Nile Equatorial Lakes Subsidiary Action Program

MARA TRANSBOUNDARY INTEGRATED WATER RESOURCES MANAGEMENT AND DEVELOPMENT PROJECT

Main Report

Investment Project Proposal

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List of Abbreviations and Acronyms

a.s.l.	Above sea level
ARU	Ardhi University
CBO	Community Based Organisation
CFA	Community Forest Association (Kenya)
CFUG	Community Forest Users Group (Kenya)
CSO	Civil Society Organisations
EIA	Environmental Impact Assessment
ENSDA	Ewaso Ngiro South Development Authority
ESMF	Environmental and Social Management Framework
FS	Feasibility Study
GAP	Gold Audit Program
GIS	Geographical Information System
GIZ	Deutsch cooperation
HR	Human Resources
ICIPE	International Center for insect Physiology & Ecology
ICRAF	International Center for research in Agroforestry (Kenya)
ILRI	International Livestock research Institute (ILRI)
IRA	Institute of Resources Assessment
IWM	Integrated Watershed Management
IWRM	Integrated Water Resources Management
KARI	Kenya Agricultural Research Institute
KDB	Kenyan Dairy Board
KEFRI	Kenya Forestry Institute
KEFRI	Kenya Forestry Research Institute
KENFAP	Kenya National federation of Agricultural Producers
KFS	Kenya forest Service
KIRDI	Kenya Industrial Research & Development Institute
KWS	Kenya Wildlife Service
LGA	Local Government Authorities
LVBC	Lake Victoria Basin Commission
LVBWO	Lake Victoria Basin Water Office

LVEMP	Lake Victoria Environmental Management Project
MAFC	Ministry of Agriculture, Food and Cooperatives
MATIU	Ministry of Agriculture Training Institute Ukiriguru (Tanzania)
MMNR	Maasai Mara National Reserve
MNRT	Ministry of Natural Resources and Tourism (Tanzania)
MoA	Ministry of Agriculture (Kenya)
MoCD	Ministry of Community Development (Tanzania)
MoEM	Ministry of Energy and Minerals (Tanzania)
MoFD	Ministry of Fishery Development (Kenya)
MoHSW	Ministry of Health and Social Welfare (Tanzania)
MoLD	Ministry of Livestock Development (Kenya)
MoLFD	Ministry of Livestock and Fishery Development (Tanzania)
MOPH	Ministry of Public health (Kenya)
MoW	Ministry of Water (Tanzania)
MRB	Mara River Basin
MRBMP	Mara River Basin Management Project
NBI	Nile Basin Initiative
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NEMA	National Environment Management Authority (Kenya)
NEMC	National Environment Management Council (Tanzania)
NGO	Non-Governmental Organisation
NLRI	National Livestock Research Institute (Tanzania)
PMU	Project Management Unit
PPP	Public-Private Partnership
SENAPA	Serengeti National Park
SIDO	Small industry Development Organization (Tanzania)
STAMICO	State Mining Cooperation
SUA	Sokoine University of Agriculture
SWAT	Soil Water Assessment Tool
TAFIRI	Tanzania Fisheries Research Institute
TAFORI	Tanzania Forest Research Institute
TMMA	Tanzanian Minerals Auditing Agency
ToR	Terms of Reference

Vi Agroforestry	Vi Agroforestry project (Swedish cooperation)
VPO Environmental Division	Vice President's Office
WB	World Bank
WREM	Water Resources and Energy Management International Inc.
WRMA	Water Resources Management Authority (Kenya)
WRUA	Water Resources Users' Association (Kenya)
WWF	World Wildlife Fund

1. INTRODUCTION

EGIS has been procured by the Mara River Basin Project to develop a preliminary investment project for Integrated watershed management through feasibility type studies.

According to the terms of reference, the study seeks to address catchment degradation issues and contribute towards the optimal and sustained production of the integrated use of natural resources for the benefit of the inhabitants and the communities linked to them. The measures will contribute towards reversal of the current basin degradation trends to ensure a healthy, improved water security and livelihood improvement.

The present study aims at completing the tasks performed by NIRAS under a previous contract in 2011 and early 2012. Under this contract, NIRAS had held consultations with the stakeholders in different points of the basin, and realized desk studies about the main features and issues of the Mara River watershed. This led to the preparation and submission of the following reports, which have been intensively reviewed and used in the new phase:

- Inception Report - May 2011;
- Thematic Report Wildlife and Tourism - November 2011;
- Thematic Report Institutional Setting - November 2011
- Thematic Report Watershed and Wetlands – February 2012
- Interim Report - February 2012

The final output of EGIS's work is a **Preliminary Investment Project Proposal** presented as the study **Final Report** comprising of the following main tasks:

- Preparation of a Watershed Management and preliminary investment plan
- Preparation of sustainable wetlands management and preliminary investment project
- Preparation of a Solid Waste and Sanitation Management Project and preliminary investment plan, extended to issues linked with diffuse water and soils pollution resulting from small scale mining activities
- Identification and development of cross-cutting activities that improve livelihoods and further make the above projects possible, more efficient and sustainable

This **Final Report** is the final output of the consultancy services, and takes into account the observations received during the Final Stakeholders Workshop held in Narok; Kenya, on December 20th, 2012. The report is comprised of a Main Report and 4 Annexes presenting respectively the different Investment Plans.

This volume is the Main Report of the study, whereas each project proposal is presented in a separate volume (Annexes 1 to 4).

FINAL REPORT	
Main report	**Investment Project Proposal**
Annex 1	Watershed Management and Investment Plan
Annex 2	Sustainable Wetlands Management and Investment Plan
Annex 3	Water Quality and Sanitation and Investment Plan
Annex 4	Cross-cutting activities

The report, after this introduction, proceeds to the following steps in successive chapters:

- Presentation of the programme and project of which the present study is part;
- Presentation of the main features of the Mara River basin, focusing of those characteristics which most relate to the watershed management issues and therefore the possible solutions. After describing the physical, environmental and socio-economical conditions, the Consultant inquires into the degradation issues and concludes with the selection of priority areas for intervention;
- Description of the intervention strategy, the guiding lines and their relationship with the proposed activities;
- A proposal for an institutional set-up based on a review of stakeholders;
- The closing chapter presents the investment proposal and each of the projects that form that investment proposal, closing with the total investment budget.

2. THE PROJECT

2.1. PROJECT BACKGROUND

The Mara River Basin (MRB) Management Project is one of the three transboundary integrated water resources management and development projects being implemented within the framework of the Nile Equatorial Lakes Subsidiary Action Program (NELSAP), an investment program of the Nile Basin Initiative. The MRB project targets economic growth opportunities through co-operative management of the shared water resources amongst Nile Equatorial Lakes countries, to alleviate poverty, enhance economic growth and reverse environmental degradation. It also contributes towards the wider Nile Basin Initiative (NBI) goal of achieving sustainable socio-economic development through equitable utilization of, and benefit from, the common Nile Basin water resources.

The MRB basin originates from the Mau escarpment and upper swamps in Kenya and drains into Lake Victoria. This catchment have experienced significant land use changes over the past years due, in particular, to increasing population pressure, as local inhabitants continue to clear forests and drain wetlands to create new agricultural land and establish new settlements.

The fast population growth in the MRB basin has led to excessive land fragmentation and has pushed farming activities into marginal areas that are vulnerable to soil erosion and nutrient loss; it has also led to increased encroachment of ecologically fragile areas such as wetlands and springs, riverbanks and protected forests (Mau forest and woodlands on hills) for farming purposes, charcoal making and illegal lumbering.

These trends threaten the future livelihood of the people and livestock as well as biodiversity and wildlife in the Maasai Mara/Serengeti Reserves. The current degradation of the basin, notably through deforestation and wetland degradation arises new challenges, like the steadily decline of average discharge in rivers during the dry seasons over the years and increased flash floods and high sediment transport during rainy seasons. Water scarcity and growing food insufficiency are some of the major issues facing these basins and the situation is expected to get worse as the population increases and as demand by the different water use sectors outmatches the existing supply and is exacerbated by the imminent effects of climate change.

Further, several sources of pollution like poorly controlled effluent discharges from mining industry (including small scale miners), sewage outflows and solid wastes from the few fast-growing urban centres, the nutrient and agro-chemical pollution from diffuse sources, have negatively impacted surface water and groundwater quality.

The Mara River Basin is also home to the World Renowned Maasai Mara-Serengeti ecosystem. Sustainable wildlife management and tourism development are central to the economic development of the Mara river basin, as well as the countries at large. Without effective and sustainable watershed conservation efforts, there will be inadequate water for wildlife and tourism services thus threatening these conservation areas, with negative consequences on revenue from tourism that supports the economic development of the countries. The ecosystems have potential livelihood opportunities especially for the communities to improve their socio economic standards through strengthening the Wildlife Management Areas (Serengeti) and Wildlife Conservancies Areas (Maasai Mara) in the context of integrated watershed management. Promoting investments in the basin will improve the

current living standards of the basin population and allow the poor to tap the benefits from the resources endowment of the Mara River Basin.

An Integrated Watershed Management Project is therefore necessary to address the above issues and contribute towards reversal of the current trend of catchments degradation, without losing sight of the need to ensure livelihood for the whole population and also water of good quality and quantity.

The proposed project will address critical trans-boundary problems of pollution, soil erosion and loss of biodiversity and share of water resource, but also enhance collaboration between communities across the common border between Kenya and Tanzania and more so strengthen regional cooperation.

2.2. PROJECT DEVELOPMENT OBJECTIVE

The project development objective seeks to address the catchment degradation and allow optimal and sustained use of natural resources of the watersheds with minimum damage to the environment and for the benefit of the inhabitants of the watershed and the communities linked to them.

The proposal for investment projects is linked with the country Poverty Reduction Strategy Papers (PRSPs) and Country assistance strategies; as well as nationally implemented programs and is expected to identify mechanisms to implement nationally while retaining transboundary coordination/collaboration.

The project arises as a major challenge to pursue and make effective into one objective the different interests and the goals at different horizons of the different stakeholders, such as:

- The improvement of living conditions, and first of all economic incomes, of the mostly rural population of the area; this improvement must be prepared to cope with the rapid increase in population which is currently observed and is expected to continue in the medium term;
- Other aspects of living conditions directly linked to watershed management, such as quality of alimentation and hygiene conditions, must also be taken into account;
- Social dimensions that must be included in the project, such as the role of women in decision making and in management, the specific role/place of the increasingly numerous youth in the communities, the general process of decentralization in both Kenya and Tanzania leading to the establishment of farmers' associations at local level
- The direct environmental protection of the watershed by improvement of the forest cover and other tree plantation, and the improvement of agricultural practices, all measures tending to decrease the amount of soil lost each year to surface runoff, causing loss of soil fertility in the slopes and impeded drainage in the lower lands;
- The induced effects of environmental degradation, such as lower river water quality, and local erosion in the river banks and along the roads;
- The protection of wetlands to conserve their role in the ecosystem and in the economic and social organization.

