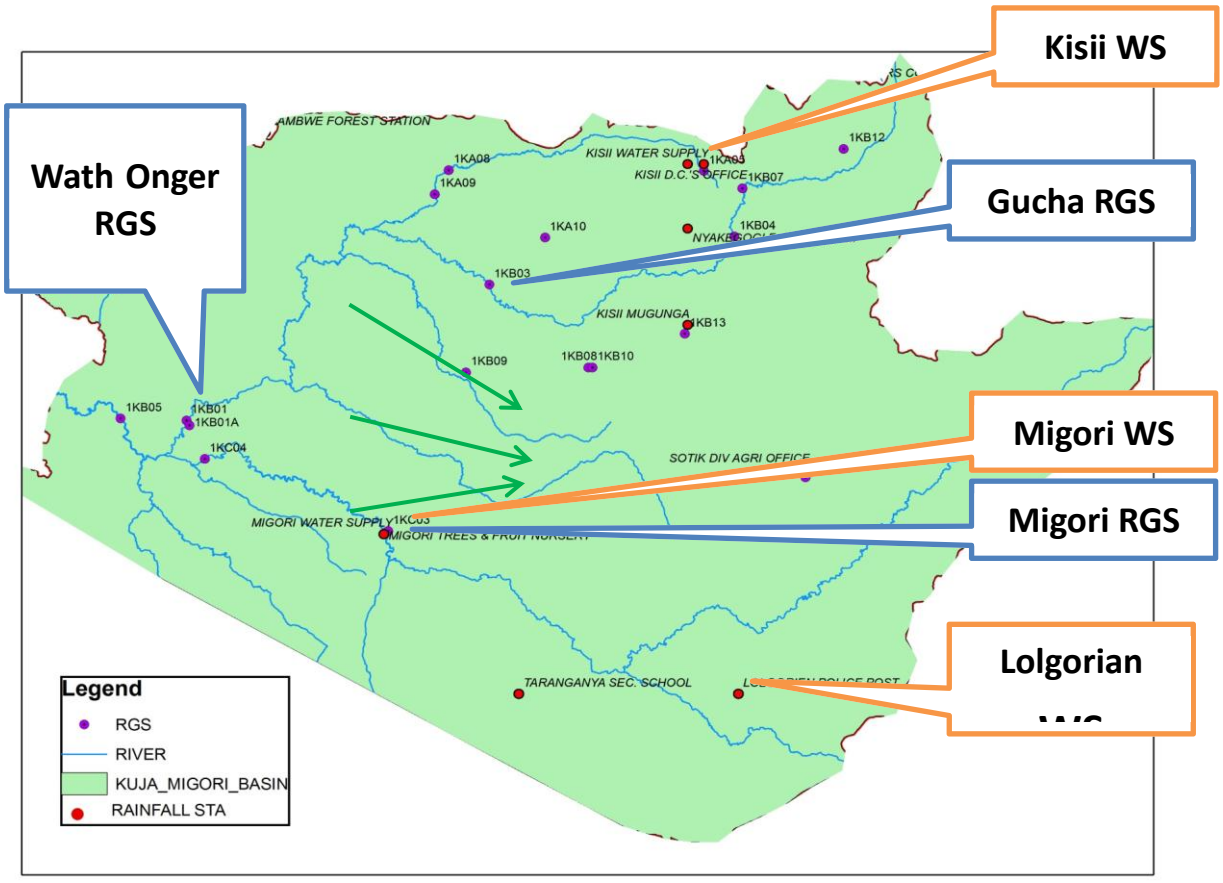


Figure 0.7 Location Map of Rainfall and Water Level Gauging Stations

Water Level Gauging Station No.:1KB11
Observation River：Oyani River

Water Level Gauging Station No.:1KC03
Observation River：Migori River
Special Note：Water level gauge is broken off and damaged.

Water Level Gauging Station No.:1KB05
Observation River：Gucha Migori River

Water Level Gauging Station No.:1KB05
Observation River：Gucha Migori River
Special Note：This is an automated gauge station that transmit data to WRMA Regional Office

(b) River Gucha Migori Discharge Data

The National Water Master Plan 1992 indicates the annual discharge for R. Gucha Migori as indicated in the Figure 2.10 below

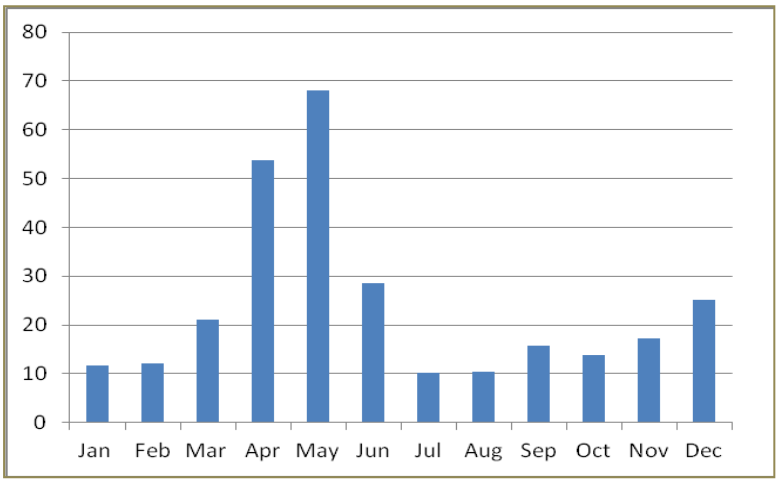


Figure 0.8 Annual Discharge R. Gucha Migori

Table 2.3 List of WRMA Rainfall Gauging Station within Gucha Migori River Basin

Station ID	Name	Status	Start Year
640	Keroka	Operational	
New	Nyamache tea factory	Not operational	
New	TDP-Kilgoris	Operational	
New	Lolgorian	Operational	
New	Nkararo	Operational	
9134025	Migori	Operational	
9134009	Muhuru bay	Operational	
9034093	Homabay	Operational	

Source: WRMA

(c) Water Level and River Discharge Observation Data

List of water gauging stations in Gucha Migori River Basin is shown on Table of the stations listed below, those stations obtained water level observation data is only Gauging Station Nos. 5DA07 indicated by color. Automatic measurement is not done at each water level gauging stations,

Table 2.4 List of Water Level Gauging Station in Gucha Migori River Basin

Station ID	Name	Status	Start Year
1KB12	Kenyamware	Operational	1970
1KB03	Gucha	Operational	1993
1KB05	Wath Onger	Operational	1980s
1KB11	Oyani	Operational	1970s
1KC03	Migori	Operational	1970s
1KC07	Enkaregituak	Operational	1970s

Source: WRMA

(2) Meteorology

Rainfall is in two seasons like in most of Kenya and the highest rainfall is between March and May. Average rainfall is approximately 1200 mm and above, but the rainfall patterns are unique, as the small town has three patterns of rainfall according to the neighborhood. It could rain in Kakrao but around Onyalo school would be very dry and Namba would have a slight drizzle.

There are several sub-counties (formerly known as districts) within the Gucha Migori River Basin. The climatic information of these districts is as follows:

a) Gucha Sub-county

i) Rainfall

The district experiences a highland equatorial climate. It receives an average of 1800 mm of rainfall annually with the long rains between March and June while the shortest rains are received from September to November. Hailstones are common occurrence during the short rains. July and January are relatively dry months. (Source: Gucha District Development Plan 2008-2012)

ii) Temperatures

The maximum temperatures in the district range between 21^{o}C to 30^{o}C while the minimu temperatures range between 15^{o}C to 20^{o}C. An average relative humidity of 80% is experienced in the district. (Source: Gucha District Development Plan 2008-2012)

b) Kisii Central District

i) Rainfall

The district has a highland equatorial climate resulting into bimodal rainfall pattern with an average annual rainfall of 2000 mm which is highly reliable. It has two rainy seasons the long rains occurring between February and June and the short rains occurring between September to early December. Dry spells however occur sometimes towards the ends of the short rains in some part of the district. (Source: Kisii Central District Development Plan 2008-2012)

ii) Temperatures

The high altitude of the district is expected to lower temperatures. However the proximity of the equator raises the temperatures to a mean annual maximum of 27^{o}C in the lowlands and minimum of 16^{o}C. The maximum temperatures of the highlands are 24^{o}C with a mean minimum of 14^{o}C. The coldest seasons are experienced in late June, July and August. (Source: Kisii Central District Development Plan 2008-2012)

c) Migori District

i) Rainfall

The district has a mild inland equatorial climate modified by relief altitude and proximity to the lake. Rainfall pattern ranges from 700 mm to 1800 mm annually, with short rains occurring between March and May while long rains fall during October to December. The lakeshore divisions experience unreliable and poorly distributed rainfall. (Source: Migori District Development Plan 2008-2012)

ii) Temperatures

The temperatures show a mean minimum of 17°C and maximum temperatures of 20°C with a high humidity and a potential evaporation of 1800 to 2000 mm per year. (Source: Migori District Development Plan 2008-2012)

The data on rainfall for the year 2009 provided by Nyatike District Agricultural Office is shown in the figure 2.11 below

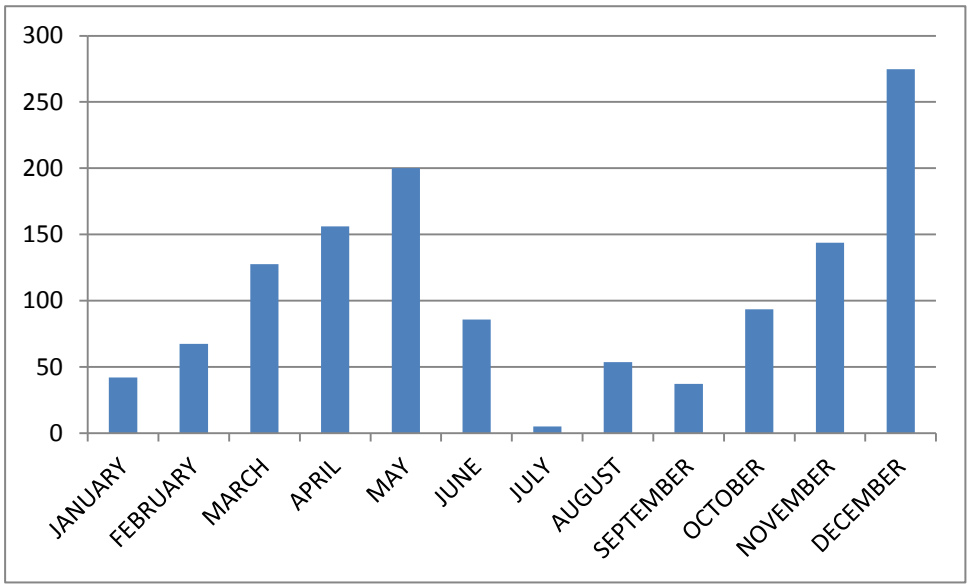


Figure 0.9 Annual Rainfall in Nyatike downstream of R. Gucha Migori

1.1.5 Lower Gucha Migori River Basin Floods

(1) Secondary Data

a) Background

The secondary data collected from Lake Basin Authority "RIVER PROFILE STUDIES VOLUME IV, LOWER KUJA, IRRIGATION DEVELOPMENT ANNEX II HYDROLOGY OCT 1985" reports that: The Kuja flow record at1KB05 provides an annual series of 15 years. Although this record is short it has the benefit of the station being reasonably calibrated up to 5.78M (534M^3/S). the highest level at which flows have been gauged by current meter; with the highesr observed level in 15 years being at 6.70M, under 1M higher than the maximum gauged by current meter. By contrast, records at 1KB1, 1KB1A and 1KC3 are longer but have less certain flood flow ratings. The highest gauged flow of the Kuja at 1KB1/1KB1A is only 139M3/S, although the 1KC03Migori has been gauged at 477 M^3/S.[4] (Page A2-17)

b) Flood Series at 1KB5

[4] Lake Basin Authority "River Profile Studies iv, Lower Kuja, Irrigation Development Annex II Hydrology Oct. 1985

The secondary data collected from Lake Basin Authority "RIVER PROFILE STUDIES VOLUME IV, LOWER KUJA, IRRIGATION DEVELOPMENT ANNEX II HYDROLOGY OCT 1985" reports that: The mean annual flood derived from this series is 407 M^3/S. Extreme Value (Type 1) analysis with Gringorten plotting positions gives the following estimates:[5] (Page A2-17)

Return Period, T (Years)	Flood Flow Q (m^3/s)	$QT/Q_{2.33}$
2.33	407	1.0
10	690	1.7
20	810	2.0
50	965	2.4
100	1082	2.7

(Page A2-18)

SOCIO ECONOMIC CONDITIONS

1.1.6 General Profile

There are three predominant tribes within the basin i.e. the Luo tribe located in the downstream and part of the midstream and call R. Gucha as R. Kuja. The Luo are mainly farmers and fishermen; the Kisii tribe is located in the upstream of R. Gucha and is mainly farmers; the Massai tribe is located in the upstream of R. Migori which they call R. Magor. The Massai are pastoralist but are quickly adapting to farming especially in Transmara East district; and Kuria tribe that are in the midstream of R. Migori. The Kuria are farmers. All these tribes keep livestock.

1.1.7 Administration

(1) Local Administration

Administration division of the Republic of Kenya as of March 2013 is shown below.

Table 2.5 Administration Division in Republic of Kenya

Administration Unit	Officer in charge
County	County commissioner
District	District commissioner
Division	District officer
Location	Chief
Sub location	Assistant Chief
Village	Village Elder
Community Unit	Respective Opinion Leader

In the administration system in Kenya, Central Government Administrative Organ (County –

[5] Lake Basin Authority "River Profile Studies iv, Lower Kuja, Irrigation Development Annex II Hydrology Oct. 1985

District – Division – Location – Sub-location) is managed under the Office of the President. The smallest administrative unit is the Sub-location. For purposes of better and grassroot oriented management the administrative organ engages village elders to manage respective village within a sub-location. The Officer in charge at respective level is as "County Commissioner" for County, "District Commissioner (DC)" for District, "District Officer (DO)" for Division and Location, "Chief", for Sub Location (Assistant Chief) and for Village "Elder".

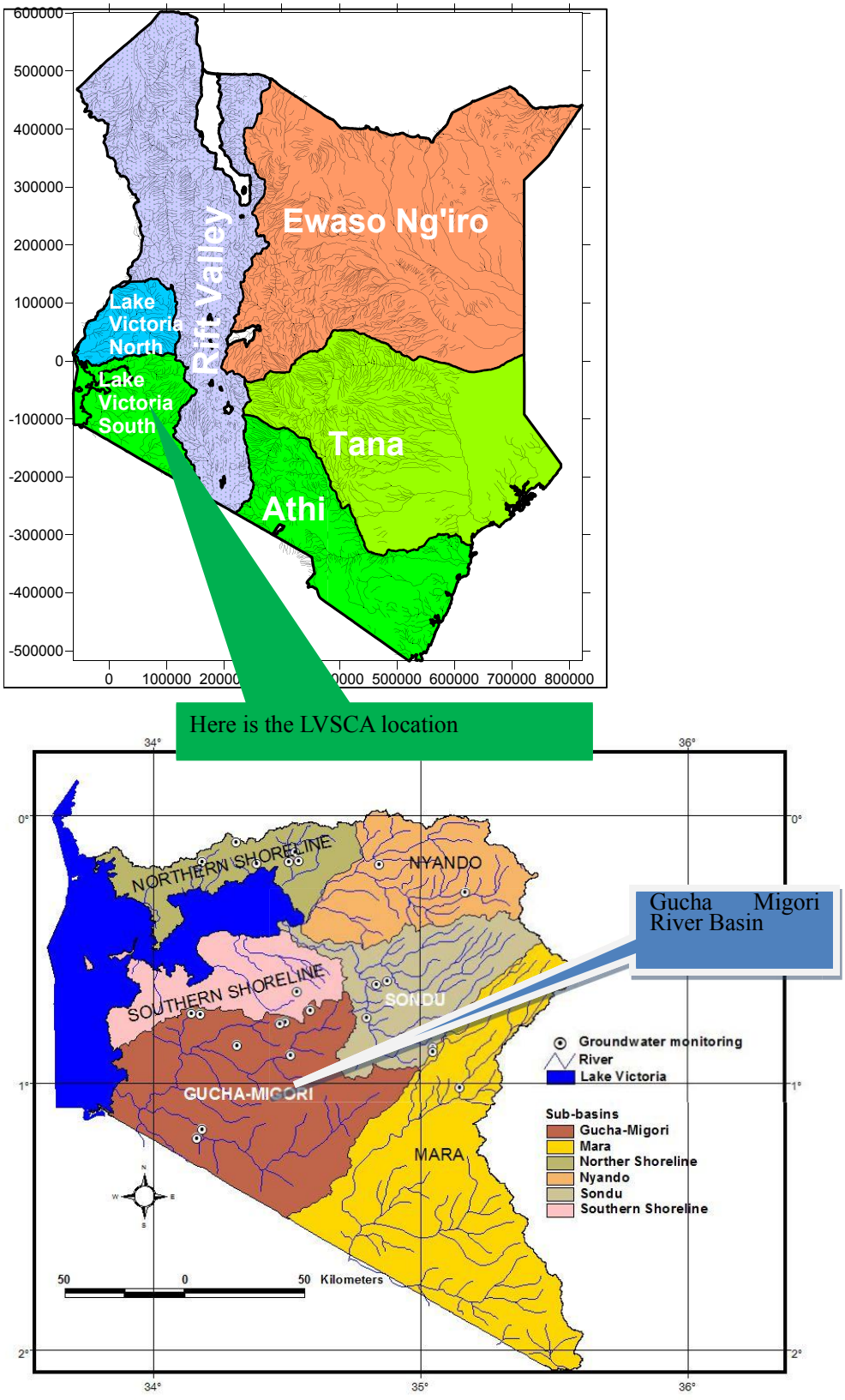
Gucha Migori River Basin consists of Nyamira County under which Nyamira and Manga districts belong to, Kisii County under which Gucha, Kisii Central, Semeta and Kenyenya districts belong to, Narok County under which Transmara East district belongs to, Migori County wherein Migori, Kuria, Uriri and Nyatike districts belong to and Homabay County wherein Ndhiwa district belongs to.