To achieve these goals, it is necessary to promote a balance between the three basic action lines, from project design to implementation process: (i) environmental protection and reasonable use of natural resources; (ii) provision of income opportunities for each family in mostly rural areas, on another side; and (iii) support to organization and management level.

Efforts to improve environmental conditions (biodiversity, erosion control, wetlands and springs protection) can be proposed to the communities and farmers if, within the same project, real opportunities for a better livelihood are included through increased production, diversification of products and activities, and improved access to market for the products. Only under such conditions will the local communities make a commitment towards measures leading to a sustainable development, leaving behind the short-sighted actions sometimes observed now to ensure immediate subsistence production.

2.3. OBJECTIVES OF THE PROJECT

2.3.1. Global Environment objective

The global environment objective of the project is to promote a set of integrated watershed management interventions so as to achieve local and global benefits. These benefits include reversal of land degradation, reduction of pollutants discharging into the water bodies and minimizing sediments eroded from watersheds that feed into rivers down to Lake Victoria, reduced greenhouse gas (GHG) emission in atmosphere, improved carbon storage in forests and woodlands and in- and off-farm biodiversity.

2.3.2. Specific objectives

The specific objectives to be reached by implementing the Mara River-Integrated Watershed Management Project are the following:

- Land and natural resources degradation is stabilized in the watershed (*destruction of vegetation, soil erosion, riverbanks and wetlands degradation,);*
- Livelihoods, incomes and standard of living of populations have improved;
- Flooding and landslide risks have decreased;
- Water pollution of surface water and groundwater has decreased;
- Wetland conservation and management has improved;
- Water resource management has been enhanced;
- River banks are stabilized and protected against destruction.

2.4. PROJECT BUILD-UP PROCESS

To reach the objectives presented above, the process builds up in successive steps and according to definite lines and principles, until it can be implemented. Note that the different steps are not necessarily sequential but can also be developed in parallel.

The final product must be a set of projects/sub-projects that can be financed and implemented, in such a way that implementation of the full set will give optimal results, whereas implementing any individual

project will yield some level of improvement in watershed management and namely in natural resources conservation and poverty reduction.

The steps expected to prepare the project are proposed as follows:

- A first step is dedicated to collecting data and understanding the on-going processes, in physical, environmental, social and economic aspects;
- Out of this information, issues that can be addressed through improved management are identified;
- Through consultations with stakeholders, the list of issues is confirmed or revised, and items are prioritized;
- Areas where the priority issues can best be addressed are identified;
- A strategy to develop activities in such a way that they effectively participate in sustainably reaching the project objectives is developed. This requires also to “package” the activities into project and sub-projects associating actions on a thematic or geographic basis, with a time frame for the activities;
- The list and role of the different stakeholders and institutions that should be involved in the project implementation is established;
- For each Project or Sub-project, the activities are defined in kind and in quantities with the corresponding estimated budget; then a consolidated budget is proposed.

This Main Report reflects this list of steps, while the Annexes present in more details the Projects and Sub-projects.

It should be reminded that, beside the Project objectives and under the letter and spirit of Integrated Watershed Management in transboundary conditions, the projects and sub-projects will need to keep a focus on such aspects as: upstream/downstream impacts, stakeholders participation in decision making and implementation, involvement of community-based organizations, attention to the role of women and youth…

3. MAIN WATERSHED FEATURES

This chapter presents a summary of the Mara River Basin features in those aspects which are relevant for Watershed Management: physical and biological aspects, population and economic activities and watershed degradation process. This leads to the selection of priority areas for implementation of Integrated Watershed Management projects and sub-projects.

3.1. STUDY AREA

The study area for the Integrated Watershed Management Project (IWMP) includes the whole of Mara river basin, one of the 10 major rivers that drain into Lake Victoria

It is also one of the main catchments in Kenya that originates in the forests of the Mau escarpment. This area plays a vital role in providing the bulk of the water that sustains these rivers and the livelihoods of the millions of people. The MRB is however particularly important in the transboundary watercourse with 65 % of its catchment in Kenya and the other 35 % in Tanzania. The total area of the basin is about 13,500 km^2 from the Mau Escarpment in Kenya to the river mouth in Lake Victoria near Musoma in Tanzania. This area corresponds to the sum of sub-catchment areas calculated by NIRAS (13 491 km²) which will be used in the Report.

Mara River has its headwater streams in the swamps and remnants of the once expansive Mau Forest (Figure 2) on the Mau Escarpment in Kenya at an altitude of nearly 3,000 m above sea level. From its main source, the river descends over 1000 meters in a distance of around 200 km before it reaches the Old Mara Bridge at the start of the Maasai Mara plains. The river then flows in a series of meanders for a further 150 kms and enters into Lake Victoria. Within Tanzania, the main tributaries are the rivers Borogonja, Somoche, Tigithe and Tobora.

The basin is divided into four distinct zones based on landscape, land use and ecology. These are:

- The forested upper catchments
- Middle rangelands
- The savannah plains
- The lower basin.

Table 1: General Watershed facts

Basin area	About 13,500 km^2; 61% in Kenya and 39% in Tanzania
Rainfall	1,500-1,800 mm/year in the upper catchment 600-800 mm/yr in the dry plains of the lower part of the basin
Elevation range	2,900 m asl to 1,134 m asl
River length	About 400 km
Source	Mau forest complex, Kenya
Outlet	Lake Victoria through Mara Bay near Musoma, Tanzania

Main tributaries	Nyangores River, Amala River, Sand River, Talek River, Borogonja River
Larger basin	Nile Basin
Main wetlands	Enapuyapui Swamp (source of the Mara river), Musiara Swamp & Olpunyata Swamp (Kenya), Bologonja Springs (Tanzania) Mara Wetlands (Masurura Swamp at the mouth of the River - Tanzania)
Main forests	Mau Forest complex in the upper catchment
Major protected areas	Maasai Mara National Reserve (Kenya); Serengeti National Park (Tanzania)
Population and growth rate	About 1,400,000 people (2012 estimate) of which approx. 70% in Kenya and 30% in Tanzania – annual growth rate around 2,7%
Activities	Pastoralism and subsistence agriculture (small scale agriculture dominant) Large scale agriculture (upper catchment) Logging (Mau forest) Tourism in and around protected areas Gold Mines (large scale mining and small scale mining)

3.2. PHYSICAL FEATURES

3.2.1. Local climate and climate change trends

The Amala sub-basin has relatively cool temperatures throughout the year, with the mean annual figures ranging from 12^0C to 16^0C. This area receives between 1500 to 1800 mm of rainfall annually which is considered to be high. The rainfall is bimodal where the long rains occur between March and May and the short rains are between October and December. There are two hundred days of rain on average yearly. In the Nyangores sub-basin the rainfall is bimodal and high; with mean annual precipitation between 1500 to 1800 mm. The annual temperature varies between 12^0C and 16^0C. There is no clearly marked dry season in the Nyangores sub-basin. The Mid-Mara sub-basin has a main dry spell between June and October, with a bimodal pattern of rain where the long rains occur between March and May and the short rains occur between November and December. The climate here is classified as semi-humid to semiarid climate with mean annual rainfall of between 600 to 1100 mm of precipitation. The average minimum temperatures of this region are in the range of 10 to 14^0C whereas the mean maximum temperatures range from 22 to 26^0C.

The Tarime and Serengeti districts cover most of the Tanzanian part of the Mara river basin. This region is divided into three major climatic zones namely; i) the northern zone which falls within the MRB in highland area covering Tarime and part of Serengeti districts. This zone receives an average rainfall of between 1250 and 2000 mm per year and it has two rainy seasons; a short one from September to January, and a long rainy season from February to June. This zone favors the growth of different annual and permanent crops including beans, maize, banana, sweet potato, vegetables and coffee respectively; ii) the central zone which covers much of Musoma district and eastern parts of Serengeti districts. The zone receives between 900 and 1300 mm of rainfall per year and is apt for growth of different crops including rice, maize, sorghum and many others.

Current climate change projections for East Africa (IPCC, 2007) forecast a light increase in total precipitation with change in the annual rainfall pattern: drier in dry months, wetter in rain months. This would lead to increase in extreme events of floods and droughts. The strong links between climate and land use/land cover may translate into modification in the links between the exchange of

greenhouse gases and the land surface, making the Mau Forest Complex a key piece for the balance of the basin.

A recent research study on the potential impact of land use changes and climate change on the Mara River basin (Mango et al, 2011) has applied the Soil Water Assessment Tool (SWAT) model to the Nyangores sub-basin. It appears that protecting the headwater forests, and improving land management practices will be crucial for Climate Change adaptation. Watershed management activities can be considered as climate change adaptation, since they are improving the watershed resilience to extreme events, such as heavy rains and extended droughts. Also recommended is Climate Smart Agriculture (e.g. agriculture where the woody components and the carbon sequestration is increased such as Agroforestry or Silvo-pastoral systems).

3.2.2. Hydrography

Mara River originates from Enapuiyapui swamp, a six hectare swamp located in the Eastern Mau forest, one of the remnants of the once expansive Mau Forest (Figure 1) on the Mau Escarpment in Kenya, The source is located at an altitude of nearly 3,000 m above sea level, and with annual average rainfall of approximately 1,400 mm.

The whole watershed was divided into 6 sub-basins from the upper to the lower reaches. Sub-basin areas are presented in Table 2, with figures rounded to the nearest 5 km².

Table 2 : Sub-basins of the Mara River

Name of the sub-basin	Area (km²)
Amala	1,420
Nyangores	935
Talek	2,665
Mid main-stem Mara	1,470
Sand River	1,830
Lower Mara River	5,180
Total	**13,500**

Source: NIRAS, 2012

Where the forest cover still remains, the rainwater percolates through the canopy into the soil and ultimately emerges in form of springs recharging Nyangores and Amala rivers from the source and as the river flows through the forest (Figure 1). At this point, waters are perfectly clear, with no sign of water pollution or sediment load (except during heavy rainfall events). The rivers exit the forest and upper tea plantations and descend more than 1,000 m on the south-western slope of the escarpment, supporting farmers, pastoralists, and growing urban centres in the region. They unite to form Mara river, which continues to pick pollutants as it flows downstream through farmlands and savannah plains in the protected areas of Maasai Mara and Serengeti ecosystem and finally through the lower basin into Lake Vitoria. The river gauging stations, past and present, are listed below in Table 3. As can be seen, only two stations are currently fully operational in Kenya, although WRMA is on a program to improve the monitoring network, and two stations with water level records only in Tanzania.

The synthesis of flow characteristics of Nyangores and Amala rivers at the gauging stations is presented in Table 4.