(2) Jurisdictional area of WRMA

Relation between the controlled area of WRMA (Water Resource Management Authority) responsible for the administration relating to the water resource and Gucha Migori River Basin is explained below. WRMA divides the country in 6 catchment areas and Gucha Migori River Basin is included in the catchment called "Lake Victoria South Catchment (LVSCA)".

Kisumu Regional Office in LVSCA have jurisdiction over the whole LVSCA. Besides, the catchment is divided into three (3), i.e. Kisumu sub-region, Kericho sub-region, and Southern Shoreline (Gucha Migori) sub-region. There are Sub-Regional Offices in the respective sub-regions.

Figure 0.10 WRMA Southern Shoreline (Gucha Migori) Sub-Regional Office



Source : Lake Victoria South Catchment Area Catchment Management Strategy (June 2009)

Figure 0.11 LVSCA Catchment within the Kenya Map indicating the six regions

(3) Jurisdictional area of WRMA

Relation between the controlled area of WRMA (Water Resource Management Authority) responsible for the administration relating to the water resource and Gucha Migori River Basin is explained below.

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1.1.8 Population

Approximately 2.5 million people live within the Gucha-Migori basin (or 360 cap/km²) and it is estimated that 4.9 million people will live within the basin in 2030 (or 710 cap/km²), with the large majority of the population dependant on subsistence farming. Rural population densities in the upper half of the Gucha River basin and around Migori are (and will be) therefore very high. This is a significant issue that poses challenges for land use, ownership, and subsistence,especially in areas that already have a high urban population density (like Kisii and Migori), and areas that have a high dependence on land. [6]

The population census data of 2009 per districts in Gucha Migori River Basin is presented in Table 2.6.

Table 2.6 Population Census Data in Gucha Migori River Basin (2009)

District	Male	Female	Total
HOMA BAY	145981	161346	307327
MIGORI	121181	132228	253409
RONGO	65240	68914	134154
KURIA WEST	66766	69496	136262
KURIA EAST	40248	41585	81833
KISII CENTRAL	133883	149234	283117
KISII SOUTH	25973	28996	54969
MASABA	67399	75588	142987
GUCHA	173472	190988	364460
GUCHA SOUTH	70458	75849	146307
NYAMIRA	125744	137457	263201
MANGA	41678	46181	87859
BORABU	34151	33461	67612
TRANS MARA	130323	130493	260816
Total	**1242497**	**1341816**	**2584313**

Source : Kenya National Bureau of Statistic, Census 2009

It is imperative to note that some of the districts lie on the boundary between Southern shoreline (Gucha Migori) and Kericho sub-regional jurisdiction for example Masaba and

[6] Identification of Multipurpose Water Resources Development Project in Gucha Migori River Basin in Kenya: Final Strategy Report

Borabu districts. It is also important to note that some of the district lie on the boundary of Gucha Migori River Basin and Awach Tende and Awach Kibwon river basins.

1.1.4 Industrial, Agricultural Products and Commercial Activities

Agricultural products in the river basin are derived from farming, animal husbandry, fishing, brick-making, sand harvesting, small scale business, carpentry and handicraft (stone carvings) making.

There are industrial factories within the Gucha Migori River Basin which are mainly involved in processing the agricultural products. The following are some of the example of industrial factories within the river basin: 1) There is sugar processing company in Awendo, Transmara and Ndhiwa, Migori county and 2) Tea factories in Nyamira and Kisii counties.

DEVELOPMENT PLAN

1.1.5 Vision 2030

Under the flagship projects on Water and Sanitation Vision 2030 envisages to rehabilitate the hydro-metrological network andm rehabilitate 600 stations and this includes the stations in Gucha Migori River Basin and in particular 1KB05 Wath Onger.Vision 2013 also envisages Constructing twenty two (22) medium-sized multi-purpose dams with a total capacity of two (2) billion M^3 to supply water for domestic, livestock and irrigation use in the arid and semi-arid areas in Kenya wherein the downstream of Gucha Migori River Basin shall be a beneficiary of one of the dams.

Gucha Migori River Basin is also the hub of agricultural, livestock and fisheries activities in Sourthern part of Western part of Kenya. In the Vision 2030 it envisages that Kenya will raise incomes in agriculture, livestock and fisheries even as industrial production and the service sector expand. This will be done by processing and thereby adding value to her products before they reach the market. She will do so in a manner that enables her producers to compete with the best in other parts of the world. This will be accomplished through an innovative, commercially oriented and modern agriculture, livestock and fisheries sector.

These interventions are expected to generate an additional KSh.80-90 billion increase in GDP, mainly through better yields in key crops, increased smallholder specialisationin the cash crop sector (2-3cropsper plot),utilisation of a million hectares of currently uncultivated land, and new cultivation of upto 1.2 million hectares of newly-opened lands.

Specific strategies will involve the following: (i) transforming key institutions in agriculture

and livestock to promote household and private sector agricultural growth; and (ii) increasing productivity of crops and livestock. Kenya will also introduce new land use policies through: better utilisation of high and medium. (Source: Kenya Vision 2030 Popular Version)

1.1.6 County Development Plan (2013-2018)

Currently the five counties in their respective jurisdiction are developing County Strategic Development Plan. The strategic plan should include integrated water resource management.

1.1.7 Lake Victoria Catchment Area Catchment Management Strategy (June 2009)

According to "Lake Victoria South Catchment Area Catchment Management Strategy" which is the management plan of WRMA in Lake Victoria South Catchment, the concept on Integrated Flood Management in LVSCA is captured in Chapter 9 Flood and Drought Management. This Chapter explains an overview of floods and drought in Lake Victoria South Catchment, Flood and Drought Early Warning, vulnerabilities to floods and drought, vulnerabilities of people to floods, priorities in floods protection, and achivement of floods. Floods occur regularly in the catchment with devastating effects causing havoc to the human population, crops and livestock and grossly undermining the socio-economic status of the local population. The total area of flood risk will be surveyed and data made available for implementation of control measures. Information and data obtained from the River Nyando Integrated Flood Management Project by JICA will be adopted for replication in areas that were not piloted. Flood mitigation measures will then be undertaken through structural measures such as the construction of dykes and dams and non-structural measures such as the development of flood early warning systems and capacity building in disaster management skills and the implementation of flood warning system. Further action will be taken to construct emergency evacuation centres and to train local communities on disaster preparedness and management strategies on flood prevention and mitigation.

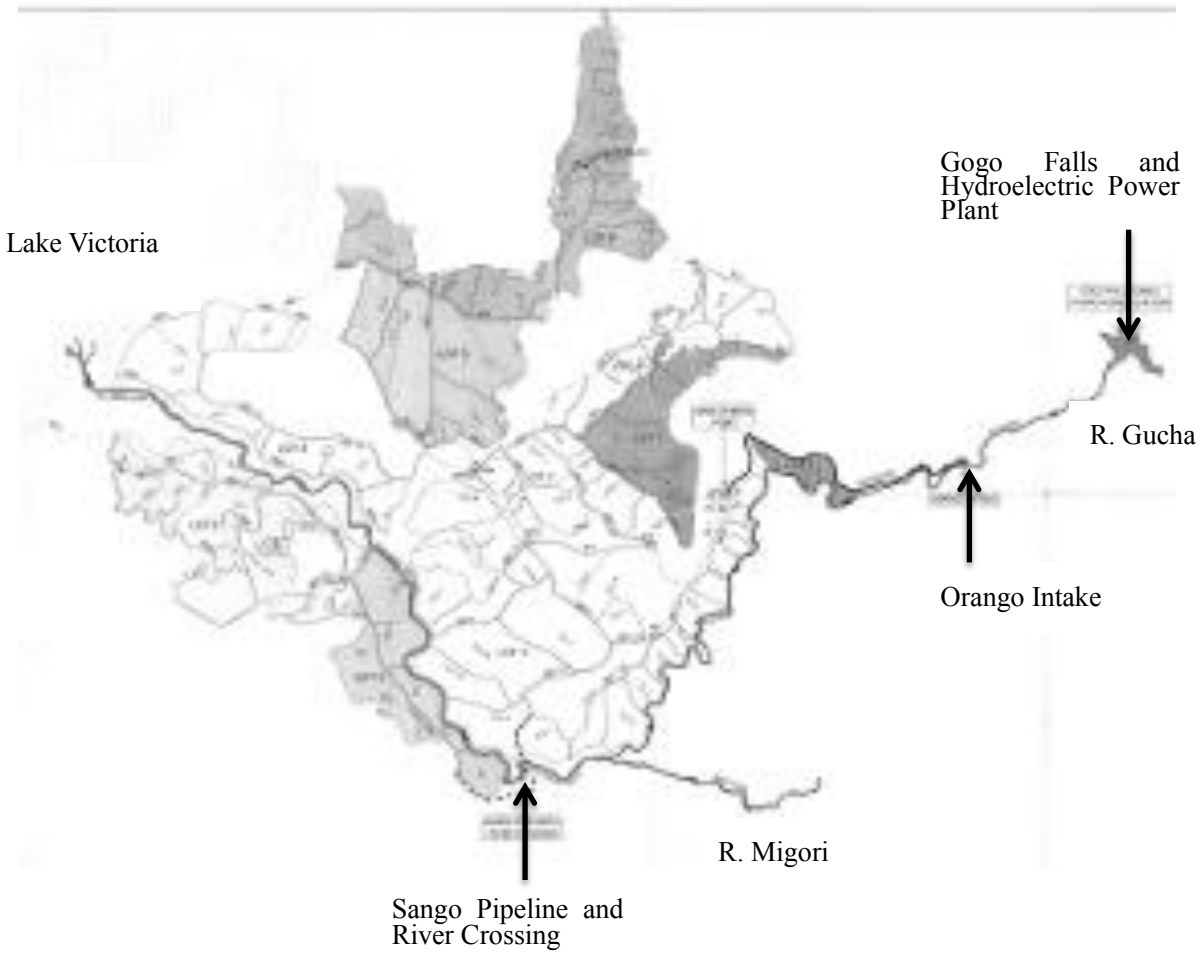
1.1.8 Bonyunyu Dam in the Upstream

Bonyunyu Dam Water and Sanitation Project aims at constructing a 7Million cubic meter capacity dam on Gucha River, construction of 55,000m^3/day Treatment works, Distribution system, tanks and sanitation.

1.1.9 National irrigation Board (NIB) Irrigation Project

The National Irrigation Board is currently undertaking and irrigation project in the downstream of R. Gucha Migori. There is an intake at Orango that will be constructed just after Gogo Dam on R. Gucha system. There is another intake and water piping works at Sango area which is at

the confluence point of R. Gucha and R. Migori. It is imperative to note that the success of this project will play an important role in the mitigation of floods in Lower Gucha Migori



Sub-catchment.

Source: National Irrigation Board Irrigation Project Planned Map

Figure 0.12 Planned NIB Irrigation Project Map

ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS

The catchment is faced with major issues which undermine the sustainable utilization of its resources. These include among others: deforestation; wetland degradation; overutilization of ecologically fragile areas including hill slopes, wetlands and river banks; land fragmentation; water pollution; and loss of bio-diversity. With exploding population, shrinking land holdings, stagnant farming practices and declining yield levels, changing rainfall regime due to global climate change, and hardly any prospects for industrialization, there is a palpable stress in the environmental conditions in the basin as manifested in poverty levels of the population and environmental degradation. It is very clear that most of the environmental and social issues are

interdependent and cannot be treated separately.[7]

1.1.10 Environmental issues

The uppermost part of the Gucha-Migori basin was originally covered by a dense, tropical highland forest similar to that currently in the undisturbed sections of the Mau water tower. Over the past five decades, human settlement activities have completely cleared this from the area, and no primary vegetation is to be found in most of the upper parts of the basin, with the exception of the highly degraded Chepalungu forest in the upper Migori basin and of some isolated areas on the valley floors although this is threatened by wetland/swamp reclamation.

The middle reaches of the Gucha-Migori basin were covered in thick bushlands and patches of light forests but this has now also given way to cultivation and pastures. In particular, the Migori River passes through large stretches of pasturelands used quite extensively by the Maasai pastoralists. The original bushlands of the lower Gucha-Migori basin are progressively being replaced by cultivation and are impacted by charcoal burning and logging as sources of income and construction materials. The riverine and mountain wetlands, once numerous in the upper parts of the Gucha basin, have been practically wiped out. The Kuja River enters Lake Victoria through a small delta that has no major swamp. There are a number of environmental issues in the Gucha-Migori basin. Most are interrelated and have become increasingly serious due mainly to high population growth and related anthropogenic reasons in many parts of the basin.[8]

1.1.11 Socio-economic issues

The catchment is notably characterized by high population density and growth rates Approximately 2.5 million people live within the Gucha-Migori basin (or 360 cap/km²) and it is estimated that 4.9 million people will live within the basin in 2030 (or 710 cap/km²), with the large majority of the population dependant on subsistence farming. Rural population densities in the upper half of the Gucha River basin and around Migori are (and will be) therefore very high. This is a significant issue that poses challenges for land use, ownership, and subsistence, especially in areas that already have a high urban population density (like Kisii and Migori), and areas that have a high dependence on land. High poverty levels Around 40% of Kenyans lived below the national poverty line In the Gucha-Migori basin, around 53%, with Gucha (67%), Kuria (59%), Bomet (58%), Kisii (54%) districts over 50% of the population below the poverty line. In addition, some of the areas within the basin had some of the highest poverty densities in the country with more than 200 people below the poverty line per km² (Gucha, Bomet, Kisii and Nyamira).

High disease prevalence rates it is recorded that the infant mortality rate is high – 95 per 1,000

[7] Identification of Multipurpose Water Resources Development Project in Gucha Migori River Basin in Kenya: Final Strategy Report
[8] Identification of Multipurpose Water Resources Development Project in Gucha Migori River Basin in Kenya: Final Strategy Report

– and the under-five mortality rate is also high –149 per 1,000 (these figures are for Nyanza province but are similar for all the Gucha-Migori districts). The most prevalent diseases are malaria, meningitis, HIV/AIDS, diarrhoea diseases, respiratory diseases, pneumonia, skin diseases, eye infections and intestinal worms. Malaria is the leading cause of morbidity across all the districts in the basin, representing an average of 52.5% of all cases. HIV prevalence varies throughout the basin from 4.3% in Manga district to 22.3% in Homa Bay district.