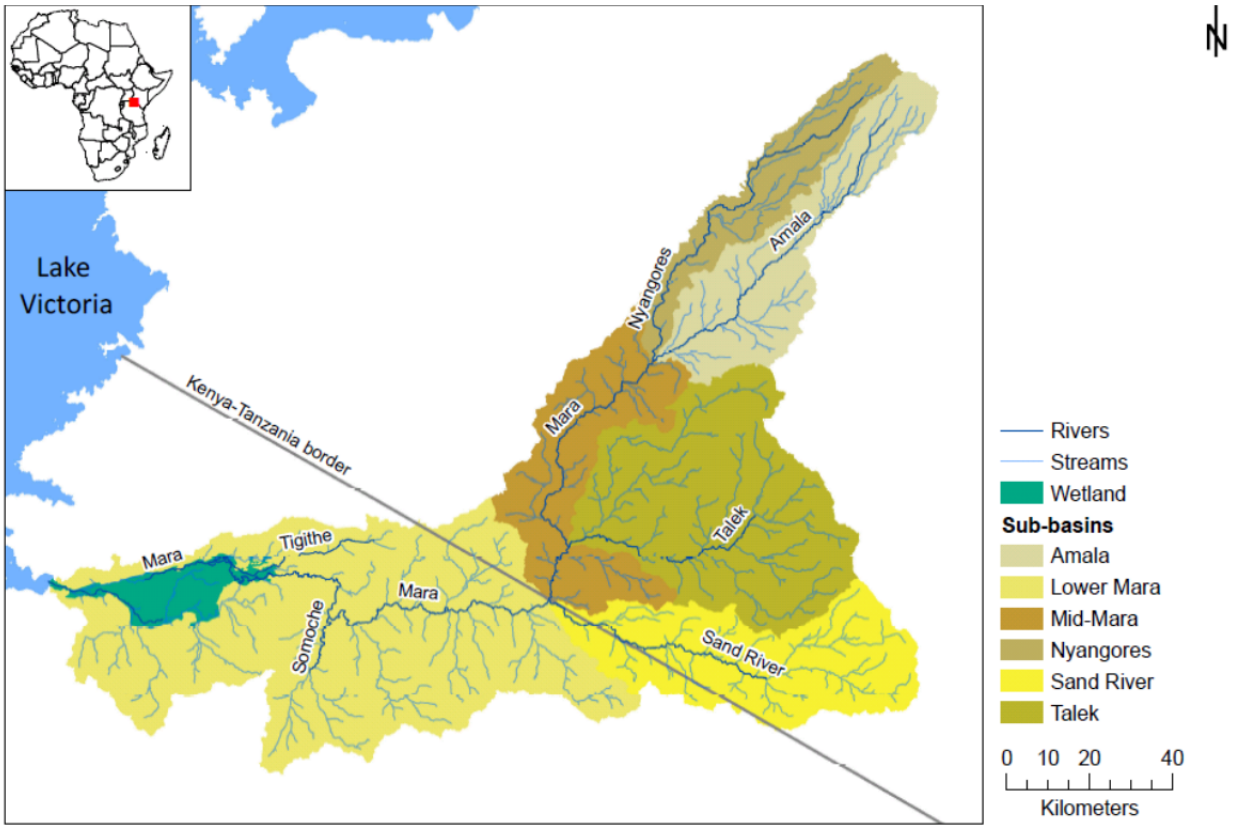


Figure 1: Hydrography and sub-basins

Table 3: River Gauging Stations in the Mara River Basin

RGS No.	River Name	Location		Period of Record	Country	Rated
		Lat.	Long.			
1LA01	Nyangores	- 0.739	35.358	1951 – 1964	Kenya	No
1LA02	Keringet	- 0.413	35.689	1956 – 1987	Kenya	No
1LA03	Nyangores	- 0.786	35.347	1963 – present	Kenya	Yes
1LB01	Amala	- 0.947	35.417	1953 – 1954	Kenya	No
1LB02	Amala	- 0.897	35.438	1955 – present	Kenya	Yes
1LA04	Mara	- 1.233	35.036	1970 – 1992	Kenya	Yes
1LA05	Mara	- 1.467	35.033	1991 – 1993	Kenya	No
5H2	Mara (Mines)	-1.549	34.554	1969-1978 (Discharge) 1969-1991; 2001 to date (Stage)	Tanzania	Yes
5H3	Mara (Kirumi)	-1.531	33.978	1970-1979; 2001 to date (Stage)	Tanzania	No
	Mara (Kogatende)	-1.563	34.887		Tanzania	No

Source: Mara Monography, WREM, 2009

Table 4: Flow duration parameters for the Mara River system (m^3/s)

Percentile	Nyangores at Bomet (1LA03)	Amala at Mulot (1LB02)
95 percentile (Q_{95})	2.18	0.70
80 percentile (Q_{80})	10.45	2.16
50 percentile (Q_{50})	33.89	7.50
20 percentile (Q_{20})	77.47	22.94
5 percentile (Q_5)	184.94	61.57
Mean daily flow	57.84	9.173

Source: Mara Monography, WREM, 2009

3.2.3. Geology and soils[1]

The underlying strata in the MRB is composed of very old igneous and metamorphic rock of Cambrian and Pre-Cambrian age (more than 600 million years old) which form the basement complex. The surface of this ancient landform was heavily eroded and then covered by younger rocks, including lava and other igneous extrusions released during the Tertiary period when volcanoes were active in the great valley.

This basic rock types condition the nature, depth and fertility of the soils in the Basin.

On the escarpment and rangelands soils of volcanic origin are rich and dark. Lower down, shallow dark reddish brown soils are found which drain freely and are easily eroded if the surface vegetation is removed through cultivation. On the plateau and plains poorly drained grey-brown and dark brown soils support extensive grasslands or sorghum plantations. Finally, in the river valleys and low lying wetlands, clay soils have accumulated. These are enriched with organic sediment and are initially fertile when first cultivated.

Therefore, the soil types of a region determine significantly the fertility level, thus the type of agricultural activities taking place and consequently the population density of the area.

- **The Amala and the Nyangores sub-basins** have similar kinds of soils which are mainly Mollic Andosols that were derived from tertiary volcanic materials. The steepest slopes of this region have Cambisols whereas in the Northern regions, Humic Nitisols are included. These two regions have high capacity for agriculture because of well drained soils, which have a high water holding capacity, with fine texture and high natural fertility. These factors have led to high population density in

[1] *Source : The transboundary Mara river basin strategic environmental assessment (March 2012)*

the region which is rapidly increasing. Bomet central has densities reaching 470 persons per km^2.

- **In the Mid-Mara sub-basin**, the soils are generally rocky, sandy and are shallow. This region is dominated by brown clay soils which are waterlogged seasonally. Weakly alkaline volcanic phonolitic tuff could be found to the North, whereas, water courses and river beds have deposits of sand, gravel and silt.
- **In the Lower Mara,** soils vary from course and light to heavy and fine textured soil. Other soil inclusions include light sandy loams, grey clays particularly in the valley bottoms and in wetlands and black calcareous soils referred to as mbuga soils. The later are located in the lower part of the basin and are naturally very fertile supporting the growth of different crops.
  In the Serengeti and Somoche sub-catchment areas, the main soil types are ferrisols in the Savannahs. Black cotton soils derived from fine volcanic material can be found on the hilly parts in Tigithe sub-catchment while alluvial soils are found in the swamps and wetlands. This region supports high population densities.

3.2.4. Land use and land cover

Table 5 presents the land use in the whole MRB and respectively in Tanzania and Kenya.

Small-scale farming is the dominant land use of the Mara River Basin accounting for 31% (4,210 km^2 or 421,000 ha) of the total.

The other big chunk of land is taken up by protected areas 23% (3,118 km2) and by range lands 29% (3,974 km^2) of the total land use.

The Kenyan part of the Mara River Basin has the range lands as the dominant land use in the area, taking up 40% (3,309 km^2) of the land. Small scale agriculture is the major land use of arable land in both Tanzania and Kenya accounts for 49% (2,582 km^2) and 20% (1,629 km^2) respectively of the total land use whereas large-scale agriculture takes up 3% (277 km^2) in Kenya.

Forested land area in the Kenyan side of the Mara accounts for 6% (532 km^2), the conservancies take up 11% (934 km^2) and the protected area covers 19% (1,526 km^2). In Tanzania, the protected area covers another 30% of the Mara, the rangelands take up 13% (665 km^2) and the wetlands account for 8% (396 km^2) of the total land use.

Tea plantations and mining areas cover significant areas only in their specific areas: Mid- Nyangores (and to a lesser extent Mid-Amala) for tea, and Mower Tigithe for mining.

Agricultural development is mainly in areas where rainfall is reliable close to the forest areas, wetlands and where irrigation can be carried out.

In terms of distribution it is estimated that cultivation alone and mixed farming occupy about the same area (Table 5).

Table 5 : Major land use in the Mara River Basin *(after NIRAS, 2012)*

Principal Land use	Tanzania		Kenya		Mara River Basin	
	km^2	%	km^2	%	km^2	%
Small-scale agriculture	2,582	49	1,628	20	4,210	31
Large-scale agriculture			275	3	275	2
Irrigated areas			8	0	8	0
Tea plantations			32	0	32	0
Mining areas	12	0			12	0
Forest			532	6	532	4
Wetland	396	8			396	3
Conservancies			934	11	934	7
Protected area	1,592	30	1,526	19	3,118	23
Range land	665	13	3,309	40	3,974	29
Total	**5,247**	**100**	**8,244**	**100**	**13,491**	**100**