Land Tenure Kenya's recent history has been dotted with several intense episodes of land-ownership conflict. The post-colonial land tenure management has led to a sectorization with certain repercussions on the distribution of the different communities which populate the country. This situation has become a source of inter-ethnic tensions which are exacerbated by the high/growing population density. Subsitence agriculture with low prodctivity. Over 80% of people depend upon agriculture (farming, livestock production and fishing) in the Gucha-Migori sub-basin. Most of the agriculture in the basin is for subsistence. The main food crops produced include maize, beans, finger millet, cassava, sweet potatoes and bananas. Subsistence agriculture is characterised by productivity levels which have remained low for decades despite technical advances which could support a major increase in productivity. This leads to food insecurity and poverty. The impact of low per ha productivity is compounded by diminishing land holdings. Frequent flooding and drought has been on increase in the Gucha Migori River Basin. By reducing agricultural productivity, destroying crops and properties, droughts and floods are major causes of food insecurity and poverty and a real obstacle to development.[9]

[9] Identification of Multipurpose Water Resources Development Project in Gucha Migori River Basin in Kenya: Final Strategy Report

ANALYSIS OF FLOOD CHARACTERISTICS

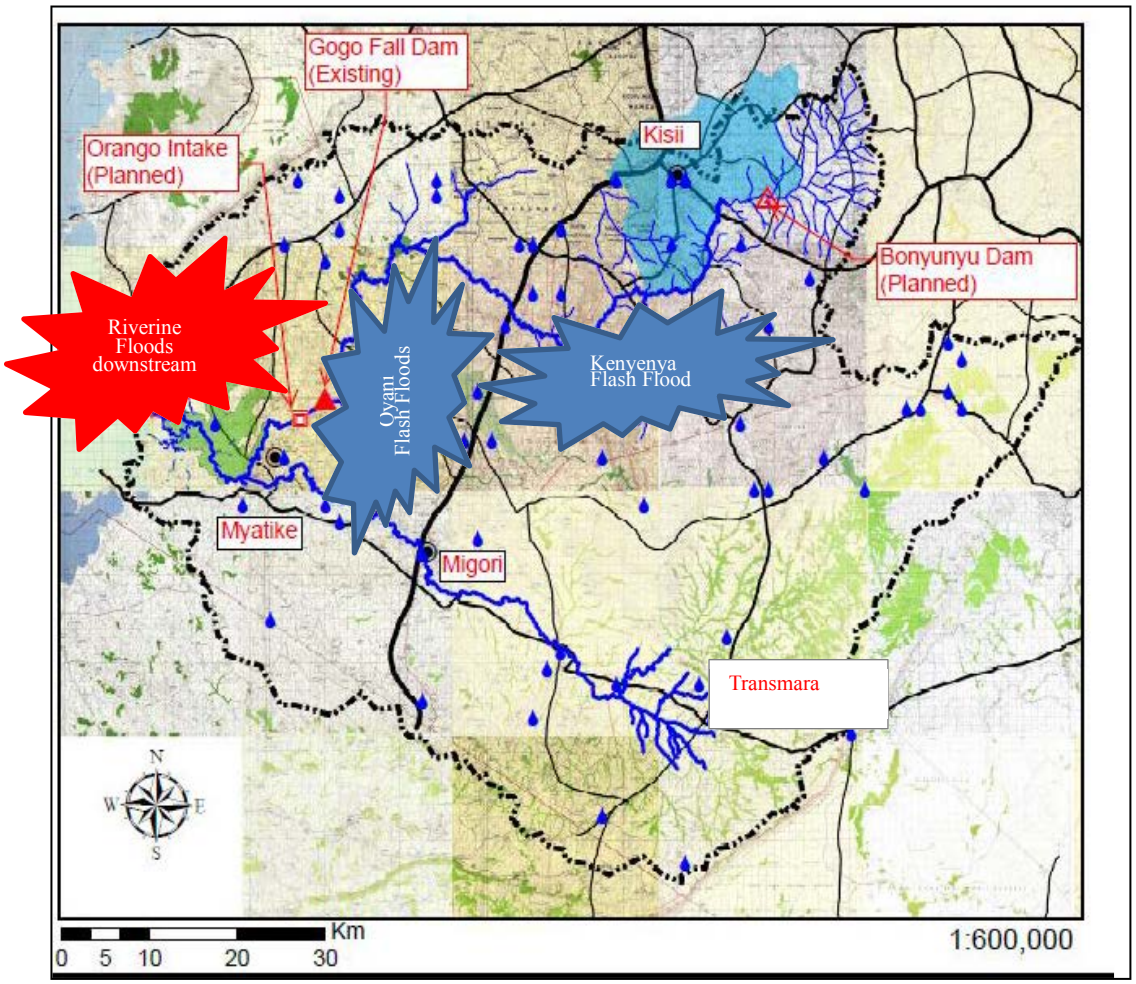
3.1 OVERALL CONDITION ON FLOODS IN THE GUCHA MIGORI RIVER BASIN

3.1.1 Records of Flood Damages

Flood damage is enormous in Gucha Migori River Basin. In the upstream Kenyenya Sub-counties the area encounters flash floods that mainly damages the farmlands and disrupts traffic. In the mid-stream the area of Oyani encounters flash floods and riverine floods that destroys farmlands and disrupts transport networks. In the downstream area suffers from both flash floods in the area surrounded by hills like Lwanda, Tito and Misiwi areas, while places in the flood plains like Nyora, Kabuto, Kimai, Sere, Aeko and Aneko suffers from riverine floods with inundation period of three weeks to two months. The Figure 3.1.1 below shows the records of flood damage in Gucha Migori River Basin.

Figure 3.1.1 Records of Flood Damage in the Gucha Migori River Basin

The longitudinal slope of the River Gucha and River Migori is steep in the Kisii Highlands and Transmara Highlands. The two rivers merge at Sango area to form one vast wide river that flows downstream at high velocity and due to heavy sedimentation the riverbed is shallow and therefore the river bursts its banks and some of the water flow along the former river channel that is silted leading



to floods along the former channel and the new channel. The soil in the area is black cotton soil that has high water retention rate that leads to longer period of inundation in the downstream areas especially around Kabuto and Nyora villages in Lower Central Kadem Location, Nyatike Sub-county. Initially before the new channel the flood occurrence was heavy in Tulu and Aneko villages in West Kadem Location, Nyatike Sub-county. But currently West Kadem location is affected when there is an

overflow into the old river channel, the overflow of the streams that used to flow into the old channel and the baskflow from the Lake Victoria.

(1) Upstream of Gucha Migori River Basin

In the upstream of R. Gucha Migori are mainly affected by flash floods. The flash floods mainly affect farmlands and disrupt traffic. In 2012 in Kenyenya Sub-county it was reported that three people drown and died as a result of the flash floods. The flash floods are as a result of the heavy rainfall leading to heavy surface run-off water on the feeder roads that flow into the streams and rivers that are tributaries of either R. Gucha in the Kisii Highlands or R. Migori in the Transmara Highlands. During site investigation the following were noted:

a) Kiabonyoru area in Nyamira

The source of River Gucha is located in this area and it was observed that there were soil erosion on the feeder roads was noted. This eroded soils forms part of sediments in the river.

b) Esani Area in Nyamira

River Gucha flow through this area it was observed that Nyantaro primary school.primary school is built on a wetland. There is a road next to school that initially used to get flooded leading to difficulties in accessing the school and this led to the community members through CDF assistance to divert the river to prevent flooding of school and neighbouring homes and prevent damage to the road.

c) Ogembo in Gucha

River Gucha flow through this area and it was observed that the river water was muddy yet the site investigation was done during the dry spell which is an indication that soil erosion is rampant in this area. In this area there are many feeder murram roads in the area that the surface run-off water flows on into the river.

d) Kebabe Area in Gucha and Kenyenya

R. Riasucha a tributary of R. Nyangweta which also acts as a tributary of river Gucha flow through this area and it was observed that a road in Kebabe has culverts constructed on it that causes havoc to the neighbouring homes when it rains heavily because the rain water flow through the culverts and have no place to flow to therefore the water inundates the farmlands, homes and has led to community members to dig a trench that enhances soil erosion that flows into R. Nyangweta. As a result of heavy surface run-off water that leads to flash floods that inundates the farmlands leading to loss of crops in the area.

(2) Mid-stream of Gucha Migori River Basin

In the midstream of R. Gucha Migori the area experiences heavy rainfall during the long and short rain seasons. The major towns in the midstream area are Migori Town, Awendo Town and Rongo Town. In Awendo there is a sugar factory. The following observations were noted:

a) Masaa area under Oyani WRUA jurisdiction
R. Oyani a tributary of river Gucha flow through this area and it was observed that there were extensive agricultural activities including human activities around the hills that surround Oyani area. The farmlands in Oyani area gets flooded during heavy rains. The floods are as a result of the R. Oyani breaking its banks but also the flood water comes from the surface run-off water from the neighboring hills.
The main cash crop grown in the area is sugarcane and during the floods in the area the farmers lose millions to the floods when their sugarcane is washed away.

There is a bridge at Masaa area that was constructed by Ministry of Roads and during the construction the contractor constructed a gabion within the water channel and after the works the decommissioned gabion remained under the bridge. The community members pointed out that during high flows the gabions blocks the river water leading to water overflowing to the nearby farms.

(3) Downstream of Gucha Migori River Basin

In the lower parts of Gucha Migori Basin which forms the downstream of R. Gucha Migori experience perennial floods and suffers damage from flood frequently. The floods cause adverse effects on agriculture and agricutural products, infrastructures, houses, lives and properties, land use, local economy and etc.

The effects and impacts of flood directly cause a stagnated economic growth. In the Sub-Catchment Management Plan developed by LOGUMI WRUA activities aimed at management of floods are prioritized.

According to information of data collected for lower parts of Gucha Migori River Basin which is shown in the Table 3.1.1. It indicates that approximately 100 km^2 was inundated in 1997 and 2002 and 2006 that was three times larger area and the number of victims and duration of the evacuation was two times larger and longer than an ordinary year.

Table 3.1.1 Overview of Flood in the Lower Gucha Migori River Basin (Ordinary year and extraordinary years)

	The flooding situation in an ordinary year	The flooding situation In an extreme year (1997, 2002 and 2006)
Flood area	25 km^2	100 km^2
Depth of water	1 m	1.5 m
No of evacuee	900	1800
Evacuation duration	1 month	3 month
No of floods in a year	2	2

Source: The table is created by JICA Project Team based on information provided by WRUA

Overview of recent flood damages in the downstream of Gucha Migori River Basin is shown in

Table 3.1.2 presents estimated flood damage cost and inundated area of agriculture sector in the downstream of Gucha Migori River Basin in the year 2012. It is imperative to note that the floods in the year 2012 waere ordinary floods yet the river level rose to 7.2M and the flood damage was enormous.

The floods affected severely Kabuto and Nyora villages and washed away most of their farmlands, inundated homesteads and made the area very difficult to access. As a result of two months inundation in the homesteads most houses sunk 1M down.

Table 3.1.2 Agricultural Damage in the Lower Gucha Migori River Basin in 2012

S/No	Villages	Crops Damaged	No. Of Affected Farmers	Affected acreage	Value In Millions (M) Kshs Lost.
1. Karungu Division in Nyatike District	i. Sito valley ii. Upper Okayo iii. Alara. iv. Okero v. Ojawa vi. Riat vii. Osiri viii. Agulu ix. Wakine. x. Atonge. xi. Lower Okayo xii. Obware valley xiii. Along L. Victoria Shore.	Young Sorghum, Kales, Maize, Young Cassava, Beans, Tomatoes, Sweet Potatoes, Watermelon. Tree nurseries and tree seedlings, Local vegetables (e.g. Mrenda,. Black night shade and Spider plant)	88	120	2.4 M
2. Nyatike Division in Nyatike District	i. Kabuto ii. Angugo iii. Modi iv. Luanda v. Kimai vi. Lower Magungu vii. Nyora	Young Sorghum, Kales, Maize, Young Cassava, Beans, Tomatoes, Sweet Potatoes, Watermelon. Tree nurseries and tree seedlings, Local vegetables (e.g. Mrenda,. Black night shade and Spider plant)	390	415	10.3M
3. Muhuru Division in Nyatike District	i. Ratieny Valley ii. Tagache/Kiambu iii. Lower Tito iv. Upper Tito. v. Lisori vi. Nyakumu	Young Sorghum, Kales, Maize, Young Cassava, Beans, Tomatoes, Sweet Potatoes, Watermelon. Tree nurseries and tree seedlings, Local vegetables (e.g. Mrenda,. Black night shade and Spider plant)	52	92	2.3M
Total			**530**	**627 Acres**	**15.0M**

Source: District Agriculture Office-Nyatike

3.1.2 Flood Condition Inquiring From Relevant Communities

The focal points having flood damages in the downstream of Gucha Migori river basin are Nyora, Kabuto, Kimai, Aneko, Aeko, Lwanda, Misiwi, Tulu, Ratieny and Tito etc.

During the community inquiry survey on these communities on the flooding situations during ordinary floods, the community members were able to reveal as shown in the following

Table 3.1.24 while figure 3.1.2 is the map that shows these areas.

Table 3.1.3 Floods impact on communities in the downstream during an ordinary year

Village name	Population				Flood Damages	Remarks
	Popn.	HH	Affected popn.	HH		
1. Nyora	2620	262	924	184	Homes, farms and transport networks	Toilets collapse leading to sanitation and hygiene problems. Community assist each other in evacuation
2. Kabuto	2678	270	844	152	Homes, farms and transport networks	Toilets collapse leading to sanitation and hygiene problems. Community assist each other in evacuation
3. Kimai	2200	220	230	20	Homes, grazing land and transport networks	Toilets collapse leading to sanitation and hygiene problems. Community assist each other in evacuation
4. Aneko	3600	360	-	-	Affects mainly farmlands	Community members are involved in drainage improvement
5. Aeko	8700	870	190	15	Few homes and farmlands	Farmland destruction that leads to heavy food shortages
6. Lwanda	1526	254	520	50	Disrupts transport and damage homes	Toilets collapse leading to sanitation and hygiene problems. Community assist each other in evacuation
7. Misiwi	2623	262	230	35	Disrupts transport and damage homes	Toilets collapse leading to sanitation and hygiene problems. Community assist each other in evacuation
8. Tulu	1010	134	468	78	Disrupts transport and damage homes	Toilets collapse leading to sanitation and hygiene problems. Community assist each other in evacuation
9. Ratieny	1300	170	200	20	Disrupts transport and damage homes	Farmland destruction that leads to heavy food shortages
10. Tito	2511	252	147	25	Disrupts transport and damage few vhomes	Toilets collapse leading to sanitation and hygiene problems. Community assist each other in evacuation

Source: JICA project team survey by inquiring to communities

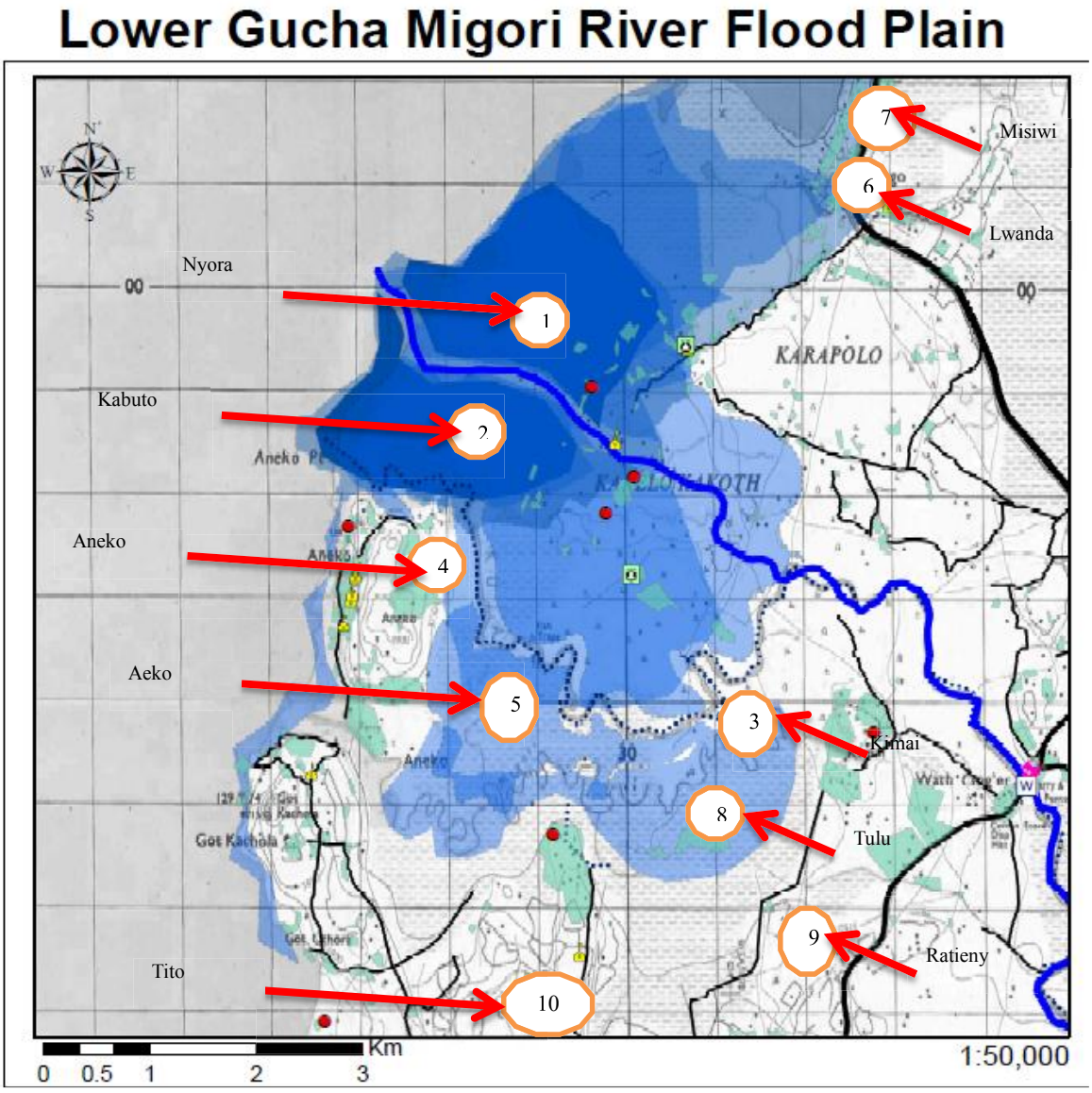


Figure 3.1.2 Location Map of Principal Community in Downstream Area

Widespread and long term inundation around the river caused by overflow from the R. Gucha Migori causes severe damages to especially "Nyora" and "Kabuto" villages located in inundation area on the either side of the river with flood depth ranging from 100cm to 150cm depth and 1 to 3 months duration period.