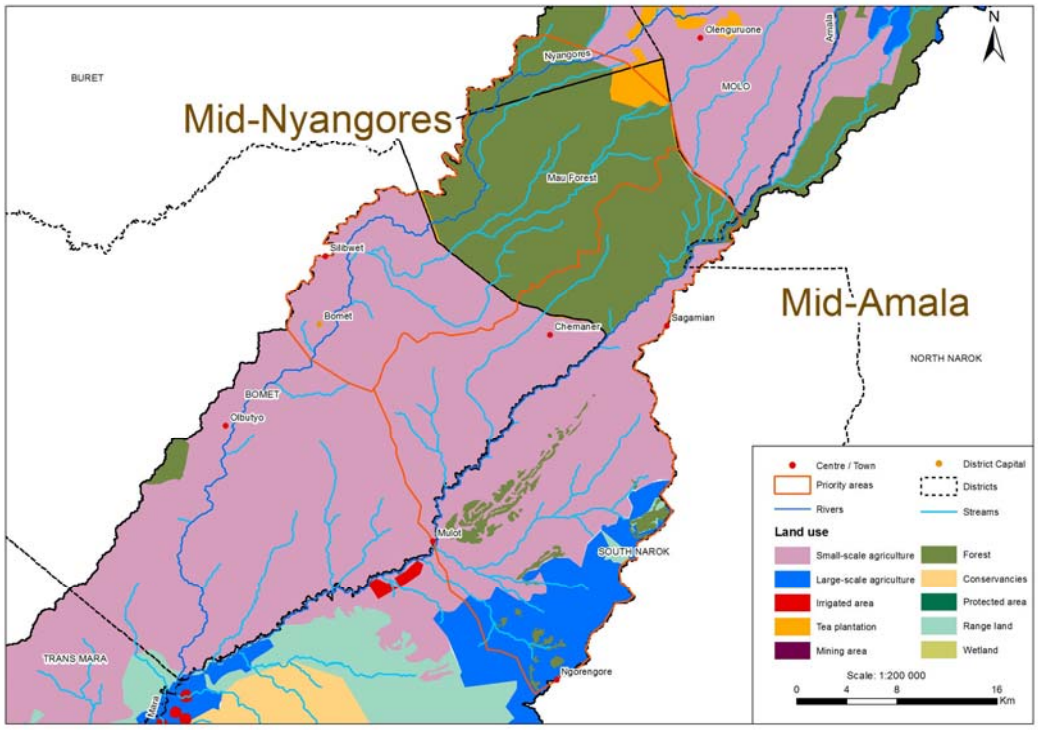


Figure 2: Land use in the upper catchment

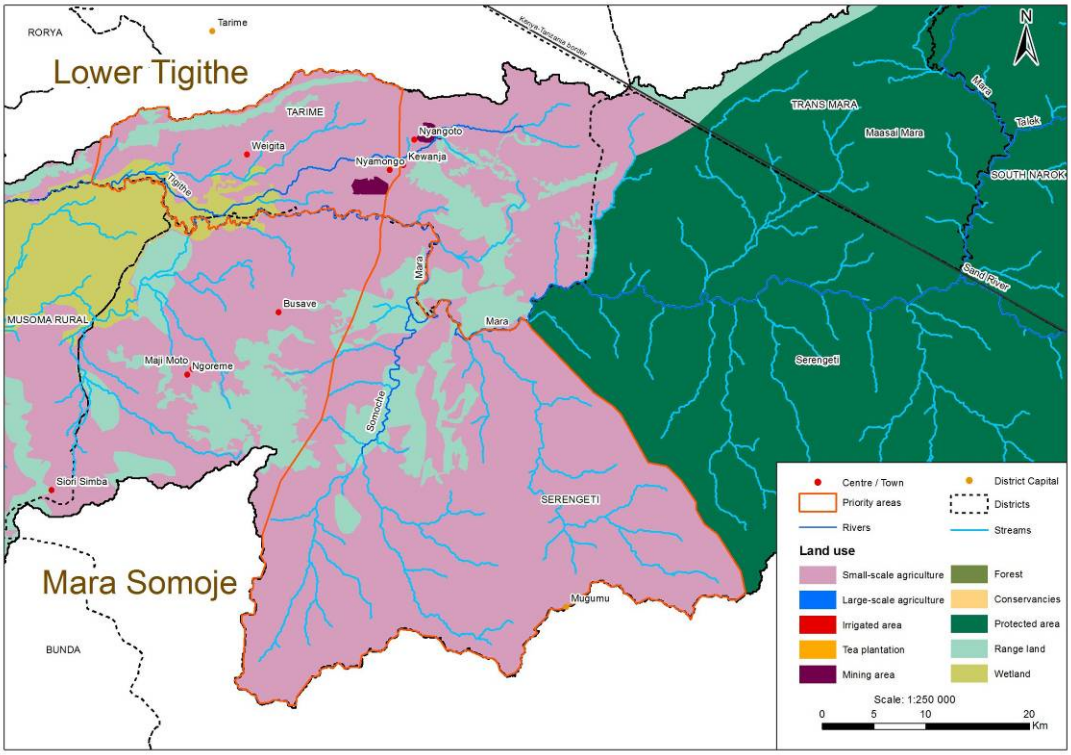


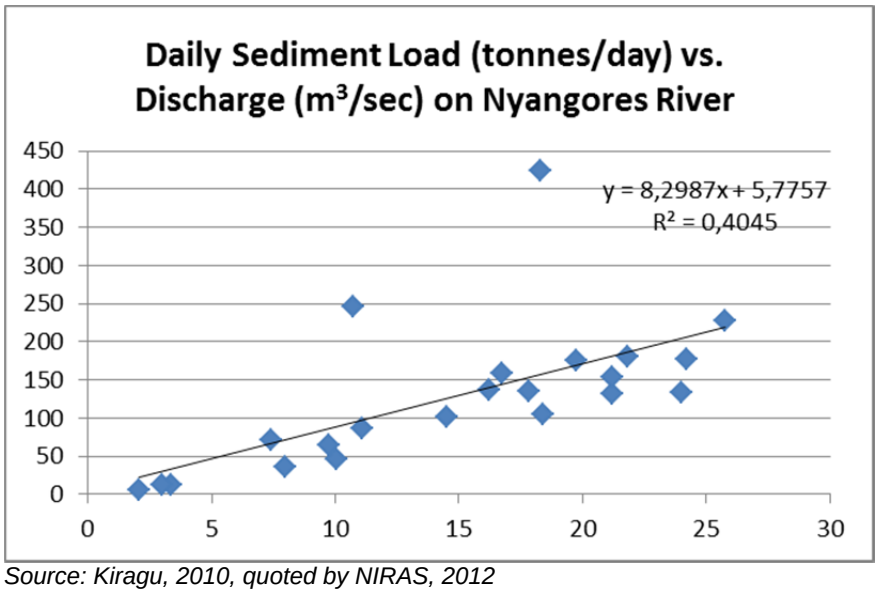
Figure 3: Land use in the lower basin

3.2.5. Water quality

A basin wide baseline water quality and vulnerability study was conducted through the Global Waters for Sustainability Program (GLOWS), which included 72 water quality samples across the basin taken in four consecutive years 2005-2008. The findings are synthetized below:

- Overall, the Mara River and its tributaries appear to be in good health with no significant signs of large-scale impairment. However, localized deviations from standards are observed.
- This suggests that, for the most part, the Mara River system is able to assimilate the current levels of inorganic and organic nutrients washed into the system. Results downstream of sites with elevated nutrient levels indicated that nutrient levels were effectively attenuated.
- Turbidity and suspended solid levels are elevated throughout most of the basin. Erosion of sediment by livestock, and in some cases by wildlife, is observed.
- Water level and discharge appear to influence water quality. Diminished flow appeared to result in increased nutrient levels and altered water chemistry.
- Abundant macrophyte growth in the wetlands suggests hyper productivity but nutrient levels seem not elevated. This may indicate that nutrients are rapidly recycled through the system or that plants may be tapping nutrients stored in the bed sediment.

The specific aspect of river water turbidity and sediment load has been studied by Mr Kiragu in 2010. A graph summarizing his findings for Nyangores river at Bomet is presented below as Figure 4.



Source: Kiragu, 2010, quoted by NIRAS, 2012

Figure 4 – Sediment load – Nyangores River at Bomet Bridge

3.2.6. Wetlands

Under the name of wetlands, different elements can be considered: localized wetlands around springs, constructed wetlands and natural wetlands. The present report focuses on natural wetlands, whereas r the small spring wetlands are considered together with the riverbanks for local protection.

Among the five wetlands identified in the Mara River Basin, the Sustainable Wetland Management Project (SWMP) is only considering the Mara Wetland (or Masurura Swamp) located in the lower-Tigithe sub-basin in Tanzania. The Mara Wetland is by far the largest of the five wetlands, and has great importance to livelihood and biodiversity in a large region in Tanzania.

Other small and temporary wetlands do exist in the rest of the MRB but they are not included in the project due to their small size and/or temporary existence, or will be considered through riverbanks and spring protection project. The many small wetlands do, however, play an important role in the overall hydrological system, as they increase groundwater recharge and the water retention capacity of the river system, and wetlands throughout the Mara River Basin should be protected as provided for in the environmental acts of both countries.

Physical and ecological features

The Mara Wetland has grown considerably in size since 1960. Probably the expansion started when the water table in Lake Victoria rose following the heavy rains of 1961 – 1964 thus causing inflow from the lake and back-up of water from the river. This situation in turn increased sedimentation and the spread of wetland species, such as papyrus and typha. Sediment deposition on the river channel and increased vegetation cover blocked the water course of the river and further reduced the flow velocity of the river and helped maintain and increase the wetland area even when the water table in the lake went down again. Although the fastest expansion of the wetland was observed in the 1980's, the swamp still continues to expand (Mthuri, 2007).

Though the wetland size relates to the flow of the Mara River and the water table in the lake, the dynamics of the expanding wetland have never been completely established, but it is clear that annual variations in flood level are large.

The siltation in the wetland is increasing. This is linked to the high rate of erosion upstream, which is partly due to deforestation and land-use changes. However, even without human-induced erosion, the river is likely to carry a high sediment load to the wetland, given the nature of soil and slopes conditions in part of the catchment area and the natural meandering of the river. Increase in siltation is also attributed to increased vegetation cover in the wetland which has enhanced the sediment trapping efficiency over the years.

The part of the wetland with open-surface water varies during the year and between years, but according to people around the wetland the overall water surface area is declining.

Satellite images and fieldwork support this. During fieldwork in May 2011 part of the former large open water areas upstream from Kirumi Bridge was blocked due to floating papyrus (the river is now only navigable for the first 2.5 km upstream from the bridge).

The Mara River itself is no longer visible in a large part of the wetland, the water probably seeping through the dense vegetation over a large area, rather than following just one main channel.

The wetland plays an important role in capturing sediment and nutrients as well as other waterborne pollutants, thereby cleaning the water before it is discharged into the Lake Victoria.

As agricultural and livestock activities increase in the Mara River Basin leading to an increase in sediment and agricultural chemicals in the water, the importance of this huge, natural filter increases even further.

3.3. BIOLOGICAL ENVIRONMENT

3.3.1. Natural reserves

The Mara River Basin is renowned for the two natural reserves: Maasai Mara in Kenya and Serengeti in Tanzania. These two areas are renowned because of the annual spectacular wildebeest migration. The high biodiversity of the reserves makes them invaluable assets for the two countries. Fauna (including larger mammals but including many more) and flora are monitored by the corresponding institutions.

The Mara River in its medium reach is the main source of water for the two Natural Reserves. The left bank tributaries Sand and Talek rivers also contribute to the water balance of the reserves ecosystems..

3.3.2. Forests and woodlands

Forests have, in the past, covered most of the Mara River Basin. Through continuous population increase and successive arrivals of farmers into the area, the need for cultivated land has led to encroachment on forested areas. Yet significant part of the basin is still forested, and exploitation of wood products is accompanied, to a certain extent, by reforestation particularly in parts of the basin where land parcels have diminished..

The upstream part of the MRB is covered by the Mau Forest, which stays as a strong forested area, although it is now formed to a large extent by exotic species of fast growth (*Pinus, Cupressus, Eucalyptus*…). Other forested areas in the upper basin are covered with bamboo and other indigenous tree species such as *Podocarpus*..

In most of the basin, trees are found in smaller number, in lines around the cultivated fields or in small woodlots, in the agricultural slopes as well as in the lower plains.

3.3.3. The Mara Wetland

The Mara Wetland Swamp (also referred to as the Masurura Swamp – Tanzania) is by far the largest wetland in the Mara River Basin. It stretches for about 50 km along the lower reaches of the Mara River where the river discharges its water into the Lake Victoria at Mara Bay. The wetland covers an area of approximately 400 km².

The extent of the flooded area, however, varies considerably from year to year. According to Munishi (2007), the wetland is surrounded by 17 villages in the districts of Musoma Rural, Serengeti, Tarime, and Rorya, but analysis of recent satellite imagery by the Consultant showed that the whole periphery of the wetland (total around 90 km) presents a nearly continuous succession of hamlets. The villages and the Mara Wetland are connected through a series of socio-economic activities including fishing, harvesting of aquatic plants, livestock grazing, dry season agriculture, and mining among other local activities.

3.3.3.1. BIODIVERSITY

The main wetland vegetation of the Mara Wetland is made up of a few species, of which the most important are papyrus (*Cyperus papyrus*) and typha (*Typha domingensis*), common reed (*Phragmites mauritianus*) and elephant grass (*Pennisetum purpureum*). The invasive species water hyacinth (*Eichornia crassipes*) is found in parts of the wetland, though rarely dominating the vegetation. According to community members in the area, the papyrus has increased its coverage over the years. In the eastern part an area with dense riverine forest and a strongly meandering Mara River together with numerous oxbow lakes is still found, though probably under pressure from human activities.

The fish fauna of the Mara Wetland includes 14 species according to Munishi (2007). However, up to 21 species have been recorded in the main river canal, the swamp area and the Tigithe tributary (Chitamwebwa, 2007). These include both typical river species such as *Barbus altianalis*, *B. kersetenii*, and *Mormyrus kannum* as well as rare species such as *Labeo victorianus*, *Schilbe intermedius*, *Synodontis afrofischeri, S. victoriae*. The latter four have been observed all along the Mara River past Mara Swamp up to Mau forest (WREM, 2008).

A number of lake species including the cichlid species of the tilapias: *Oreochromis niloticus*, *O.leucostitus*, *O. Esculentus*, *Tilapia zillii* and *T. rendalli* have colonised the pools in the wetland which have provided a refuge for species otherwise thought to be lost due to Nile perch (*Lates niloticus*) predation and other factors (WREM, 2008).

The most important species in the artisan fisheries in the wetland include the African lung fish (*Protopterous aethiopicus*) and catfish (*Clarias alluaudi* and *C. gariepinus*), as well as *Oreochromis niloticus*. Fishing in the wetland is most often done using hooks on longlines as well as traps. Though illegal, juvenile Clarias are caught and sold for use as bait in the Nile perch longline fishery in the lake (Chitamwebwa, 2007; WREM, 2008).

The most common wildlife directly linked to the wetland and the swamp include hippopotamus (*Hippopotamus amphibius*), Nile crocodile (*Crocodylus niloticus*), sitatunga (*Tragelaphus spekii*), and spotted-necked otter (*Lutra maculicollis*). There are a number of other animal species that approach the wetland, especially in the dry season, and altogether 32 mammal species have been reported in connection to the wetland.

In addition, 33 water-bird species have been recorded in the wetland where the most common are grey heron (*Ardea cinerea*), cattle egret (*Balbus ibis*), sacred ibis (*Threskiornis aethiopicus*), grey

crowned crane (*Balearia regulorum*) and hadada ibis (*Bostrichia hagedash*) (Munishi, 2007). The wetland is included in the Important Bird Area TZ041, which has been triggered by the presence of 10,000 white-winged tern (*Chlidonias leucopterus*) – more than 1% of the population (BirdLife International, 2011).

3.3.3.2. SOCIO-ECONOMIC FEATURES

The wetland is of great socio-economic importance to the communities around the wetland, who use the various resources for their sustenance. The Mara wetland uses include:

- Grazing for livestock;
- Farming (along and inside the wetland);
- Fishery;
- Harvest of papyrus (production of mats); typha (production of mats and for thatch), common reed (production of baskets);
- Hunting (the wetland attracts wildlife); and
- Provision of water for livestock, irrigation and other household uses.

Munishi (2007) reported livestock grazing to be the most important of the above activities, followed by farming, fishing and harvest of papyrus and other plant species.

3.3.3.3. LIVELIHOODS FROM WETLANDS

The activities conducted by the local communities around the wetland are socio-economically important, and the wetland has a great potential for supplying numerous resources.

- **Farming Practices:** Farming in many areas takes place right down to the edge of the swamp or even into areas that are flooded in wet years, and are part of the actual wetland. Agricultural activities inside the wetland especially take place along the north central and north eastern shores of the Mara Wetland, from Mara Sibora and eastwards (figs. 19 and 20). The zone outside the core Mara Wetland is humid during part of the year and this facilitates production of several agricultural crops including maize, sorghum, finger millet, beans cassava, paddy, groundnuts, simsim, tomatoes, amaranthus, water melon, onions, and sweet pepper both for domestic consumption and for sale in the local markets. The cultivation of the agricultural crops especially during the dry season has been ranked the second major socio-economic activity carried out around Mara Wetland (Munishi, 2007), where 90% of the local population around the swamp depend on crop cultivation (Yanda and Majule, 2004).

- **Grazing:** Livestock keeping is a dominant activity of the communities found around the Mara Wetland including the Kuria, Luo, Zanaki, Simbiti and Ngoreme communities (Yanda and Majule, 2004). A recent study (Munishi, 2007) shows that 79% of the communities along the wetland perimeter own livestock including the cattle, goats, sheep and donkeys in large numbers. Mara Wetland is an important grazing area and grazing pressure around the swamp and along the Mara River has increased over the years. During the dry season, most of the pastures in uplands dry out and the swamp becomes the only source of green pastures, where 68% of the local population graze their livestock (Munishi, 2007). Livestock grazing especially during the dry season has impact on both the terrestrial land and the wetland. Overgrazing was observed to induce land degradation through soil erosion, a process that increases the sediment flow into the river and swamp system with subsequent effects on hydrology, fish fauna and aquatic plants.

- **Fishing practices:** Fish constitute an important source of food for most of local communities. Over 80% of the population around the Mara Wetland is involved in fishing activities (Munishi 2007). The major species of fish harvested for subsistence and commercial purposes include

the cat fish – kambale/ mumi (Clarias gariepinus), African lung fish - kamongo (Protopterus aethiopicus), and tilapia - pereghe (Orechromis nilotica).

- **Harvesting of wetlands biodiversity products:** The biodiversity of the Mara Wetland represents a large economic potential for sustainable use by the communities adjacent to the wetland and beyond. The total value of the wetland including total biodiversity benefits from agricultural crops and other wetland products, water, grazing lands and environmental functions has been estimated at TSh. 27,637,000,000 (US$ 22,109,600) per year, Munishi, 2007). The aquatic flora of Mara Wetland is dominated by papyrus (*Cyperus papyrus*), a giant sedge that regenerates prolifically when harvested (Ngumbi, 2009). Other common aquatic plants of the swamp include typha (*Typha domingensis*), *Pennisetum purpureum* and water hyacinth (*Eichhornia crassipes*). The communities around the Mara Wetland harvest papyrus and other aquatic plants for handcraft especially mat making (Majambvi), thatching and construction among other uses as presented in Table 6.

Table 6 : Utilization of aquatic plants of Mara River

Name of the Plant		Local Name	Uses
Cyperus papyrus	Papyrus	Matende	Making of mats (majambvi), thatching and fodder for cattle during dry season
Typha domengensis	Typha	Mukuruwili	Making of mats (mabimbili) and fodder for cattle during dry season
Phragmites mauritiianus	Reed	Matete	Building of granaries and fodder for cattle during dry season
Pennisetum purpureum	Elephant grass	Rusaka	Common fodder for cattle
Cyperus immensus		Ngeri	Making of baskets, thatching and fodder for cattle

Source: Information from the community of Kwibushe and Ryamisanga villages during NIRAS field investigations, 2011

The use of papyrus handcrafts forms a lucrative business among women in the majority of villages surrounding the Mara Wetland. The products from this plant have a ready market in the towns of Musoma, Tarime and other business centres in the region. In addition to the utilization of the wetland plant products, hunting for wildlife species including sitatunga, hippopotamus, wild pig, and warthog is practised around the swamp (Munishi, 2007).

Although presently the communities utilize the wetlands products substantially, the harvesting is mainly concentrated at the swamp edge close to the villages and the interior of the swamp is still barely used. However, as the population of the villages increases, more demand will come on the Mara Wetland resources and hence the need to plan for the sustainable utilization of the wetlands products.

- **Charcoal burning:** The trees and large shrubs of the Lower Mara basin around the Mara Wetland are currently under heavy pressure of exploitation for charcoal and firewood. The widespread harvesting of trees in the catchment is driven by high demand for charcoal and firewood

3.3.3.4. IMPORTANCE OF THE WETLAND

The wetland plays an important role in capturing sediment and nutrients as well as other waterborne pollutants, thereby cleaning the water before it is discharged into the Lake Victoria.

As agricultural activities increase in the Mara River Basin leading to an increase in sediment and agricultural chemicals in the water, the importance of this huge, natural filter increases even further.

The wetland also plays an important role as a refuge for several fish species from Lake Victoria (WREM 2008), which escaped the Nile perch predation by "hiding" in the small lakes and canals in the Mara wetland.

Papyrus swamps along Lake Victoria in Kenya (e.g Dunga Swamp, see BirdLife International, 2011b) provide habitats for a number papyrus-specialized species of birds, some of which are listed as vulnerable, globally threatened and near threatened in the IUCN red data list (including papyrus yellow warbler (*Chloropeta gracilirostris*), the near threatened papyrus gonolek (*Linarius mufumbiri*), white winged warbler (*Bradypterus carpalis*), Carruthers's cisticola (*Cisticola carruther*) and papyrus canary (*Serinus koliensis*). Those species have not yet been recorded from the Mara Wetland, but it is most likely that at least some of them appear here. The wetland forms part of the 50,000 ha Important Bird Area TZ041 Lake Victoria: Mara Bay and Masirori Swamp (BirdLife International 2011c). The assessment made by BirdLife suggests that the area should become a RAMSAR site.

As stated above, the wetland also has significant socio-economic importance, providing products such as fish, papyrus and other plant material, water and grazing for domestic and wild animals. Agriculture along the shores of the wetland (or into wetland areas where the water table is low) provides food and income to the people around the wetland.

In combination, all those benefits are very important to the region, and serious efforts should be taken to manage the area in a sustainable way, involving all the stakeholders.

3.3.3.5. CONSERVATION STATUS

The wetland has increased considerably in size over the last 30-40 years, and the overall existence and functions of the wetland do not appear to be threatened by human activities at the moment. However, pressure on the land seems to be increasing, and water inflow may be decreasing, thus in absence of management and enforcement of regulations, the wetland may soon start to be seriously affected. Some areas are under more pressure than others, and those areas have been included among the biodiversity hotspots.

They include areas were farming encroaches on the wetland, and the area in the lower part of the wetland where the remaining areas with open water is found, and where pressure from fishing, hunting and burning as well as natural vegetation growth (closing the open water surfaces) appears most intense.

Overall, the conservation status of the wetland is closely linked to the water table: potential threats to the wetland are represented by a decline of Mara River discharge, or depletion of the groundwater level. This would occur, in particular, if large scale water extraction (from the river or from groundwater) were to occur to provide resources for agricultural development. Such development projects could speed up this process significantly and cause the wetland to disappear very quickly and should obviously be avoided. A similar effect would occur if the water level in Lake Victoria would decrease. The decline in open water surface is likely to influence the presence of a number of species, including birds, fish, insects and aquatic plants. The increase in the vegetation cover may be due to natural processes – the young wetland being colonized by the plants, and this process may be speeded up by the impact of human actions (increased siltation and inflow of nutrients).