According to the figure described above, "Nyora" or "Kabuto" villages are located in the downstream of R. Gucha Migori approximately 3KM from Lake Victoria. The river bursts its banks and overflow into the farmlands thereafter into the homesteads, schools etc. The inundated area becomes one big like basin full of water that looks like a lake.

Both Kabuto and Nyora are densely populated and the crops in the farmlands in the area and poultry especially chickens being washed away into Lake Victoria.

Lwanda, Misiwi, Tito and Ratieny are affected by flash floods as a result of heavy rains in the neighboring hills in the downstream. While Tulu, Aeko, Aneko areas are affected by both flash floods and riverine floods. The flash floods are caused by the numerous streams (both permanent and seasonal) that flow through these areas. In Tulu area the water overflows the stream and inundates the area for more than two weeks with extensive damage in the farmlands.

According to this, the damage situations and flood type in each community by project team's inquiring survey on the communities are shown below.

(1) Nyora Village

- Water depth is 150cm in the farmlands and 120-100cm in the homesteads, duration is 1 to 2 month when floods occur.
  .....(Inundation caused by overflow of River Gucha Migori)
- Flow from river water and from upstream even when there is no rainfall in Nyora area
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- Waters and sediments flow into the houses make homesteads inhabitable
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- Small livestock such as goats, sheep, chicken and ducks swept away
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- The murram roads are inundated with flood water cutting off the villages from travelling and community members use canoes from one place to the other.
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- The farms are flooded sweeping away the food crops
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- During very heavy flows Nyora Primary School is closed and used as evacuation centre
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- Some mud houses are swept away and others sink in case inundation is more than 2 months
  ..... (Inundation caused by R. Gucha Migori breaking its banks)

(2) Kabuto

- Water depth is 150cm in the farmlands and 120-100cm in the homesteads, duration is 1 to 2 month when floods occur.
  .....(Inundation caused by overflow of River Gucha Migori)
- Flood water flows from the R. Gucha Migori old and new channel and a seasonal stream that transverse through the village.
  .....(Inundation caused by overflow of River Gucha Migori old and new channel)
- Flood waters flows into the farmlands and sweeps the crops away
  .....(Inundation caused by overflow of River Gucha Migori new channel)
- Sediment flows into the houses and deposited inside
  .....(Inundation caused by overflow of River Gucha Migori new channel)
- Access roads are affected by the flood water making Kabuto Health Centre inaccessible and give affected families difficulties to access Kabuto Primary which acts as evacuation centre(Inundation caused by overflow of River Gucha Migori old and new channel)
- Small livestock such as goats, sheep, chicken and ducks swept away
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- The murram roads are inundated with flood water cutting off the villages from travelling and community members use canoes from one place to the other.
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- The farms are flooded sweeping away the food crops
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- During very heavy flows Kabuto Primary School is closed and used as evacuation centre
  ..... (Inundation caused by R. Gucha Migori breaking its banks)
- Some mud houses are swept away and others sink in case inundation is more than 2 months
  ..... (Inundation caused by R. Gucha Migori breaking its banks)

(3) Kimai

- Water depth is 100cm in the farmlands and 50-100cm in the homesteads, duration is 2 weeks to 1 month when floods occur.
  ..... (Inundation caused by overflow of Onyongo and Nyakori streams)
- Some of the grazing lands like Olumbe have permanent depression that makes the area be like a water-pan during floods and even after
  (Inundation caused by overflow of Onyongo and Nyakori streams and surface run-off from Otho area)
- The flood waters sweep away the food crops

.....(Inundation caused by overflow of Onyongo and Nyakori streams)

- The murram roads are inundated with flood water cutting off the villages from travelling. (Inundation caused by overflow of Onyongo and Nyakori streams and surface run-off from Otho area)

(4) Aneko

- Water depth is 100cm in the farmlands and 50cm in the homesteads, duration is 1 to 3 weeks when floods occur. (Inundation caused by overflow of River Gucha Migori old channel and backflow from the L. Victoria)
- Flood water flows from the R. Gucha Migori old channel, backflow from the lake, Kanga and Nyakore and surface water from Othora hills. ...(Inundation caused by overflow of River Gucha Migori old and backflow from L. Victoria)
- The farms are flooded sweeping away the food crops ...(Inundation caused by overflow of River Gucha Migori old and backflow from L. Victoria)

(5) Aeko

- Water depth is 80-100cm in the farmlands and 50cm in the homesteads, duration is 1 to 3 weeks when floods occur. .....(Inundation caused by backflow L. Victoria and run-off water from Othora hills)
- Flood water flows from the R. Gucha Migori old channel, backflow from the lake, Kanga and Nyakore and surface water from Othora hills. .....(Inundation caused by backflow L. Victoria and run-off water from Othora hills)
- The farms are flooded sweeping away the food crops .....(Inundation caused by backflow L. Victoria and run-off water from Othora hills)
- The grazing grounds are inundated making it difficult for livestock to graze .....(Inundation caused by backflow L. Victoria and run-off water from Othora hills)
- The murram roads are inundated with flood water cutting off the villages from travelling. .....(Inundation caused by backflow L. Victoria and run-off water from Othora hills)
- Some of the homes are inundated leading damages of the houses especially mud thatched huts. .....(Inundation caused by backflow L. Victoria and run-off water from Othora hills)

(6) Lwanda

- Flood waters mainly from the neighbouring Magungu and Obware hills ..... (Flash flood)
- Leads to disruption of transport Lwanda Karungu Road..... (Flash flood)
- Disruption of Education Programme .....(Flash floods)
- Leads to disruption of economic activity at the busy Lwanda trade centre..... (Flash flood)
- Houses are inundated with flood water..... (Flash flood)
- Destruction of toilets. ..... (Flash flood)

(7) Misiwi

- Flood waters mainly from the Aora Chudho stream and Got Bim hills ..... (Flash flood)
- Leads to disruption of transport..... (Flash flood)
- Houses are inundated with flood water..... (Flash flood)
- Destruction of toilets. ..... (Flash flood)

(8) Tulu

- Water depth is 80-100cm in the farmlands and 50cm in the homesteads, duration is 1 to 4 weeks when floods occur. (Inundation caused by Nyokore stream and run-off water from Suna hills) .....(Inundation caused by Nyokore stream and run-off water from Suna hills)
- Flood water flows from run-off water from Suna hills and Nyakore stream). .....(Inundation caused by Nyokore stream and run-off water from Suna hills)
- The farms are flooded sweeping away the food crops .....(Inundation caused by Nyokore stream and run-off water from Suna hills)
- The grazing grounds are inundated making it difficult for livestock to graze .....(Inundation caused by Nyokore stream and run-off water from Suna hills)
- The murram roads are inundated with flood water cutting off the villages from travelling.

.....(Inundation caused by Nyokore stream and run-off water from Suna hills)
- Tulu Siko village becomes an island as the flood water surrounds the village make it in accessible .....(Inundation caused by Nyokore stream and run-off water from Suna hills)

(9) Ratieny
- Flood waters mainly from the Ratieny stream that is fed by run-off water from the neighbouring hills ..... (Flash flood)
- Leads to disruption of transport..... (Flash flood)
- Few houses are inundated with flood water..... (Flash flood)
- Farmlands and grazinglands are seriously affected .....(Flash floods)

(10) Tito
- Water depth 60-100cm with a duration of 3 weeks .....(Flash floods)
- Flood waters mainly from the Kamegeta hills in Tanzania and flows into the R. Tito that eventually over flow its banks..... (Flash flood)
- Leads to disruption of transport feeder roads and road that links Kenya and Tanzania (Flash flood)
- Houses near R. Tito are inundated with flood water..... (Flash flood)
- Schools like Nyakondo are seriously affected ..... (Flash flood)

3.1.3 Existing Structures along the River

a) Water Plant at Kigati in Kisii central Sub-county
The Water Plant at Kigati was established in 1976 and water intake at plant is 6000M^3/day and the water is supplied to Kisii town and its environ. The plant is currently under upgrading and it targets an intake of 18000M^3/day.
Based on interview with staff at the Water Plant it is estimated that sediment sieved during intake is 1 tonne in 3 months i.e. one tonne in three months of sediment is removed by the water plant from the river channel during intake. They dump this sediment within the farms within the water plant compound. The sediment charecteristics is fine sand and soil (reddish-brownish in colour) granules.

b) Water Plant at Ogembo in Gucha Sub-county
The Water Plant at Ogembo was established in 2005 and water intake at plant is 200M^3/day and the water is supplied to Ogembo town and its environ.
Based on interview with staff at the Water Plant it is estimated that sediment sieved during intake is 1/4 tonne in 6 months i.e. a quarter tonne in six months of sediment is removed by the water plant from the river channel during intake. They dump this sediment within the farms within the water plant compound. The sediment charecteristics is fine sand and soil (reddish-brownish in colour) granules.

c) Water Plant at Keroka in Gucha Sub-county
The Water Plant at Keroka was established in 1980 and water intake at plant is 500M^3/day and the water is supplied to Keroka town and its environ.
Based on interview with staff at the Water Plant it is estimated that sediment sieved during intake is 1/2 tonne in 3 months i.e. a half tonne in three months of sediment is removed by the water plant from the river channel during intake. They dump this sediment within the farms within the water plant compound. The sediment charecteristics is fine sand and soil (reddish-brownish in colour) granules.

d) Water Plant at Oyani in Uriri Sub-county
Targets water supply to Migori Town and its environ and the plant is currently construction.

e) Gogo falls dam
The secondary data collected from Lake Basin Authority "RIVER PROFILE STUDIES VOLUME IV, LOWER KUJA, IRRIGATION DEVELOPMENT ANNEX II HYDROLOGY OCT 1985" reports that: Gogo Falls dam was completed in 1957. In 1961 a severe flood caused the dam to be overtopped and resulted in failure of the right abutment wingwall and the formation of 8M deep erosion gully around the right end of the dam. Grundy estimated a discharge of 30,000Ft^3/S (850M^3/S) for the same flood a few KM downstream at KB1…
Following this failure a roughly built cofferdam was constructed at the upstream end of the gully.

The cofferdam blocked off a section of the secondary spillway, reducing the level of security of the main dam, and by 1979 had developed serious leaks. In order to restore the dam to its pre 1961 level of security a fuse plug spillway was constructed in 1981 in the erosion gully on the right bank; it is designed to fail by overtopping and subsequent erosion.
The dam now has three distinct spillways. The first spillway is typicaly in use, except periods of low flows. The second spillway comes into operation at a discharge of approximately 220 M^3/S. The third, fuse plug, spillway is designed to breach at a discharge of 390 M^3/S, corresponding to a 1 in 5 year flood. On failing, the initial outflow will be of the order of 300-400 M^3/S. Combined with flow already in the river this will result in a surge downstream of 700-300 M^3/S.
It may be noted therefore that in 1 in 5 year flood at Gogo could result in a flood discharge of similar magnitude to that estimated for 1961. Attention is drawn to this because flood estimates provided for 1KB05 and the Project do not allow for failure of Gogo Falls fuse plug spillway. Careful consideration needs to be given to this aspect in relation to safety of staff engaged in hydrological monitoring at Gogo Falls, 1KB1A and 1KB05… [10] (Page A2-19)

f) Drainage Canals
In Gekano area in Nyamira Sub-county there is a drainage canal that is dug by community through CDF funding. The canal flows into R. Gucha, its water comes from the hilly areas near Gekano Secondary. In Esani area in Nyamira Sub-county there is also a drainage canal that was dug by community through CDF funding and it is the current channel of R. Gucha. The purpose of canal was to reduce the impact of flash floods in the area during rainy seasons especially the can now protects the vehicular bridge, the road and it reduces inundation of the nearby school compound.

g) Bridges and Culverts along R. Gucha Migori System
There are at least twenty seven (27) civil works structures constructed along the R. Gucha and R.Migori as they join to form R. Gucha Migori. These structures include culverts, footbridges and vehicular bridges. It was noted during site visit survey that some culverts were blocked by debris. In R. Oyani a tributary of R. Gucha for example at Masaa Bridge there is decommissioned gabion that was left within and in the middle of the river channel by the contractor who constructed the bridge. At Daraja Aego in Nyatike Sub-county the river channel is rocky with sandy riverbed and there are wooden logs in the river channel. These two place lie within R. Gucha system. While in the Migori system at Esoit-Naibor area it was noted during survey that the river had rocky riverbed and wooden logs were observed in the river channel. And in R. Gucha Migori in many places wooden logs were observed in the river channel for example at Wath Onger Bridge.