The actual use of wetland vegetation does not constitute a threat to the plant resources or the wetland. This may, however, change if a large-scale project to exploit the present enormous plant biomass resources of the wetland is started. In such case detailed impact assessment – and subsequent monitoring should be implemented.

The artisanal fishing may threaten the fish populations in the wetland; in particular, the harvest of Clarias juveniles for use as bait in Nile perch fishing needs to be stopped or controlled. Populations of some species may, however, be more threatened by the apparent increase in vegetation cover and density in the wetland, reducing the areas with open water (see Table 5.1). The "Lower Mara Wetland" Biodiversity Hotspot includes an area with intensive fishing and include the last major open water areas in the wetland. Detailed studies on the fish population and the impact of vegetation cover and fishery would provide very useful information in relation to management of this important resource.

Agricultural activities take place all around the wetland, and in many places right down to the edge of the wetland, using seasonally flooded areas in "drawdown cultivation". It is most intensive along the northern shore and especially in the north central and north-eastern part, were farming is done inside wetland areas and in areas periodically flooded (the area called "Agriculture in Wetland" on fig. 67 and the description in section 3.4). At present, use of pesticides and fertilizers is low in those areas, but these activities should be regulated to protect the wetland against future contamination. Enforcement of a 60 meter buffer-zone around the wetland, as provided for in the 2004 Environmental Management Act, would reduce the pressure; however, it would strongly affect the communities around the wetland, most of which have already lost significant cultivation areas due to the expansion of the wetland.

3.3.3.6. MANAGEMENT CONSIDERATIONS

The actual management of the wetland is limited, and in most areas the wetland seems to be used with no restrictions imposed by district or local authorities. According to WREM (2008), wetlands are held in trust by the government and are considered common property, and the lack of wetland ownership by the communities combined with limited awareness of management of wetland resources may present serious obstacles to the wise and sustainable management of the resources.

It should be considered to propose the area – or at least part of it – as a Ramsar Site. The site could include the Mara Bay (i.e. part of the Lake Victoria) and some of the islands at the entrance of the bay (those included in the IBA TZ041). The assessment made by BirdLife states that the bird population in the IBA triggers criteria 4 and 6 for designation as a Ramsar Site (See Table 5.7) due to the presence of more than 1 % of the population of the white-winged tern (*Chlidonias leucopterus*), and support that species in a critical stage of their life cycle. A detailed inventory of the wetland will most likely identify other criteria in support of the assignation; for example, the role served by the wetland as a refuge for several species of fish from the lake may trigger several criteria, including 3,4, and 7.

Considering the abundance of certain wetland species, especially papyrus and typha, there is probably no need to control the harvest of those species at the present exploitation level, but if large scale commercial exploitation of those species (e.g. for fuel briquettes or ethanol production) is initiated, the impact should be evaluated in details.

3.3.4. Occurrence of invasive weeds

Spread of invasive species: Invasive unpalatable species appears to be spreading, covering increasing land areas bordering the wetland and devastating in the first place natural pastures. Losing grazing and farming areas to invasive species may further increase pressure on the wetland and control measures should be initiated. The most common invasive species are *Chromolaena odorata, Parthenium hysterophorus (*Santa Maria feverfew weed) and *Argemone Mexicana.*

The most serious case in the lower basin is that of *Chromolaena odorata* which is a major threat for the farmers around the Mara Wetland complex, whereas *Parthenium hysterophorus* represents a risk for the Maasai Mara and Serengeti Reserves, their wildlife and thence tourism.

3.4. Population and Economy

3.4.1. Population features

3.4.1.1. DEMOGRAPHY

The Mara River Basin has experienced high population growth rates over the last few decades, which has been aggravated by migration into the basin during various periods in the past. It is estimated that 1,400,000 people reside within the basin of which about 70% live in Kenya and 30% in Tanzania, and general population growth rate stands at an annual 2.7%.

The distribution of the people is such that high population densities exist in the upper part of the basin, while the middle section is sparsely populated. This low population density is due to presence of the Maasai Mara National Reserve and the Serengeti National Park. Downstream of the parks, the population density again increases somewhat.

This feature is confirmed by the fact that the two upper sub-basins, Amala and Nyangores, have an estimated combined population of 500,000, about half of the Mara River Basin total population – and yet these two sub-basins with a combined area of 2,355 km^2 only constitute about 17% of the entire basin area.

The socio-cultural fabric and settlement pattern show a marked diversity in the basin due to presence of the indigenous population combined with the modern trends of immigration from outside.

3.4.1.2. ETHNIC GROUPS AND MAIN ACTIVITIES

In Kenya, the highlands of the Mara River Basin with good agricultural potential were traditionally inhabited the Kalenjin community. The ideal climatic conditions and fertile soils make it possible to grow high value cash crops like tea, coffee, pyrethrum and maize. Livestock production is also an important economic activity in this part of the basin.

The middle section comprises mainly grazing lands for the pastoralist Maasai community; they also grow crops like wheat, barley and various horticultural crops.

Other traditional dwellers of the Kenyan part of Mara River basin include the Ogiek community, which traditionally were hunters and gatherers and resided in the forests, and the Kipsigi community, which practice both agriculture and livestock rearing. More recently, because of the agricultural opportunities, other groups have settled in the upper basin, including Kikuyu, Kisii and Luhyas communities.

In Tanzania, a diversity of ethnic groups exists with the main ones being the Wakurya, Wajaluo and Wajita communities; they are associated with different cultural practices impacting in various ways on natural resource management in the basin. In particular, land ownership by the community/clan and not by individuals makes it difficult for the Government to act directly al field level, but imposes a certain level of peer control on potential threats on watershed management. In such a situation it is hard to find deforestation caused by outsiders. Clans they have internal regulations and rules on how land resources in the clan's land should be managed. This fact should be seen as an opportunity in the perspective of natural resources management.

Additionally, socio-economic activities in the lower Mara Basin also include tobacco growing in certain locations and fishing in connection with the Mara Wetlands as well as small-scale (artisanal) gold mining at various locations.

Culturally, most ethic groups in the lower Mara basin are agro-pastoralists and they value the number of livestock as a sign of wealth and a symbol of status in society. The total number is valuated above the yield (in animals per ha or in average animal weight or milk production) opening the way for overgrazing and low income from cattle rearing.

Within the basin there are pockets of forests located at springs and/or swampy areas, which are used as sacred sites. Such cultural practices are environmentally friendly because water sources are protected, and may also be of biodiversity importance.

3.4.2. Agricultural production

3.4.2.1. FARM SIZE

Continued fragmentation of land into very small farm sizes is not viable in the long run, this may lead to negative impacts on agriculture, where the yields would not be enough to support livelihoods, leading to food insecurity and low social welfare, and consequently there would be limited investments in land improvement.

Mid Mara Sub-Basin

Small-scale farming in the dominant land use of the Mara River Basin accounting for 31% (4210 km²) of the total land use. The other big chunk of land is taken up by protected areas 23% (3118 Km²) and range lands 29% (3974 Km²) of the total land use. Over the years, there has been rapid conversion of forest land into agricultural and grass lands due to dense human populations settling in the upper reaches of the Mau escarpment. In the mid-Mara region of Amala and Nyangores, 60% of the households are small holder farmers, with farm sizes ranging from 0.25 to 2 ha. The main crops grown are tea, maize, potatoes, beans, coffee, wheat and pyrethrum in the upper region while maize, beans, horticultural crops, sweet potato, millet, wheat, cassava and sorghum are grown in the mid and lower areas. The land under irrigation in this region is very small with a majority of farmers irrigating small (<1/4 acre) vegetable gardens along the river basin. Most of the agricultural and most people are dependent on rain fed agriculture. However, with expansion of irrigation larger areas are targeted as schemes. Large scale wheat and maize fields are only found in Amala sub-basin where commercial farmers produce wheat and maize from several hundreds of hectares.

Lower Mara Sub-Basin

Rainfed agriculture is dominated by small-scale subsistence farming and approximately 85% of the arable land is used by smallholder farmers and traditional agro-pastoralists. The land holdings are getting smaller due to population pressure leading to land sub-division. Farmers have adopted indigenous technologies for water harvesting. Examples of indigenous strategies include traditional water harvesting techniques (which include, among others, the excavated bunded basins locally called Majaluba for rice production, raised broad basins locally called Vinyungu and water storage structures locally called Ndiva (NAPA, 2007). The land holdings are slightly larger than the Kenyan side with farmers producing on an average of 12– 5 Ha. The major constraint to production is lack of rainfall and farm equipments especially tractors for land preparation.

3.4.2.2. CROP PRODUCTION PATTERNS

Crop production skills and knowledge depends on the target farmers are the area under cultivation as well as the production objective. Tea, coffee, wheat and pyrethrum are commercial crops whereas maize, beans and potatoes could be for subsistence or for commercial purposes depending on the scale of production. Maize growing is the major farming enterprise and it is usually intercropped with legumes. In the Lower-Mara sub-basin, the main crops grown are maize, beans, cotton, banana, sweet potato, cassava, and tobacco is also grown in certain areas. Small-scale irrigation goes on in this region but no major irrigation developments have been implemented thus far.

The cropping patterns are closely inter-related to the rainfall patterns. During the long season, (November – May) almost 100% of the farm families go into cropping as compared to 50% - 60% of farm families who go into cropping during the short season (June – October). The community's feeding habits are heavily skewed towards a higher intake of carbohydrates in the form of Maize and its products. Posho (Ugali), Porridge, Milk and local vegetables are the main diet components for most households in the region. Because of this, the bulk of annual farm yields and percentage area coverage is taken by Maize at about 20%%.

The cropping patterns can be divided into two production systems: mono-cropping and multiple cropping. Mono-cropping is mainly carried out on large scale production of cash crops such as sugarcane, coffee, sisal, cotton and tobacco.

Mixed cropping is on small holder farms where farmers practice several crop combinations with the following being the most common:

- Maize, beans in most areas of the basin,
- Coffee, banana and vegetables;
- Maize and beans (other pulses);
- Banana and vegetables in irrigated areas in the uplands.