3.2 FLOOD CHARACTERISTICS AND SITUATIONAL DAMAGES IN GUCHA MIGORI RIVER BASIN

3.2.1 Concept of Flood Characteristics and Situation of Damages in the Gucha Migori River Basin

There are three types of flood characteristics in the Gucha Migori River Basin as described in table 3.2.1 below:

[10] Lake Basin Authority "River Profile Studies iv, Lower Kuja, Irrigation Development Annex II Hydrology Oct. 1985

Table 3.22.1 Floods impact on communities in the downstream during an ordinary year

Mark	Flood Type	Area
A	Soil and sediment run off	Upstream and mid-stream of the river basin
B	Widespread and long-running inundation which is caused by overflow leading to breaking of the R. Gucha Migori riverbanks and heavy backflow from Lake Victoria	Low-lying area at the lower river basin)
C	Flash floods from the neighbouring hills, overflow of small tributaries of R. Gucha Migori and permanent and seasonal streams overflow	Upstream, Mid-stream and downstream

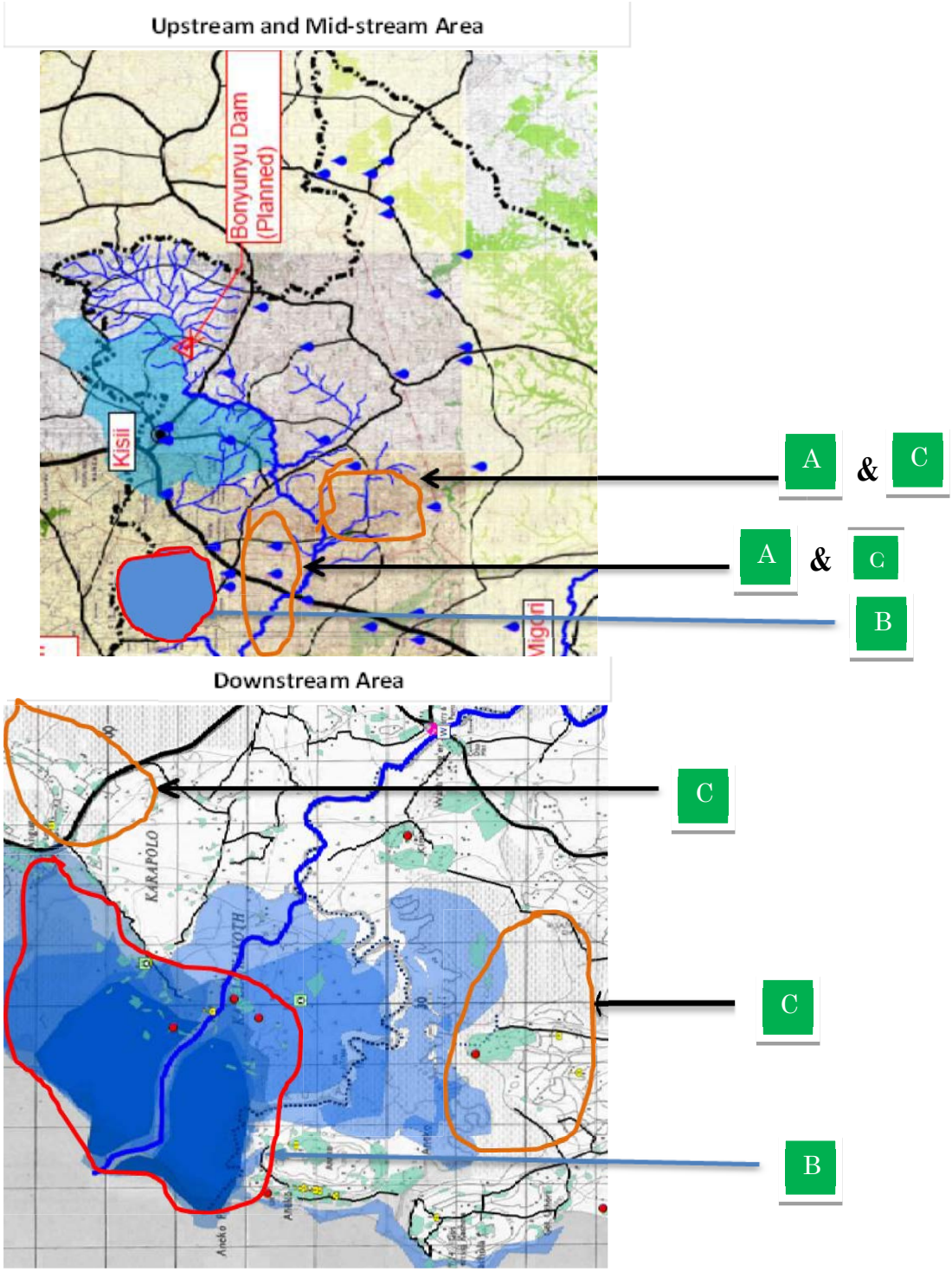
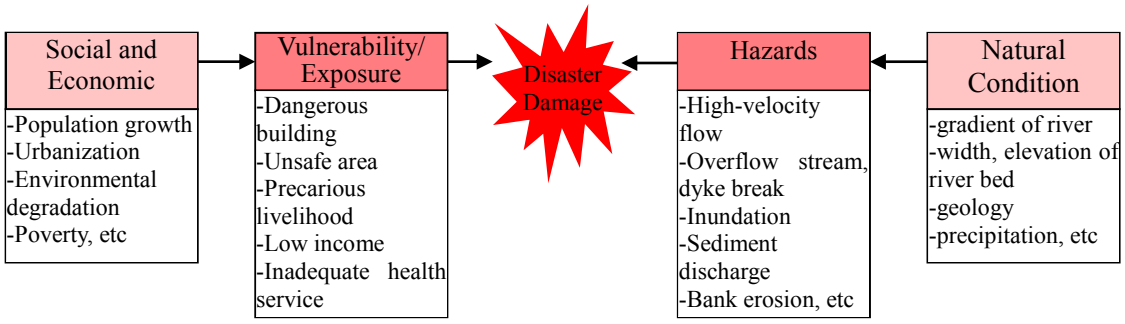


Figure 3.2.1 Records of Flood Damage and Classification of Flood Characteristics in the Gucha Migori River Basin

Flood damage has a close relationship with natural condition and Socio-economic condition in a local area. Natural condition defines types of Hazards in a river basin and Socio-economic condition defines vulnerabilities and exposures. Moreover, it could be said that disaster (flood) damage is defined from both aspects. Characteristics of flood damage are analyzed using information of last chapter (Natural condition and Socio-economic condition) about each flood characteristics of A), B) and C) as above-mentioned.



Source: Revised by JICA Project Team, based on material of "Community and Development assistant of Disaster Prevention, Mr. Mikio Ishiwatari(1997)

Figure 3.2.2 Mechanism of Flood Damage

3.2.2 Soil and sediment run off in upstream middle stream and downstream

(1) Flood Characteristics from Natural Conditions

During the rainy seasons of March to May and September to November there is heavy rainfall in the upstream area of Kisii and Transmara highlands. In both areas in the upstream there are heavy agricultural activities and many feeder murram roads, and therefore during rainy season a large amount of volcanic alluvial soil is washed away from the farms and the murram road that flows downstream at high velocity. The feature is as follows:

- Sediment discharge in the upstream is causing aggradation of river bed levels in the downstream that is gentle slope and low flow velocity.
- In addition, flash floods occur in the upstream areas on the tributaries of R. Gucha and R. Migori.

Natural Conditions that are described in the last chapter and Hazards in this area are shown as Table 3.2..

Table 3.2.2 Natural Conditions and Hazards in Upstream and Middle Stream

Natural Conditions	Hazards
Heavy rains in the Kisii and Transmara highlands Geography: A sharp inclination (High Altitude of 1867m in Kisii Highlands and 1808m in Transmara highlands and lowlands of less than 1151 at Wath Onger downstream)	Soil Erosion High velocity and tractive force High peak discharge
Many earthen (murram) feeder roads	Soil erosion Sediment run-off

(2) Characteristics of Flood Damage from Socio-economic conditions

Relationship between conditions on Social and Economic and Vulnerability/ Exposure to Natural disasters in the upstream and middle stream are shown below:

The upstream area is an agricultural rich area with farmers engaged in cash crop farming especially of tea and sugarcane plantations. There farmers also grow food crops like maize and beans. There is heavy infestation of eucalyptus tree in the upstream of Kisii highlands. In Transmara the forest cover is drastically reducing as many community members in the area adapt agricultural farming lifestyle at the expense of pastoralist lifestyle. This has enhanced soil erosion in the upstream..

Table 3.2.3 Conditions on Social and Economic and Vulnerability / Exposure in Upstream, Middle Stream and downstream

Socio-economic conditions	Vulnerability/ Exposure
Population is 1,671,328 . Density of population 1500~2200 person/km^2	Density of population is high. Vulnerability is high.
Cash Crop Farmers in the upstream and midstream	Access roads to the farms and market are many. Exposure to surface water run-off is high
Riparian land owners in the downstream	Farms are close to the rivers. Vulnerability is high
Feeder roads and trunk route	Structural vulnerability of roads and bridges
The basin is vast cutting across five counties	Difficult to coordinate, integrate or collect and analysis data of metrological, hydrological

(3) Flood Damage Mechanism

3.2.3 Flood Characteristics of Low-lying Area in the Lower Gucha Migori River Basin (B)

(1) Flood Characteristics from Natural Conditions

Downstream area is inundated by flood water that over flow R. Gucha Migori and backflow from the Lake Victoria. The overflow is a result of the river lack of flow capacity due to heavy sedimentation of the river channel. The sedimentation is also heavy at the mouth of the lake leading to the backflow.

- The lack of flow capacity is caused by heavy sedimentation of Gucha Migori River. Aggradation of river bed levels is generated by discharged sediment.
- Meandering nature of the river at a sharp bends leading to the river changing its course and continuous breaking of the riverbanks.
- Continuous widening of the river due to sedimentation.
- In addition, due to rising water level of the Lake Victoria, flooding water has nowhere to go

(2) Characteristics of Flood Damage from Socio-economic conditions

Due to long term inundation, the floods have heavy impacts including damages to properties and farmlands, destruction of crops, no-access to drinking water (the only borehole with good drining water is located in a high depth inundated area), non-functioning of infrastructures facilities (severed road, physically impossible to commute to school, flooding in hospitals and etc.) and loss of livestock and poultry.

- River Gucha Migori breaks its banks and inundated more than two villages with Kabuto and Nyora villages being heavily affected. During floods community members use canoes to access various points of the affected areas.
- Five hundred and seventy nine (579) households were inundated (KRCS calculation puts six persons per one household) and 3,474 residents were affected in the year 2012.
- Evacuees who are evacuated during floods are displaced for over one month. The evacuees move to schools for temporary shelter but because of the damage to school facility during evacuation sometimes the evacuees are denied a place to evacuate to and they have to stay in the cold or at the raised places in their relatives' homes.

Relationship between "Socio-economic conditions" and "vulnerability/ exposure" in this area are shown in

Table 3.2.4.

Table 3.2.4 Conditions on Social and Economic and Vulnerability/ Exposure in the Lower Gucha Migori River Basin

Socio-economic conditions	Vulnerability/ Exposure
Highly-populated villages (population density of 400 people per square kilometer)	A big number of community members are affected by flood
Fishing, agriculture and livestock rearing are the major source of livelihood in this area	Agricultural activities are affected, lack of grazing land for livestock, canoes are used for evacuation and transport hampering fishing activities all this affects the residents' livelihood
Encroachment of the riparian land by farmers.	Riverbanks are weaken and easy to be breached
Unpaved community road	Roads are severely damaged by floods
Education activities in the area	Schools are occupied as evacuation places. Long period of education programmes being suspended enhances school dropout rate in the area.

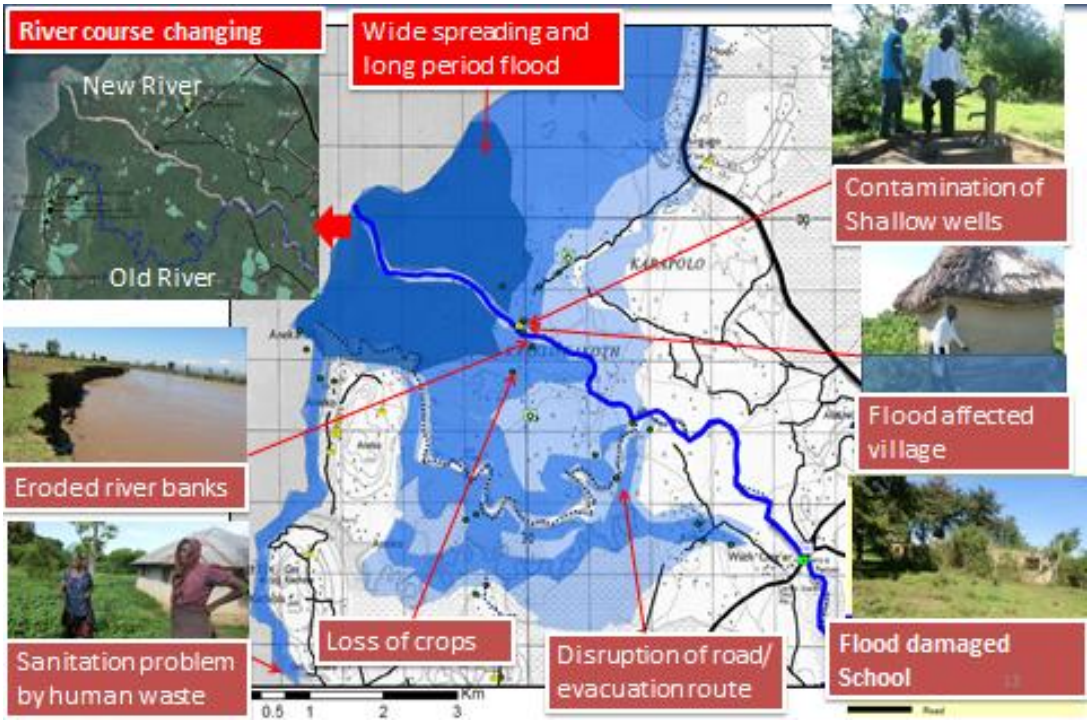


Figure 3.2.3 Flood Characteristics in the Low-lying area of Lower Gucha Migori River

(2) Flood Damage Mechanism

Around upstream to middle stream, sediment outflow occurs heavily with farmland erosion caused by furious rainfall and high velocity sheet flow. Interviews with Agricultural Officers in the upstream revealed that there is heavy erosion during heavy rains and that the storm water flows through the many murram feeder roads into the river channel.

In the upstream and midstream agriculture is the main economic activity with much of their fertilizer being deposited in the downstream as silt that makes the community members in the downstream consider floods as having some good effects to their agricultural land by providing good silt that add value to agriculture in the area.

Figure 3.2.4 Flood Characteristics near the Gucha Migori River's Tributaries

Figure 3.2.5 Flood Characteristics: Damaged riverbank after floods by R. Gucha Migori

3.2.4 Flash flood from the neighbouring hills, overflow of small tributaries of R. Gucha Migori and permanent and seasonal streams overflow(C)

(1) Flood Characteristics from Natural Conditions

Table 3.2.1 Natural Conditions and Hazards near the Gucha Migori River's Tributaries

Natural Conditions	Hazards
Short-term torrential rainfall at hilly areas	Arrival time of flood is short. High peak discharge Steam erosion occurs

(2) Characteristics of Flood Damage from Socio-economic Conditions

Table 3.2.2 Conditions on Social and Economic and Vulnerability/ Exposure near the Gucha Migori River's Tributaries

Socio-economic conditions	Vulnerability/ Exposure
Highly-populated villages (population density of 600 people per square kilometer)	A big number of community members living at the Lwanda township are affected by flash flood

Agriculture, motorcycle transport and livestock rearing are the major source of livelihood in this area	Agricultural activities are affected, lack of grazing land for livestock, and transport by motorcycle is dirupted
Unpaved community road	The tarmac roads becomes the channel through which the strom water flow on and aftermath of flash floods the roads are severely damaged by floods

Figure 3.2.6 Flood Characteristics: Run-off water from nearby hills flow downstream

Figure 3.2.7 Flood Characteristics: The road through which the run-off water flow on

Figure 3.2.8 Flood Characteristics: The rain run-off water flow into the township

(2) Flood Damage Mechanism

Flash flood in the area is caused by concentrated rainfall around the hilly areas and occurrence of flood with large peak flow in short term into the Lwanda Township. In Tito and Ratieny area the concentrated heavy rains flow at high peak into the small seasonal river course and the nearby streams and thereby leading to floods in the area.

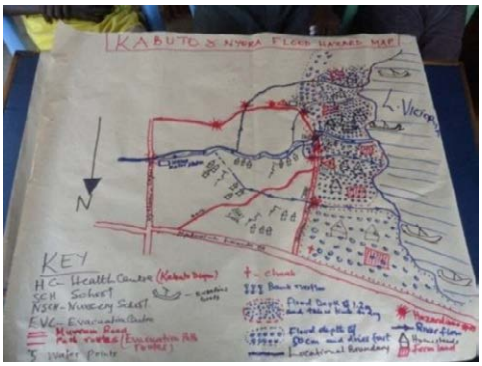
3.2.5 Flood Hazard Map in the downstream of Gucha Migori river basin

Community members in Lower Gucha Migori Sub-catchment have developed four (4) community-driven flood hazard maps. The maps are for the following areas:

i) Kabuto-Nyora (areas mainly affected by overflow of R. Gucha Migori);
ii) Lwanda Misiwi (areas that are affected by heavy rainfall run-off steming from the neaibouring hills);
iii) Ratieny Tito (areas that are affected by heavy rainfall run-off steming from the neaibouring hills that flows into the seasonal rivers and streams); and
iv) Aneko, Aeko Tulu (areas affected by the old channel that overflows during the high flow peaks and the backflow from the lake).

Example of the community driven flood hazard map is shown in the figure 3.2.8 below.

Drawing the map on the ground



Drawn map is transferred to manila paper

Figure 3.2.9 Flood Characteristics: The Community-driven Flood Hazard Map

3.3 ANALYSIS ON FLOOD DAMAGE AND COUNTERMEASURE

3.3.1 Analysis on Flood Damage and Countermeasure for Earth and Soil Flown Out Area in the Upstream of Gucha Migori River Basin

(1) Summary of Damage and Measures

Based on the field survey done by this time, flood damage in the downstream of Gucha Migori River was analyzed using by logic tree.

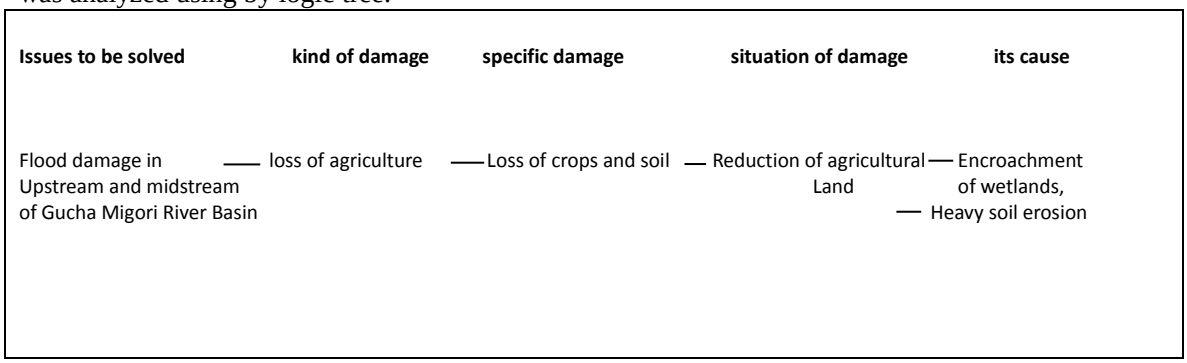


Figure 3.3.1 Analysis on Problem Tree

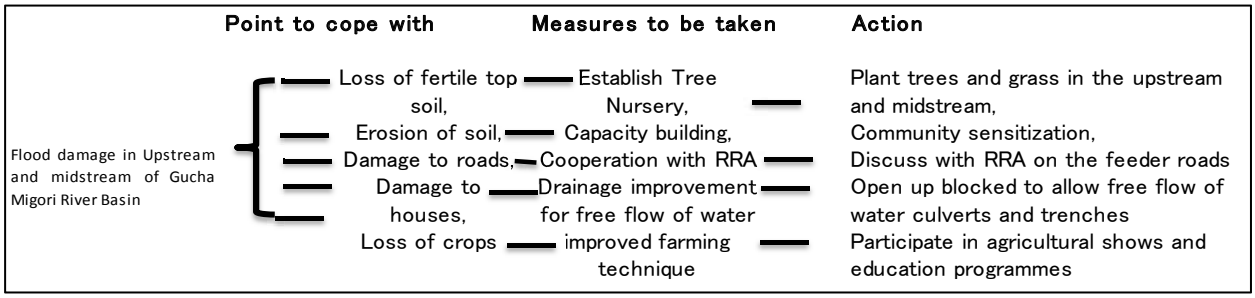


Figure 3.3.2 Analysis on Objective Tree

3.3.2 Analysis on Flood Damage and Countermeasure in the Long-term Inundated Area of the Downstream of Gucha Migori River

(1) Summary of Damage and Measures

Based on the field survey done by this time, flood damage in the downstream of Gucha Migori River was analyzed using by logic tree.

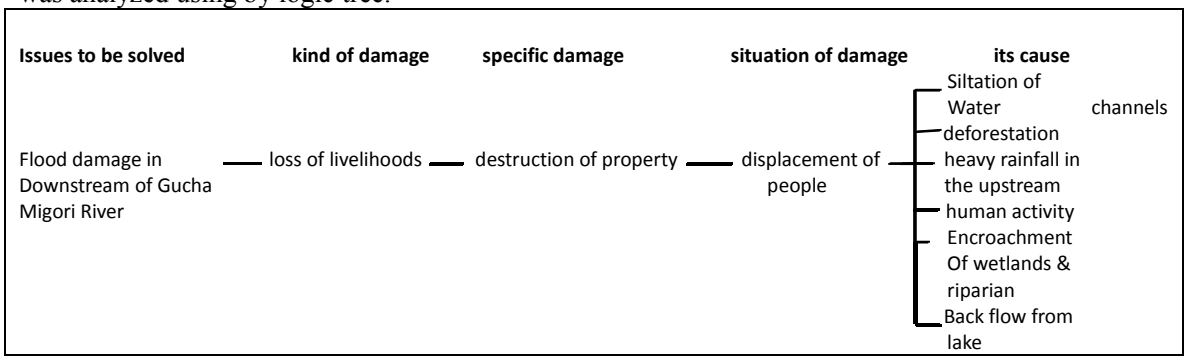


Figure 3.3.3 Analysis on Problem Tree

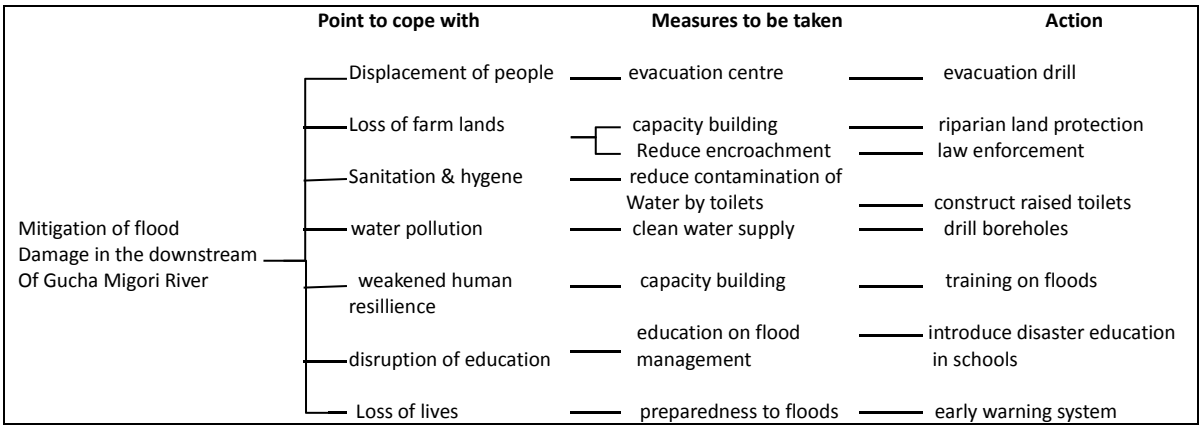


Figure 3.3.4 Analysis on Objective Tree

Table 3.3.1 Countermeasure Method to be considered in Gucha Migori River

	Short Term (1 year)	Medium Term (2 – 5 years) (SCMP)	Long Term (5 -10 years)
Structural and non-structural measures by the government (Large scale)	1. Mainstreaming Flood Management concepts into school curriculum 2. Construction of mobilets or provision of mobilets to every homestead	1. Improvement of evacuation route by constructing footbridges, culverts and bridges; 2. Construction of check-dams in the upstream and mid-stream 3. Improvement of drainages including the storm run-off water on the feeder road	1. Construction of dykes along R. Gucha Migori; 2. Desilting of R. Gucha Migori and its tributary; 3. River training of R. Gucha Migori; 4. Gabion works at breached riverbank ; 5. Improvement of Gogo falls dam
Community participatory works/activities with government assistance including structural and non-structural measures (Medium scale)	1. Improvement of agricultural practices; 2. Drilling of borehole and installing water tanks at evacuation places 3. Conducting evacuation drills (bi-annually); 4. Construction of Retarding basins; 5. Construction of raised toilets in evacuation places	1. Construction of an evacuation centre; 2. Construction of water pans 3. Establishing an integrated flood management forum (Umbrella WRUA) 4. Construction of a storage facility that can store food and household properties of the evacuees; 5. Improved Irrigation-based agriculture	1. Construction of health facility with an admission wing with capacity of at least 50 and maternity wing;
Community initiative works/activities including structural and non-structural measures (Small scale)	1. Construction of well maintained flood resistant toilets; 2. Developing flood sensitization posters; 3. Promotion of low-cost water treatment; 4. Advocacy on sanitation and hygiene	1. Establishing community based early warning system; 2. Capacity building on use of eco-san toilets	1. Raising of houses in the flood affected areas;

3.4 SELECTION OF FLOOD DAMAGE TO BE PREVENT PREFERENTIALLY

3.4.1 The Result of Workshop for Flood Damage Analysis by Community

In Gucha Migori River Basin, the workshop was held to analyze the problems in Lower Gucha Migori sub-catchment with WRUA members, WRMA-SRO staff and JICA project team members on 30th and 31st October 2012.

As a result of analysis, the causes of flood are pointed out as below:

Table 3.4.1 Analysis for the causes of flood by interviewing to WRUA Members

Area	Causes	Characteristics of flood
Downstream of Gucha Migori River	Delta and lowland; Lack of flow capacity of river channel in the downstream; Heavy rainfall in the upstream; Deforestation by cultivation; Large volume of sediment discharge	Wide spreading and long period inundation in lowland of the downstream
	River meandering; Bank erosion	Shifting of river channel in the downstream
Small rivers in hilly area	Heavy rainfall; Lack of flow capacity	Flash flood from small rivers in hilly area

Concerning flood damages, following analysis was done and was indicated the priority order lead by WRUA members

Table 3.4.2 Damage Analysis and Priority Order Determined by WRUA Members

Priority by WRMA-Kisii	Theme	Direct impact	Secondary impact
1	Evacuation problem	-Disruption of evacuation route -People have to evacuate	- Death of people - Doctor and medical service doesn't reach the area - Closure of school for evacuation use
2	Destruction of infrastructure	-Road -Communication networks	- Public transportation system does not work - Community is divided - People can't transfer - Supplies don't reach the market - Delayed response from out side
3	Destruction of farm land (livelihood)	-Loss of crops -Loss of livestock	-Lack of food -Income decrease
4	Water contamination	-Contamination of well-water -Overflow of sewer from toilet	-Outbreak of disease

During the workshop that was held in Gucha Migori River Basin, on 30th and 31st October 2012 the community members were able to discuss the flood problem in Lower Gucha Migori Sub-catchment vis-à-vis hazard, risks, vulnerability and capacity.

The result of the discussion is indicated below:

Table 3.4.3 Discussion on flood problem vis-à-vis hazard, risks, vulnerability and community capacity to cope

Hazards

- Flood hazards includes: Heavy sedimentation of the river channels; Encroachment of the riparian areas and wetlands and heavy rains at the hilltops (rapid speed for onset leads to delayed warning on possible flooding scenario)
- Poor farming techniques leading to soil erosion in the upstream;
- Lack of ability to control sedimentation through trapping the sediments in the upstream;
- Lack of capacity for community in desiliting the river channels

- Lack of machinery for desiltation;
- Soil infertility in the area leading to cultivation of riparian land that are assumed to be fertile;
- Lack of knowledge on small scale irrigation methods leading to assumption that cultivating near the river leads to easy irrigation;
- Uncontrolled gold mining activities ; and
- Destruction of reeds in the wetlands. Reeds are harvested to be used for house construction.

Risks

- Cultivation of riparian land leading to breaching of riverbanks;
- Lack of security of the homes disserted as affected families evacuate;
- Poor evacuation routes that lack facilities like bridges that lead to hazardous evacuation;
- Lack of education programmes on issues of flood management and also interference of education programmes leading to poor performances of people therefore reduced capacity on management of floods;
- Contaminated water sources;
- Invasion of the villages and farmlands by aquatic animals like hippopotamus, crocodile etc
- Poor farming practices which includes riparian land cultivations;
- Poverty: This lead to destruction of forests through charcoal burning etc;
- Lack of capacity in flood management; and

Poor construction techniques whereby community people lay low foundations for houses that are below the flood depth.

Vulnerability

- Farms: The farmlands are located near the rivers or near the water sources are vulnerable;
- Children: Mainly children aged between 2 years and 6 years are the most vulnerable because during flooding disaster there is panic confusion that makes this children more vulnerable because of inability to make informed decision;
- The aged: Senior citizens in the community majorly sixty five and above years are most vulnerable. There is lack of caring for the elderly system;
- Settlements: There are no alternative places for resettlement and most community members do not prefer evacuating to the schools or evacuation places because there is lack of established evacuation place or centre and evacuation to raised places makes evacuees be at the mercy of those in charge of the raised place whether school or any other facility;
- Water points: Contamination of water bodies leading to epidermis and quick spread of diseases; and

Sick persons: The sick who are being treated while at home also vulnerable. This is because they are few trained community health workers

Capacity

- Lack of collective responsibility in addressing flooding disaster;
- Poor communication skills: One major way of communicating is through barazas that some people do not attend and others though they attended they disseminate wrong information to others. Communication through mobile phones is often hampered due to lack of providers' network;
- Lack of technical know how in the community on preparedness;
- Destructive cultural practices and believes;
- Lack of community mobilization skills;
- Lack of knowledge on proper management of evacuation place which includes how to live at the evacuation places; and

Lack of institutionalized flood early warning system

3.4.2 Selection of Flood Damage to be prioritized

The flood damages in Gucha Migori River Basin is principally classified 3 types such as A) Soil and sediment run off (Upstream and midstream of the river basin), B) Widespread and long-running inundation which is caused by overflow leading to breaking of the R. Gucha Migori riverbanks and heavy backflow from Lake Victoria and C) Flash floods from the neighbouring hills, overflow of small tributaries of R. Gucha Migori and permanent/seasonal streams overflow.

Based on the evaluation of flood damages by communities as elaborated above, each impact from flood damages are evaluated from the viewpoints of social impacts as "Number of affected people and houses" or economic impacts as "Losses of merchandise, agriculture, transportation and sightseeing industry", and are shown in the following table.

Table 3.4.3 Selection of The Flood Damages Should Be Corresponding Preferentially

Flood type	Social impacts		Economic impact				Priority order
	Number of affected people	Number of affected houses	Merchandise	Agriculture	Transportation	Small Scale business	
A) Soil and sediment run off	Low	Low	Low	**High**	Mid	Mid	Low
B) Widespread and long-running inundation which is caused by overflow leading to breaking of the R. Gucha Migori riverbanks and heavy backflow from Lake Victoria	**High**	**High**	Low	**High**	**High**	**High**	High
C) Flash flood	Mid	Mid	Mid	Mid	**High**	**High**	Slightly high

In the 3 types of flood damages, it shows that the damage by "B) Widespread and long-running inundation which is caused by overflow leading to breaking of the R. Gucha Migori riverbanks and heavy backflow from Lake Victoria" has strongest impacts socio-economically, and next is the damage by flash flood. The damage by "Soil and sediment run off" in upstream and midstream to midstream has impacts to agriculture but the impacts to socio-economic matters is not so high, and then the priority is low. The countermeasure to reduce the soil erosion and sediment outflow should implement in long term perspective because it takes long time to be given the effects.

(3) Selecting Process FOR POSSIBLE Projects

4.1 Evaluation on 5 Criteria

4.1.1 View Point of Evaluation

Candidate countermeasures that are extracted in last chapter are studied in detail. On the basis of the result of last chapter, 5 criteria; relevance, effectiveness, efficiency, impact and sustainability is considered.

The project team defined 5 criteria as the description on following table, and then evaluated the countermeasures by marking "A", "B" and "C" according to these 5 Items.

Table 3.41.4 Definition of 5 Items for Pilot Project Selection

1	Relevance	Requirements from the stakeholders, Needs of target area Dimension of economic damage and human suffering.
2	Effectiveness	Degree of damage mitigation (Number of beneficiary, Reduction of submergence period, area and number of affected people)
3	Efficiency	Cost effectiveness (It is evaluated by estimated qualitative dimension and degree of damage mitigation)
4	Impact	Spreading effect within a same basin or to other areas Indirect effects

5	Sustainability	Sustainability of maintenance and project effects (On the assumption of pilot project completion according to the design.)

*The project team defined these 5 items for the purpose of this study according to "DAC's evaluation 5 items"

The Integrated Flood Management Committee (IFMC) Gucha Migori River Basin Meeting that was held on 24th July 2014 was tasked with the responsibility of keenly reviewing the proposed countermeasures based on the above elaborated evaluation criteria thereafter rank the countermeasures based on the priority as perceived by the IFMC members.