A number of factors were found to influence overall cropping intensity of any selection of crops that farmers considered when formulating cropping patterns. These include:-

- Soil constraints – nutritional levels, texture and topography – farmers, through experience are able to allocate certain crops to certain areas within their farms where they feel the crops will perform best.
- Water availability - inefficient utilization and high wastage of water would be a constraint. Where there is water available, farmers if not well trained can over irrigate leading to increase in waterlogging cases and poor crop performance.
- Cropping calendars – Water availability will determine the cropping calendar. In rainfed agriculture planting dates were closely related to onset of rains across the study sites.
- Rotational constraints –Some farmers do not practice crop rotation because of lack of knowledge and also due to small land sizes. Rotation is important in the reduction of risk of pests and diseases and to maintain soil fertility. Farmers need to be trained on good crop rotation programmes
- Crop relative profitability – Farmers who are producing for commercial purposes consider crops that are profitable. Gross margins are generally related to a unit of land. The small irrigated farms observed had high value horticultural crops such as tomato and kales.
- Labour availability – Farmers indicated that they produce crops which do not give them problems during major peaks in labour requirements such as weeding and harvesting. The large scale farms use machinery and herbicides to handle this problem. Family labour is the main tillage practice in all study areas of the upper Mara, mid-Mara and lower Mara. Land preparation is by use of hoes and ox-plough is used on small farms while tractors are used in the large scale farms.
- Food security – Farmers consider food security as the first on the crop priority list and will opt for cropping patterns that satisfy their food needs and sell surplus produce.

The main cropping method practiced in the Nyangores, Amala, Tigithe and Somoche sub-basins is single cropping among large scale farmers and mixed cropping among small scale farmers. Fallow is virtually not practiced in all river Su-basins.

The very few farmers who practice fallowing do not change to other crops then fallow. The widespread use of fire to clear land for farming and land management is also recorded as a common farming practice. There is also burning of the crop residue and very few of farmers make use of it as animal feed, for cooking or distributing it on the land as manure. The use of crop residues to improve soil fertility should be encouraged.

In order to increase food production, various challenges facing agriculture in the Mara River Basin must be addressed and these include:

- Chronic food insecurity due to unreliable weather conditions especially in the dry lower zones,
- inappropriate agriculture practices,
- over dependency on a few crops,
- over-reliance on rain fed agriculture due to unreliability rainfall,
- Postharvest management practices as there are high postharvest losses,
- Use of inappropriate varieties and uncertified seeds
- High cost of farm inputs
- Poor marketing of agricultural produce
- Lack of access to farmer friendly credit
- Uncoordinated Stakeholders activities
- Inadequate extension service
- Inadequate infrastructure

3.4.2.3. LIVESTOCK KEEPING

Grazing is another important land use practice. The major types of livestock kept are cattle, goats and sheep. The farming communities have fewer cattle of better quality and mainly dairy cows especially in Bomet and Oloolunga districts in Kenya. In the Tanzanian part, the Somoche river sub-basin presents more opportunities for intensification of livestock because of the availability of rangeland.

Communities in Mara sub-catchment keep large sizes of cattle and over-grazing is common. This often leads to land degradation and soil erosion. The average size of the livestock is more than 10 in Mara River basin among pastoral communities and these could be up to 50 heads of cattle.

Due to this large size of livestock there is acute shortage of pasture. The critical months of pasture shortage are July to December, characteristically the dry season. During pasture shortage most livestock keepers move their livestock for grazing from one place to another or graze along the river banks. This can lead to conflict with farmers who practice irrigation along the rivers. For those with a small size of livestock teeter them with ropes to control movements in the homesteads. The rivers are also the main livestock watering point in all study sites.

The livestock reared includes poultry, dairy cattle, goats, and sheep. These are kept throughout the region of the Mara river basin.

3.4.2.4. OTHER LIVELIHOOD STRATEGY

Aquaculture is practiced at the Lower Mara due to presence of wetlands and high rainfall that can support this activity. Other livelihood strategies observed in the watershed are bee keeping and fishing.

3.4.2.5. EXTENSION SERVICE PROVISION

The main weaknesses that need to be addressed to improve extension services are:

- Poor extension facilities especially in the Lower Mara
- Weak research – extension – farmer linkages where messages from research are not readily available
- Low educational status for the frontline extension workers at village level
- Poor funding of extension programmes
- Low manpower to cover the continuously extending production areas
- Poor information flow even among extension staff from various departments
- Poor logistical support
- Poorly motivated staff

3.4.3. Forestry

The forests of the Mau escarpment are one of the largest remaining blocks of moist forest- in Kenya. There has been a progressive reduction in the area of forest caused by land fragmentation and settlement from the 1970's.

Other forest patches especially the riverine habitats along Mara river have also been under immense pressure die to human encroachment and expanding trade of charcoal.

Forest resources are used by local communities for timber, firewood, charcoal making and a wide range of non timber products including medicinal plants, fruits and honey.

Private woodlots planted with fast growing species like Eucalyptus, or *Grevillea robusta* sold for construction wood of fire-wood represent a good source of income for households

3.4.4. Livelihoods and Poverty

The MRB supports some quite profitable economic activities in Kenya and Tanzania including tourism, agriculture and mining; contribution to both countries' gross domestic product (GDP) has been assessed at about 10-15 %. However, the actual conditions for most people on the ground are very different. In the Mara River basin, provisional figures show 80% of the Tanzanian population living below the poverty line and around 60% in Kenya, although these estimates need further confirmation.

Thirty per cent of families experience food shortage in most years. 60% of all residents in the MRB obtain their water from the Mara and its tributaries.

3.4.5. Health and sanitation

Fast growing towns, mainly located in the upper part of the basin do not have a wastewater collection system and households mainly depend on pit latrines. Most rural areas do not have proper access to clean water and women and children need to collect water from the river and/or are dependent on water from shallow-wells or springs. These water sources are often not protected and may be contaminated, exposing the inhabitants to water-borne diseases.

Solid waste is mainly generated by domestic and commercial activities. In the more developed urban and market centres, solid waste is collected from garbage collecting points and brought to an open

dumping site. These dumping sites are usually not fenced and waste is dumped without being covered. The number of collection points in the urban centres is often low compared to the large population. In addition, these collection points are poorly maintained, and exposed to wind and water run-off during heavy rain, resulting in additional spreading of solid waste.

Gold mining activities take place in the Tigithe river sub-basin, near the city of Nyamongo; they appear as very large mining sites, like the North Mara Gold Mine managed by Barrick, or as very small mining business at village or family level. Because of the chemicals used in the process of separating gold from the ore, there is a risk of pollution of water by toxic heavy metals, and mainly Mercury.

3.5. MAIN DEGRADATION AND ENVIRONMENTAL ISSUES

3.5.1. Deforestation

Most of the deforestation in the Mara River Basin is taking place in the upper catchment area, which comprises the Mau Forest Complex in Kenya. The Mau Forest Complex when combined covers an area of 400,000 ha, and constitutes the largest remaining closed canopy forest block in East Africa. The Mau Forest Complex forms the upper catchments of most rivers that drain into Lake Victoria including the Yala, Nyando, Sondu and Mara.

The forests are rich in the biodiversity of flora and fauna and support key economic sectors, including energy, tourism, agriculture (cash crops such as tea, sugar cane, rice, pyrethrum, subsistence crops, and livestock) and water supply. It is estimated that water from Mau forests serves more than 4 million people in the Rift Valley and western Kenya and northern Tanzania.

Despite the importance of the Mau ecosystem in the sustenance of current and future socio-economic development in the region, Mau Forest Complex has been substantially degraded through legal and illegal excisions, which have opened the way to forest encroachment through settlements, farming, and poaching, and selective and clear loggings.

But deforestation concerns also numbers of hills forest cover in the whole basin that regress progressively to install agriculture even on very sloppy areas source of active erosion and sediment transport in the streams and river.

3.5.2. Soil Erosion

A visible indicator of environmental degradation is the accelerating rate of soil erosion witnessed in many parts of the Mara River Basin. The increased soil erosion has resulted in higher turbidity of the surface water with increased sediment transport and siltation along the river course as a result. Some of areas prone to erosion are outlined below as follows:

- Upper catchment of the Mara Basin due to forest clearing, intensification of agricultural activities and cultivation along the river banks;
- Clearance in the upper/middle parts of the basin to give way to agriculture and settlements and logging activities;
- Overstocking in the grassland zone of the lower reaches of the Mara River Basin;
- Steep and hilly slopes; and
- Cattle tracks, road reserves and gullies.

Erosion is found throughout the basin, and land management / agricultural practices in all parts should consider erosion control.

Figure 5 shows important erosion hotspots in the Mara River Basin. The hotspots are areas where immediate action is needed to prevent siltation of rivers, wetlands and dams, and to protect

agricultural soils. Natural riverine erosion, e.g. caused by meandering rivers is high in parts of the basin, especially in the lower part of the Mid main stem Mara and Lower Mara Sub-basins.

These hotspots can easily be compared with the zones with heavy slope in the areas shown in Figure 5.

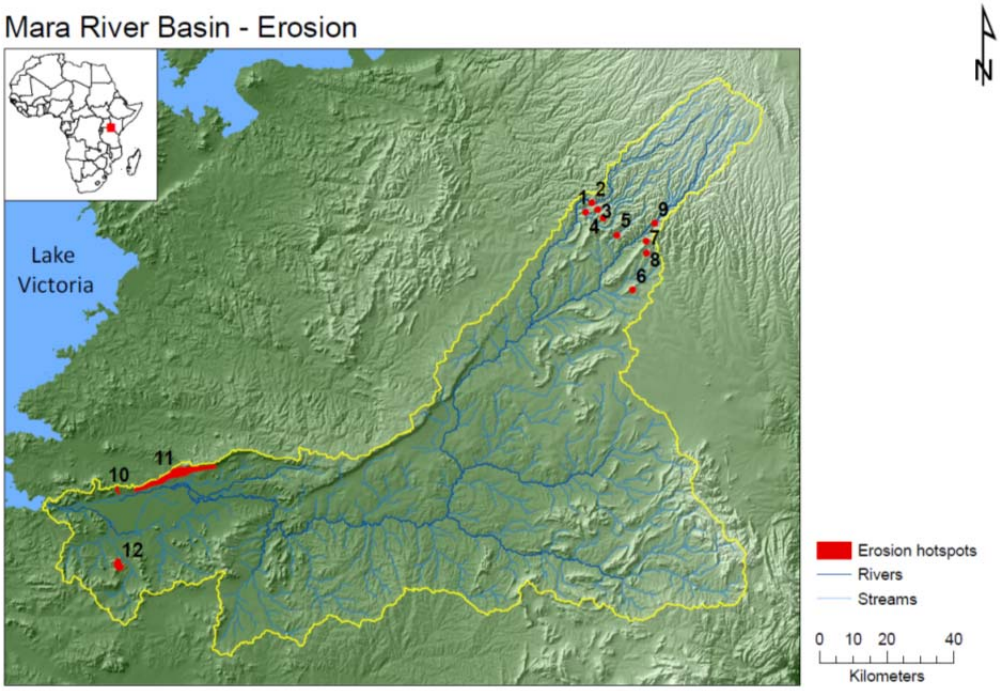


Figure 5: Erosion hotspots in the Mara river basin

The hotspots in Kenya include: Nyangores River Sub Catchment (2); Ngetunyek River Sub Catchment (3); Chepkositonik River Sub Catchment (4), Ise River Sub catchment (including Chemaner) (5); Kuto Hill Sub Catchment (6), Mogoiywet Sub Catchment (7); Sogoo- Rigat Sub Catchment (8); Maasai Mau Sub Catchment (including Sagamian area) (9). The Hotspots in Tanzania include the Mara Sibora area (10); a long stretch of the escarpment north of the Mara Wetland (11); and the catchment area for the Buswahili Dam (12). Sources: field visits; Amala WRUA, 2011; Google Earth). However, large parts of the basin are prone to erosion, and all projects related to land use should consider how to reduce/avoid erosion.