Through the group discusssions wherein groups were divided into three and each group was tasked with evaluation of the countermeasures. Group one was tasked with evaluation of the shortterm countermeasures, while group two was tasked with evaluation of mid-term countermeasures and group three was tasked with evaluation of the longterm countermeasures. The groups thereafter presented to the plenary on their findings including prioritization of the countermeasures and the implementation period of such countermeasures. The group presentations based on the evaluation, prioritization of the possible countermeasures is herein captured in the table below:

Table 3.4.2 Proposed Activities in Community-driven Flood Management Action Plan

Activity	Relevancy	Effectiveness	Efficiency	Impact	Sustainability	Ranking	Implementation period
Proposed countermeasures for Shortterm implementation							
1) Developing flood sensitization posters	High	High	High	High	High	(1)	Jan 2015 to Dec 2017
2) Conducting evacuation drills (bi-annually);	High	High	High	High	High	(2)	Jan 2015 to Dec 2017
3) Drilling of borehole and installing water tanks at evacuation places	High	High	High	High	High	(3)	Jan 2015 to Dec 2017
4) Construction of raised toilets in evacuation places	High	High	High	High	High	(4)	Sept. 2014 to Sept. 20167
5) Advocacy on sanitation and hygiene	High	High	High	High	High	(5)	Jan 2015 to Dec 2017
6) Promotion of low-cost water treatment;	High	High	High	High	High	(6)	Jan 2015 to Dec 2017
7) Construction of mobilets or provision of mobilets to every homestead	High	High	High	High	High	(7)	Jan 2015 to Dec 2017
8) Improvement of agricultural practices;	High	High	High	High	Fair	(8)	Jan 2015 to Dec 2017
9) Mainstreaming Flood Management concepts into school curriculum	High	High	High	High	Fair	(9)	Jan 2015 to Dec 2017
10) Construction of well maintained flood resistant toilets;	High	High	High	Fair	High	(10)	June 2015 to June 2016
11) Construction of Retarding basins;	High	High	Fair	High	Fair	(11)	Jan 2016 to Dec 2017
12) Check dams in the up-streams	High	High	Fair	Fair	Fair	(12)	Jan 2016 to Dec 2017
Proposed countermeasures for Mid-term implementation							
1) Construction of an evacuation centre	High	High	High	High	High	(1)	Jan 2015 to Dec 2017
2) Construction of water pans	High	High	High	High	High	(2)	Jan 2015 to Dec 2020
3) Establishing an integrated flood management forum (Umbrella WRUA)	High	High	High	High	High	(3)	Jan 2015 to Dec 2015
4) Construction of a storage facility that can store food and household properties of the evacuees	High	High	High	High	High	(4)	Jan 2015 to Dec 2017
5) Improved Irrigation-based agriculture	High	High	High	High	High	(5)	Jan 2015 and conitinuous
6) Capacity building on use of eco-san toilets	High	High	High	High	High	(6)	Jan 2015 to Dec 2015
7) Improvement of evacuation route by	High	High	High	High	Fair	(7)	Jan 2015 to Dec 2018

constructing footbridges, culverts and bridges;							
8) Construction of check-dams in the upstream and mid-stream	High	High	High	High	Fair	(8)	Jan 2015 to Dec 2019
9) Establishing community based early warning system;	High	High	High	High	Fair	(9)	Jan 2015 to Dec 2017
10) Capacity development in proper farming methods in the upstream;	High	High	High	High	Fair	(10)	Jan 2015 to Dec 2020
11) Improvement of drainages including the storm run-off water on the feeder road	High	High	High	High	Low	(11)	Jan 2015 to Dec 2019
Activities targeted for long-term implementation							
1) Construction of health facility (dispensary)	High	High	High	High	High	(1)	Jan 2015 to Dec 2020
2) Raising of houses in the flood affected areas;(Through capacity building)	High	High	High	High	High	(2)	Jan 2015 to Dec 2020
3) Construction of dykes along R. Gucha Migori	High	High	High	Fair	Fair	(3)	Jan 2015 to Dec 2020
4) Gabion works at breached riverbank	High	Fair	Fair	High	High	(4)	Jan 2015 to Dec 2020
5) Improvement of Gogo falls dam 6)	High	High	High	Fair	Fair	(5)	Jan 2015 to Dec 2025
7) Construction of the dams in the upstream	Fair	Fair	Fair	Fair	Fair	(6)	Jan 2015 to Dec 2025
8) River training of R. Gucha Migori	Fair	Fair	Fair	Fair	Low	(7)	Jan 2015 to Dec 2023
9) Desilting of R. Gucha Migori and its tributary	Fair	Low	Fair	Fair	Low	(8)	Jan 2015 to Dec 2020

PROJECT IMPLEMENTATION PLAN OF FLOOD COUNTERMEASURES

5.1 FLOOD COUNTERMEASURES IN THE FLOOD MANAGEMENT PLAN

The Flood Management Plan defines the most prioritized flood damage as a result of the long term inundation after the confluence of R.Gucha and R. Migori and hence R. Gucha Migori and that is the downstream areaof the both R. Gucha and R. Migori and also experience the backflow of the L. Victoria and the second prioritized flood damage as result of the Flash Flood from Tributary River, heavy runoff from the neighbouring hills and this is in the upstream, midstream and downstream areas.

The countermeasures against the above mentioned flood damage should be incorporated in the CMS. In addition, planning of small scale projects that can be implemented at the WRUA scale should be incorporated in the Lower Gucha Migori WRUA SCMP and in the SCMPs of the WRUAs' in the midstream and upstream.

5.1.1 Structural Countermeasures

1) Short-term Structural countermeasures should be implemented in the following order:

· Drilling of borehole and installing water tanks at evacuation places
· Construction of raised toilets in evacuation places
· Construction of mobilets or provision of mobilets to every homestead
· Construction of Retarding basins;
· Check dams in the up-streams

2) Mid-term Structural countermeasures should be implemented in the following order:

· Construction of an evacuation centre
· Construction of water pans
· Construction of a storage facility that can store food and household properties of the evacuees
· Improvement of evacuation route by constructing footbridges, culverts and bridges;
· Construction of check-dams in the upstream and mid-stream
· Improvement of drainages including the storm run-off water on the feeder road

3) Long-term Structural countermeasures should be implemented in the following order:

· Construction of health facility (dispensary)
· Construction of dykes along R. Gucha Migori
· Gabion works at breached riverbank
· Improvement of Gogo falls dam
· Construction of the dams in the upstream
· River training of R. Gucha Migori
· Desilting of R. Gucha Migori and its tributary

5.1.2 Non-structural Countermeasures

1) Short-term Structural countermeasures should be implemented in the following order:

· Developing flood sensitization posters
· Conducting evacuation drills (bi-annually);
· Drilling of borehole and installing water tanks at evacuation places
· Advocacy on sanitation and hygiene
· Promotion of low-cost water treatment;

· Improvement of agricultural practices;
· Mainstreaming Flood Management concepts into school curriculum

2) Mid-term Structural countermeasures should be implemented in the following order:

· Establishing an integrated flood management forum (Umbrella WRUA)
· Improved Irrigation-based agriculture
· Capacity building on use of eco-san toilets
· Establishing community based early warning system;
· Capacity development in proper farming methods in the upstream;

3) Long-term Structural countermeasures should be implemented in the following order:

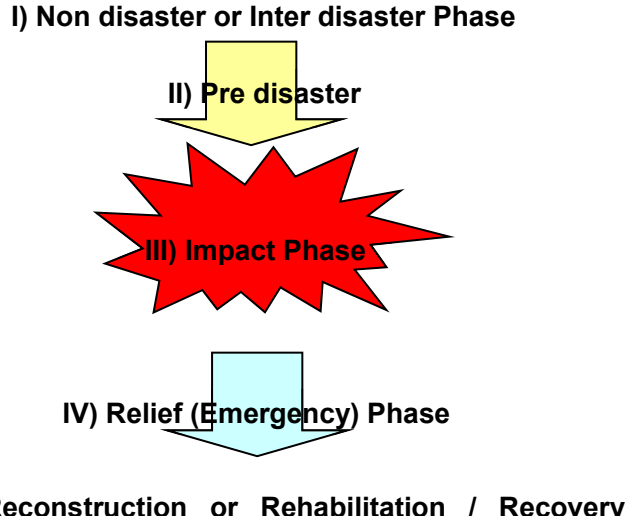
· Raising of houses in the flood affected areas;(Through capacity building)

5.2 DRAFT IMPLEMENTATION SCHEDULE OF FLOOD COUNTERMEASURES

WRMA, LOGUMI WRUA, stakeholders and members of the IFMC and JICA Project Team proposes draft implementation schedule of flood countermeasures as following.

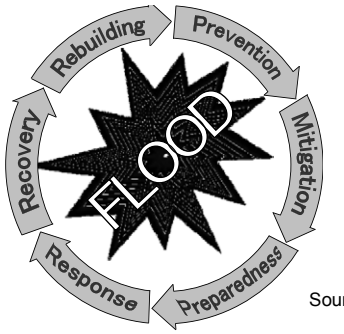
RECOMMENDATION

- ✓ Fundamental countermeasure against long term inundation in the downstream of Gucha Migori River on a long term basis should be considered.
- ✓ Collaboration with existing organization such as Sub-county Disaster Management Committee and County Disaster Management Committe is necessary to implement a project that can enforce resilience of community against flood.
- ✓ Integrated approach in flood management is important and should be the driving force. The integrated apprpach gives room for cooperation between upstream. Midstream and downstream. It also encompasses the idea of stakeholder cooperation and collaboration which includes sharing of knowledge, data and information.
- ✓ When undertaking flood management activities it is important to consider age, sex, human physical vulnerabilities etc. It is important that when structures are constructed there must be consideration of the physically challenged persons within the community (persons with disabilities).
- ✓ Flood management is not based on one phase of floods alone i.e. response but effective flood management considers all the phases of floods. The pre-flood phase that entails preparedness, flooding phase that entails response and post-flood phase that entails rehabilitation, reconstruction and developing plan for the next flood occurrence.



Source: Trainers Training Manual on Flood Disaster Management developed under the Nyando Project

Figure 5.1 ***Phases of Disaster***



Source: Flood Management Textbook for school pupils

Figure 5.2 ***Phases of Disaster***

WRMA STAGE ONE TRAINING

WRMA Stage One Training was held on 14th to 25th October 2013 at KEWI in Nairobi and Sunset Hotel in Kisumu respectively. It is predetermined by the Project Design Matrix that WRMA staffs be trained in effective flood management. The trainings are divided into three stages i.e. stage one trainees are trained in effective flood management, stage two the qualified trainees train other WRMA staffs and thereafter the training spreads across to all the sub-regional offices and WRUAs are also trained. The stage one training was segmented into two phases: phase one was held in Nairobi while the phase two was held in Kisumu.

The training in Nairobi commenced in earnest on 14th October 2014 and the training was officially opened by Technical Manager WRMA HQ Eng. Kinyua representing the Chief Executive Officer (CEO) and the Financial Manager WRMA HQ who both made the opening remarks.

Eng. Kinyua makes the opening remarks

The training in Nairobi was theoretical in nature and entailed understanding the concepts in flood management and modalities of achieving effective management of floods. Facilitation during this phase was through a workshop mode of approach which entailed PowerPoint presentations and thereafter questions and comments from the trainees and in some cases there were group discussions and thereafter group presentations.

There were also various lecturers engaged during the Stage One Training and they included leading Kenyan Professors, Japanese Experts and Project Supervisor Gucha Migori.

The participants were WRMA staffs mainly from the Flood Management Unit in the Headquarters and the three Project Areas inclusive of the Regional Offices that the Project Areas fall under.

Stage One Participants keenly follow the lecture proceedings

WRMA Stage One Training in Nairobi and Kisumu held from 14th 25th October 2013

A participant to the training states his expectations

During the Stage One Training the participants agreed to be time conscious and to maintain high level of disciple through out the training period.

Group Photo

Opening Session of the training

WRMA STAGE ONE TRAINING PROCEEDINGS IN NAIROBI

During the entire training period in Nairobi the participants showed highest level of discipline and more importantly they were all keen with their studies with an average of 99% attendance in all the lectures.

The lecture room was electrifying and glowed with hunger for knowledge from the participants and passion for sessions by the lecturers. Just like they say "accounting for every drop of water" the participants were accounting for every minute of the lecture by their attentiveness, raising issues of concern, participating in group works making presentations and answering every question asked. It was awesome!

The modules covered during stage one training included: Cause and effect of floods; Understanding flood management; Flood disaster management; Rainfall observation; Rainfall Data and Statistical Processing; Integrated River Basin Flood Management (IRBFM); Community managed Flood Disaster Risk Reduction (DRR); Vulnerability assessment; Developing a Community Flood Hazard Map; Flood Early Warning System; Community Based Flood Early Warning; Introduction to Integrated Flood Analysis System (IFAS) and

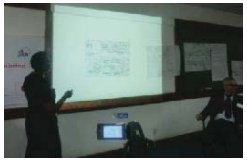
Presentation on Progress in Lumi River Basin

Global Flood Alert System (GFAS); Evacuation Planning; Evacuation Centre Management; Capacity for Transmitting and Communication Skills; Communication on Desired Information to Schools; Effective Public Awareness Raising on Flood; Planning and design of flood damage mitigation measures; Flood Damage Mitigation Non-Structural Measures including Community Based Measures; Flood damage mitigation structural measures including community-based measures; Co-operation and Co-ordination between Upstream and Downstream ; Role of Co-operation and Coordination; Co-operation with County Government, WRUA and DDMC; Role of District Disaster Management Committee (DDMC).

Keen attention during training

Group discussion in progress

Training in progress



Presentations after Group discussion

WRMA STAGE ONE TRAINING PROCEEDINGS IN KISUMU

The training in Kisumu was held at Sunset Hotel and it involved both theoretical and practical engagement. In theory sessions the participants were given lectures on effective flood management and the lecturers used PowerPoint Presentation mode.

Thereafter a field excursion exercise on community flood hazard mapping was carried out. The Winam WRUA played host to the training wherein the WRUA benefited by being part and parcel of Community Flood Hazard Map development. The areas visited that fall under the jurisdiction of Winam WRUA were Okana and Nyamware areas and two Community Flood Hazard Maps for the two areas were developed.

There was also a site visit to rainfall station at Ahero National Irrigation Board Compound and also observation of high flow measurements at R. Nyando. The participants also visited Kamagaga Evacuation Centre a structural measure constructed under the Japan Grant Aid Nyando Project.

Briefing meeting at Rabuor

Field excursion to Okana village

Sketching of hazard map on ground

Transfer of map to manila paper

TRAINING IN JAPAN

Disasters mainly earthquake, Tsunami and floods have occurred in Japan over centuries. This disaster occurrence has not led to submission of the people but in the spirit of the nation and her people Japan has exerted resilience that has seen the nation rising up from the horrors of history of disaster to become one of the most developed nation in the world.

Therefore the training in Japan by WRMA staffs on Effective Flood management was timely.

The training in Japan entailed of 20 staffs from WRMA including 3 members from the WRUA. During the training in Japan the participants were taken to various sites in Japan but during the sites visits there were observations that indicated culture shock and the amazement of the melting pot characteristics of Tokyo City. The following were noted:

A) Timeliness which is a strong characteristics of Japan the City Shuttle leave on time and the smallest delay by a passenger means missing the Shuttle! Let's put in a context, "The welcome was very warm and the staff had prepared everything it made us forget the jetlag we were all suffering from. Fast forward and the next day some of us missed breakfast and that was lesson number 1: that in Japan, allocated time for activities is strictly adhered to!" Mrs. Elizabeth Diego.

Other notable issues were work ethics, sea food, hospitability. Humility etc. For more do not miss the next month issue of IFM Newsletter!

Group Photo during the training in Japan

Osaka train station: time is strictly adhered to

Eng. Matagaro receives a 3D Map

SITE VISITS IN JAPAN

The training in Japan was characterized with numerous site visits. In the next month Issue of the IFM Newsletter Training in Japan will be revisited. Do not miss your copy!

From Tokyo to Osaka we made several site visits to rivers, dams, museums, forest and had a close view of Mt . Fuji on our way from Tokyo to Osaka in a Shinkasen. A site visit to Arakawa river and we could not believe that this was a flood-way i.e. a man made river that was built purposely to control floods. The river is well managed and there is heavy investment by Ministry of Land, Infrastructure and transport that in each of their offices for the class A rivers managed there is Disaster Information system that comprises of equipped offices with Fibre optic cables, CCTV,C-Band radar ,TV broadcasts. Data collected is real time which is relayed on the screens in the office this has empowered the Japanese in management of all kinds of disasters without causing wide spread destruction.

The management of rivers in Japan is anchored in River Law which is adhered to by the citizens and implemented to the letter.

For every river there is a dedicated river museum and its history is preserved, the rivers are continuously maintained, and we observed a multi purpose dam that was first constructed in 616 AD and is in perfect use to date over the centuries they have been building more embankments. In every place we went the welcoming was warm and thanks to NEWJEC for the entertainment the dinners, sushi, beef bowl and all the cold drinks that came in ice. More will be in the next issue of this newsletter but I leave you with this quote: "The greatest lesson is enhancement of disaster prevention with focus on ability by people needs; 'ji jyo' 'kyo jo' 'ko jyo' meaning " myself" each other" public"

R. Arakawa flood-gates

Yodo Gawa weir

Amagase Multipurpose dam

Dinner: Sea food delicacies

COMMUNITY BASED FLOOD EARLY WARNING SYSTEM (CBFEWS)

The workshop on CBFEWS took place on 12th to 14th May 2014, as per the planned schedule. The purpose of the workshop was to assemble CBFEWS which would be used in the next phase of the project and also for the WRUAs to acquire skills on how to assemble the FEWS. The Workshop was attended by 3 Isiolo WRUAs, 3 LOGUMI WRUAs, 3 Lower Lumi WRUAs, 1 Kabarnet WRUA, 1 Nairobi WRUA, 1 JICA Volunteer and 3 WRMA members.

It is imperative to note that even before the workshop the observers for the Flood Early Warning System were had been trained on the monitor and the gauge. With the assistance from KRCS, the observers were trained on how to take and keep records. A tool set for the maintenance of the CBFEWS was given to Isiolo, Lower Lumi and LOGUMI WRUAs.

In Gucha Migori for example it was noted that the observer stationed at Emuria Dikiri in Narok County relayed information by sending an sms to WRMA Kisii SRO, LOGUMI and Upper Magor WRUAs' Secretaries.

River gauges and rain gauges with accessories of a sensor and alarm were installed in the three pilot areas.

In Gucha Migori 4 rain gauges and 1 river gauge were installed. KRCS and Migori County participated in some of the installation. During the Taveta IFM Forum observer from Gucha Migori was considered the best observer and was rewarded.

It is imperative to note that the cooperation and coordination between the upstream and downstream is of uttermost importance to ensure the success of the CBFEWS.

WRUA members are being trained on assemble of the CBFEW gadgets and installed CBFEW in Isiolo

Description : Teachers and students participate in the installation of the rain gauge and the sensor

Description : The sensor having been installed is being tested and also explanation to the observer on how to operate and manage the sensor

Installation of rain gauge at Kiong'ongi Highin Middle Gucha WRUA jurisdiction

Description : Explanation to the teachers and students during the installation of the rain gauge and the sensor

Description : The rain gauge is fitted in its holder at the weather station to enable its draining after every rainfall in the area.

Installation of rain gauge at Emuria Dikiri High in Upper Magor WRUA jurisdiction

Description : Installation of the rain fall gau ge gadget sensor

Description : The rain gauge is fitted in its holder at the Iterio Girls, the co ntainer will be drained after every rainfall in the area.

Installation of rain gauge at Iterio Girls High in Upper Riana WRUA jurisdiction

TAVETA INTEGRATED FLOOD MANAGEMENT FORUM: SITE VISIT

Day one of Taveta IFM Forum entailed presentations. Mr. Karimba of Isiolo WRUA made a presentation on the situation report of community based flood early warning (CBFEWS) in Isiolo, Mr. Joshua Ouma of LOGUMI WRUA made a presentation on the situation report of (CBFEWS) in Gucha Migori River Basin, Mr. Fred Reuna of Lower Lumi WRUA made a presentation on the situation report of (CBFEWS) in Lumi River Basin. There were presentations by the respective Pilot Project Area WRMA SRO. Mr. Kinyanjui of WRMA Isiolo presented on Riverbank Protection in Isiolo, Mr. Njihia presented on implementation of non-structural activities in Gucha Migori and Mr. Musau presented on evacuation centre in Lumi river basin.

There were presentations from WRMA HQ with Mr. Mwangi presenting on recommendations for nationwide expansion of (CBFEWS). Ms. Orina presented on draft manual for non-structural measures against floods. Mr Maina of WRMA Loitoktok presented on draft manual for structural measures against floods.

There were also group and plenary discussions in the course of two days event. The group discussions entailed the theme of the future activities of the WRUAs and plan of expansion of flood management in other 12 flood prone areas.

Day one of the Taveta IFM Forum also entailed site visit to Eldoro primary School that culminated with the handing over ceremony of the completed structures. During the site visit the pupils dramatized a flood occasion in Taveta that surrounded the theme of early warning, evacuation, response and relief distribution. The head teacher led the participants to the raised road, the installed culvert, the raised evacuation hall and toilets.

The participants were therefore able to observe and have an understanding of community-driven flood management activities that can be undertaken in flood prone areas.

Awarding of certificates to observers

Explanation of raised road

Official opening of evacuation hall

Official opening of raised toilet

Eldoro pupils dramatize a drama with a flood theme on flood led community evacuation during handover ceremony

Integrated Flood Management Newsletter

THE PROJECT

ON CAPACITY DEVELOPMENT FOR EFFECTIVE FLOOD MANAGEMENT IN FLOOD PRONE AREAS

IFM Newsletter Issue No.013 30th July, 2014

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FOURTH GUCHA MIGORI IFMC MEETING

The fourth Integrated Flood Management Committee (IFMC) for Gucha Migori was held on 24th July 2014 at IFAD Hall in Migori County.

The fourth IFMC for Gucha Migori was unique because it was largely organized by WRMA-LVSC Southern Shoreline Gucha Migori. The preparatory works entailed developing presentations, procure the hall for the meeting and inviting all the stakeholders to attend. On 24th July the meeting was therefore held and it was attended by various stakeholders.

In the opening remarks session the JICA Project Team Leader Eng. Hideki SAWA speech was read by Project Supervisor for Gucha Migori Mr. NGIDA. In the speech the JICA Project Team Leader congratulated Gucha Migori IFMC for holding its 4th meeting which he referred to as the 1st post-project IFMC meeting. He therefore wished the IFMC well and stated that it was JICA Project Team that such meetings will be continuous and the developed IFMP would be implemented through the IFMC effort. He concluded his speech by stating that the good success will be when the IFMC structures will be replicated in other flood prone areas.

Eng. Matagaro makes opening remarks

Eng. MATAGARO DTCM in charge of floods from WRMA HQ in his opening remarks stated that the IFMC was noble committee that must be all inclusive and integrated in nature. He explained the purpose of the 4th IFMC and stated that at the end of meeting it was expected of the IFMC members to critical examine the IFMP, make comments and mutually agree on the document and thereafter adopt it. WRUAs formulation of flood management plans. sub-regional level.

The Zero Draft IFMP was presented and discussed and the countermeasures evaluated and prioritized by the participants. The lesson learnt extracted from the Project was also presented to the participants.

In closing remarks Eng. MATAGORO stated that the 5th IFMC was important because the comments of the IFMC members would have been factored into the IFMP. He added that the IFMC will be tasked also with identifying the actors to implement the IFMP thereafter he declared the meeting closed.

TAVETA INTEGRATED FLOOD MANAGEMENT FORUM

Taveta IFM Forum was held on 24th and 25th June 2014 at Greenpark Hotel Taveta County. The Forum was graced by the WRMA CEO Eng. Philip OLUM, WRMA Director Hon. Jackson Mwalulu, the Taveta and Meru County government representatives, JICA Kenya Ms. Meri Fukai JICA Chief Advisor Eng. KONDO, JICA Project Team led by Eng. SAWA WRMA staff from the HQ, the three pilot site and all Flood Management Officer (FMO) and also the WRUAs from the three pilot project areas. In his opening remarks the WRMA CEO pointed out the importance of involvement of the County governments in flood disaster management. He elaborated that through the JICA Project structures had been constructed and O&M was critical and therefore he called for cooperation between WRUA, WRMA and respective County government. He also thanked the Japan Government for the continuous support and assistance that Japan Government has offered to Kenya on flood management.

The Chief Officer Taveta County on her part stated that Taveta County government was going to implement more structural measures. She also clarified that she was going to share Taveta IFMP with Taveta County Executive in order to strengthen flood management.

Eng. KONDO in his opening remarks explained the JICA Projects on flood management in Kenya. He further explained the scope of PCDEFM Project. He clarified that through the Project the institutional framework had been strengthened. He appreciated WRMA for deploying FMO in all the flood prone areas in the country.

WRMA CEO Eng. Olum makes opening remarks

WRMA Board Director Hon. Mwalulu appreciated JICA efforts in Flood Management in Taveta. He called for stakeholders cooperation in flood management.

He stated that as a member of WRMA Board he was going to request WRMA to strengthen flood management department. He thereafter declared the Forum official opened.

WRMA STAGE THREE TRAINING

Capacity development for WRMA and WRUA entailed trainings. The WRMA Stage One Training was predetermined by the Project Design Matrix that WRMA staffs be trained in effective flood management by JICA Project Team. Stage two entailed the qualified first stage trainees training other WRMA staffs from other flood prone regions. Stage three entailed trained WRMA staffs training the WRUAs. The third stage training was therefore held in Migori County wherein LOGUMI WRUA and representatives of Middle Gucha, Upper Magor and Ongoche WRUAs also participating. The training commenced on 19th May 2014 and ran for one week i.e. it was completed on 25th May 2014.

The third stage training was officially opened by Eng. Matagaro from WRMA HQ. In his opening remarks he pointed out that the WRUA were the institution that were actively involved in flood management at the grassroots. He therefore stated that for WRUA to be effective in engaging in flood management activities there was need for the WRUA members to be trained. He concluded his speech by stating that the WRUA members selected for the training were just but a few and it was expected that the trained members share knowledge and information with other WRUA members that did not actively participate in the third stage training.

WRMA staff lectures as trainees keenly listen

There were five WRMA staffs that were involved in the actual training of the WRUAs. The staffs prepared PowerPoint presentations based on the revised WDC Manual that had a module of flood management incorporated therein. The training entailed lectures in a workshop environment, site visits to LOGUMI SC and group discussions and presentations.

Lecturer explains concepts to eager for knowledge trainees

WRMA STAGE THREE TRAINING PROCEEDINGS: SITE VISITS

WRMA Stage three Training in Migori County held from 19th to 25th May 2014

Relentless lecturers during 3rd stage training

During the Stage Three Training the participants agreed to be time conscious and to maintain high level of disciple through out the training period.

Lecture at KB05 stn Wath Onger

WRUA member explains operation of CBFEWS

During the entire training period the participants showed highest level of discipline and more importantly they were all keen with their studies with an average of 100% attendance in all the lectures.

The lecture room was electrifying and glowed with hunger for knowledge from the participants and passion for sessions by the lecturers.

Just like they say "accounting for every drop of water" the lecturers and participants were accounting for every minute of the lecture by their attentiveness, raising issues of concern, participating in group works making presentations and answering every question asked. The WRUA members raised pertinent issues concerning flood management and the lecturers were apt in their response. The lecturers were creative in ensuring that the trainees do not miss out on the knowledge. One example to note was Mr. Rueben Ngessa creativity in ensuring a technical oriented lecture on IFAS and modelling was simplified and understandable to the trainees. The lecturers used English, Swahili and sometimes Luo as language of instruction. The sessions were awesome! This actually indicates that flood management in Kenya has been taken by horns and both WRMA and WRUA were up to the noble tasks.

The site visits were equally awesome experience. The trainees were trained on understanding the importance of accurate data collection, purpose of the river gauge stations and the installed community based flood early warning gauges. There were transect walks in Sere and Angugo Villages that culminated by the trainees drawing the community flood hazard maps for these two village. During the transect walk JICA Kenya representative Ms. FUKAI who was in attendance walked through the tough terrains with the lecturers and trainees. It was an awesome experience.

Trainees draw community-based flood hazard map

Day two of the site visit entailed execution of an evacuation drill at Nyora. The drill was executed in collaboration with KRCS Migori branch which was an indication of the future stakeholders cooperation. It is important to note that the Migori County government also implemented an evacuation drill a week later in Kabuto.

Teacher explain the raised toilet at Nyora

Wrap up meeting after a successful execution of evacuation drill

KRCS staff explain execution of drill

Execution of an evacuation drill

KRCS staff demonstrates basic first aid during the Nyora execution of drill

WORKING GROUP MEETING IN MACHAKOS

The Working Group Meeting was held at WRMA-Athi Regional Office Hall in Machakos Town on 4th and 5th June 2014. The objective of the Working Group Meeting was to carryout post-project capacity assessment of WRMA.

The evaluation was based on the previous assessment that had been carried out during the 1st and 2nd working group meeting that was held in 2012 and it was premised on the following thematic viewpoints: to develop a system for collecting and analysing information/data with respect to flood phenomena; to analyse cause and effects of floods by using related information/data; to coordinate relevant stakeholders for better flood management in the communities; to technically advice WRUAs in developing the SCMPS; to formulate and update training manuals on flood management and to conduct training seminars for staffs in HQ, ROs and SROs; and to introduce the concept of river basin flood management plan (RBFMP) which should be set between CMS and SCMP.

Working Group Participants in deep discussion on assessment

THIRD IFMC MEETING LUMI RIVER BASIN

The third Integrated Flood Management Committee (IFMC) for Lumi River Basin was held on 10th April 2014 at Greenpark hotel in Taveta County.

The meeting was well attended by stakeholders within the basin. Lower Lumi and Upper Lumi WRUA were well represented. WRMA HQ, WRMA Athi and WRMA Loitotok was well represented in the meeting. JICA Project Team was also adequately represented. The Taveta County government was also represented.

During the meeting there were various presentations that mainly aimed at effective flood management. After the confirmation of the previous minutes, Mr. Joseph Maina FMO presented the overview of IFMP for finalization. In his presentation he explained that the 4th IFMC meeting was scheduled for August 2014 and thereafter the meetings will be held annually. Eng. Kondo clarified the importance of understanding the role of WRUA, WRMA and Taveta County government in the implementation of the IFMP. He also presented on discussion on current improvement and future revision of the IFMP.

Mr. Robert Owaga, JICA Project Supervisor for Lumi River Basin presented on Report on the countermeasures at Eldoro Primary School and CBFEWS operation in Lumi River Basin. During his presentation Eng. Kondo pointed out the importance of CBFEWS as experienced in Isiolo where floods occurred but because the upstream community issued a warning the flood damage in terms of human lives losses was averted.

Presentation on IFMP Finalization

Mr. Clement Ngida, JICA Project Supervisor for Gucha Migori River Basin presented on Establishment of CFMO in LOGUMI SC. In his presentation he explained the difference of the CFMOs in LOGUMI SC and Nyando River Basin. He thereafter explained the current activities of the CFMOs. After his presentation the Lower Lumi WRUA requested that the presentation which was in English be translated to Swahili that they may use to establish CFMO in their own area.

Plenary session during IFMC

THIRD IFMC MEETING ISIOLO RIVER BASIN

The third Integrated Flood Management Committee (IFMC) for Isiolo River Basin was held on 21st May 2014 at Rangeland hotel in Isiolo County.

The meeting was well attended by stakeholders within the pilot area river basin. Isiolo WRUA were well represented. WRMA HQ, WRMA RO and WRMA SRO was well represented in the meeting. The Isiolo and Meru County governments were also represented.

The main objectives of the meeting were: finalization of IFMP, discussion on IFMC constitution and report on river bank protection and FEWS installation and operation.

During the meeting, the following discussions were made: review of Isiolo SCMP to incorporate flood management activities, IFMP to be incorporated in ENNCA CMS, enhancement of monitoring network for collection of more reliable data in relation to flood management. There was need to escalate the activities identified in draft IFMP as finalization of the Plan is underway. In the composition of stakeholders for the IFMC, the members agreed to include media, this will ensure the effective flow of information relating to the floods to the intended target communities. The implementation of riverbank protection was a success amidst challenges like low community participation during implementation, lack of community incentives. The members a greed to change clause on ' education on disaster prevention' to 'education on disaster management'. The proposed constitution for IFMC was to be amended by the members and relevant clause be included. The adoption of the constitution was scheduled for the next IMFC meeting.

Mr. Mutie presents the previous minutes to the participants

Participants in the 3rd Isiolo IFMC meeting held on 21st May 2014 at Rangeland Hotel