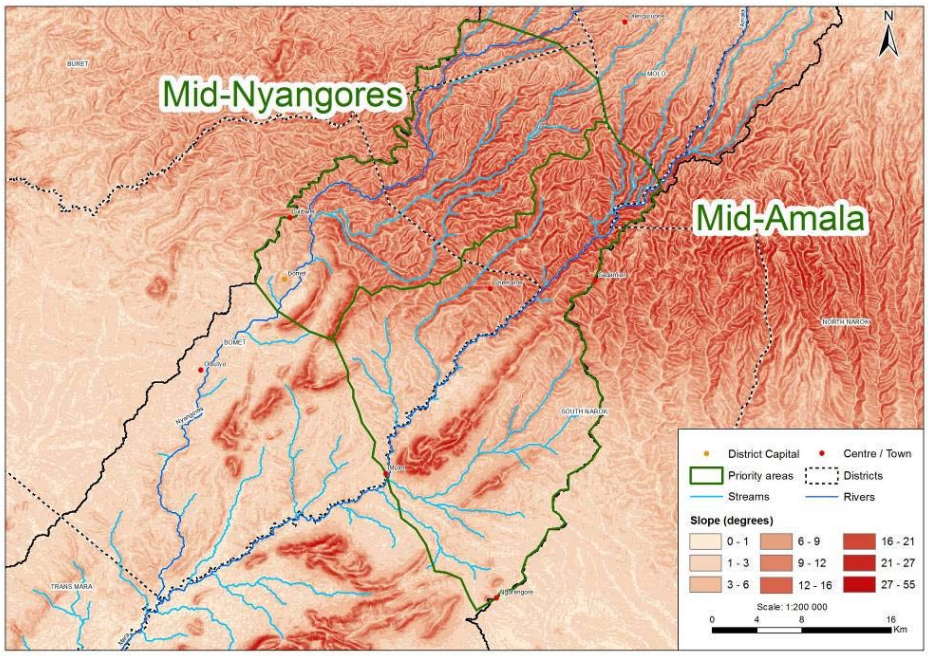


Figure 6: Map of slopes in the upper areas

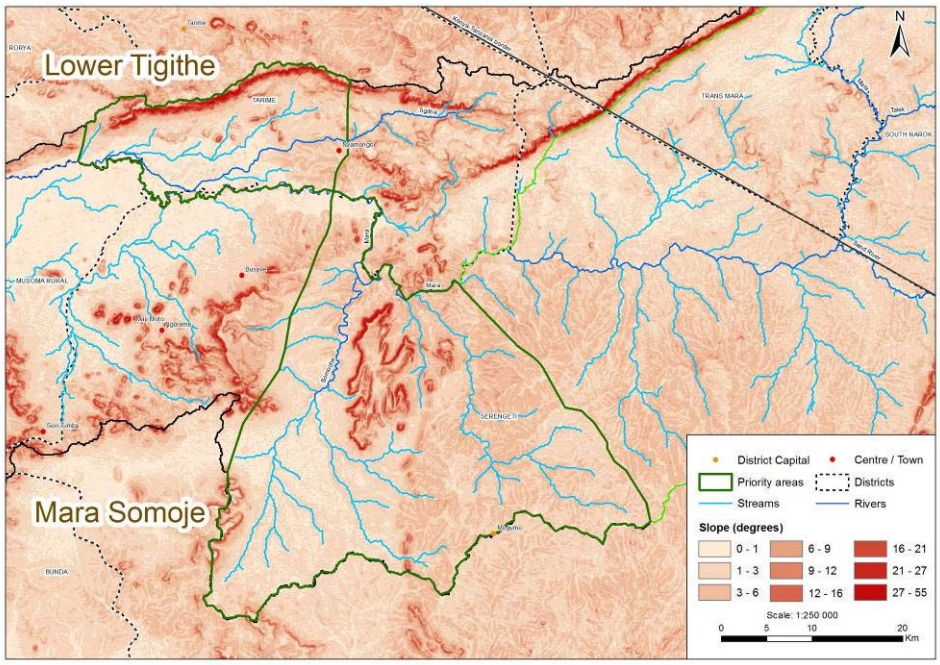


Figure 7: Map of slopes in the lower areas

3.5.3. Riverbank erosion

Riverbank erosion occurs largely in the whole watershed, due mainly to encroachment of riparian land through riverine cultivation and also due to trampling of cattle coming to drink and causing destabilization of the edge. Such degradation contributes to the release of sediment into the river system.

3.5.4. Wetlands degradation

The potentially degrading processes are fuelled by population growth; lack of alternative **livelihood activities, lack of wetlands' ownership since they are held in trust by the** government and are therefore considered common property; inadequate legal provisions and constraints imposed by the land tenure systems and a general lack of awareness and sensitization of all stakeholders.

Some of the wetland exploitation practices may have negative impacts on the Mara Wetland and may lead into land degradation with the following negative impacts:

Pollution **-** According to WREM 2008, vegetable farming on the edges of the wetland as well as other intensive agricultural activities in the basin make use of agrochemicals (herbicides, insecticides, fungicides, and fertilizers) which end up into the wetland. This, however may still be quite limited in extend in the lower Mara area, and some observers inform that pesticides is mainly used in the tobacco growing areas along the Tobora River. Anyway, it is important that future intensification and expansion of farming activities employs agrochemicals with great care, using Integrated Pest Management (IPM) techniques or apply organic farming practices. Intensive use of agrochemicals in and around the wetland and in the upstream catchment areas may affect the downstream wetland biodiversity especially the fish fauna and other organisms that are sensitive to chemical pollution and which could be wiped out from the wetlands and the river system (Mbuya, 2004). Especially important are the pollution effects on the fish species that migrate between Lake Victoria and upstream Mara River to spawn (Chitamwebwa, 2007; WWF, 2007).

Eutrophication **–** Use of fertilizers increases the potential for loading the wetland with nutrients that emanate from agricultural landscapes around the wetland and beyond which lead to eutrophication and faster colonization of aquatic weeds such as water hyacinth (*Eichhornia crassipes*). However, the wetland vegetation in general is capable of absorbing large quantities of nutrients, thus mitigating the impact of nutrient pollution to a large extent. Also, at this point the use of chemical fertilizers is still limited.

Changes in hydrology – Increased farming activities in the basin are likely to modify the hydrology of the Mara River and the Mara wetland system. Sediment loading in the wetland has led to rising of water table, causing the water course to change in some parts, and the flooding of the swamp over wider areas (Mati et al., 2005).

Over Grazing: Overgrazing in and near the wetland (wetland is used as refuge for the animals during the dry season), combined with the deforestation along swamp edges (e.g. for firewood and charcoal production observed in many places) may increase erosion and siltation of the wetland. Grazing in a controlled manner, however, can be done in a sustainable way both within the dryer parts of the wetland and along the margins of the wetland.

Fishing practices: The fish resources of the swamp are presently facing threats from overfishing, overharvesting of juvenile fish, and use of poison in fishing.

> *Overfishing* – Availability of ready fish markets has encouraged overfishing which threatens available resources (Yanda and Majule, 2004; Munishi, 2007).
>
> *Overharvesting of juvenile fish* – Overharvesting of juvenile fish especially the *Clarias aluwardi* (vigugu) that is used as bate for Nile perch hook fishery in Lake Victoria is likely to result in degradation and overharvesting of the affected fish species in the wetland; and
>
> *Use of poison in fishing* - The use of poison in fishing which has been reported to take place in the area is a threat to fish biodiversity of the wetland.

Charcoal burning: During the field investigations, the study team witnessed large quantities of charcoal and fire wood being ferried to Musoma through bicycles and cars, an indicator of serious environmental degradation that is taking place in the Mara River lower catchment.

Burning of wetlands vegetation: Burning of the wetlands vegetation is a common activity in and around the Mara Wetland. It is usually carried out for the following purposes:

- Widespread burning of grasslands around the swamp is carried out to stimulate fresh grass
- Burning of the swamp is conducted to facilitate hunting and fishing
- The vegetation at the swamp edge is burnt in the dry season to prepare the land for farming
- Get rid of mosquitoes

Although burning is an important socio-economic activity for the communities around the wetland, it may result in degradation of the wetland biodiversity, e.g. by affecting the birds nesting in the papyrus.

Impacts of the degradation of the upstream catchment: Recently, the hydrology of the Mara Wetland has been greatly affected by land use changes that have occurred in the upstream catchment in Kenya (Mbuya, 2004). Increased farming activities and the deforestation of the Mau Forest Complex, have resulted in increased sediment loading in the Mara River leading to altered river flow, change of river morphology and enhanced wider flooding and expansion of the Mara Wetland (Mati et al, 2005).

3.5.5. Water pollution

The increasing socio-economic activities and settlements in the Mara River Basin generate wastes which have adversely impacted the quality of the surface and groundwater resources. Pollution falls in two categories:

- Point source pollution is related to contaminants discharged from discrete locations. These are the readily identifiable inputs, e.g. untreated sewage discharged to the receiving waters in an open drain.
- Non-point source pollution refers to all other discharges that deliver contaminants to water bodies and originates from widespread sources. Often it can be hard to pinpoint exactly where non-point pollution comes from.

Both pollution sources affect the Mara River and its water quality.

3.5.5.1. POINT SOURCE POLLUTION

Point source pollution in the upper Mara catchments appears considerable, particularly from fast growing urban and market centers like Bomet Municipality, Mulot Urban Council, and Tenwek. These towns – some located right adjacent to the open water courses – lack proper sewerage systems and well organised solid waste collection and disposal practices.

Point source pollution in the lower Mara basin in Tanzania appears relatively moderate and confined to towns like Mugumu and Nyamongo, including the North Mara Gold Mine. And again, based on water quality monitoring results, the findings suggest that generally the water quality of the lower Mara River is not alarmingly adversely affected by e.g. toxic pollutants from the mining operations.

The various categories of point source pollutions can be listed as follows:

- Municipal wastewater. Particularly emanating from the fast growing towns in the upper part of the basin, which have no sewerage systems other than wastewater disposal in pit latrines and with only a few proper septic tanks installed.

- Domestic wastewater. Poorly designed and / or poorly managed septic tanks in secondary schools, lodges, hotels and camps in the basin.

- Cattle dips for controlling ticks and other parasites from cattle. Some are sited close to the open water courses.

- Slaughterhouses. Almost all the market centres posse a slaughter house. In some centres, like Bomet, there is a pit for the condemned parts of the carcass and other wastage, but the water used for washing and cleaning the slaughter houses is disposed off overland, and is washed into the rivers during the rains.

- Car washing. Car washing is particularly more common in upper Amala and Nyangores rivers than in the mid Mara. There are notorious sites like Tenwek Bridge, Olbutyo bridge, R. Ng'ashiat at Mulot and Nyangores at Bomet.

- Solid waste disposal. Solid wastes are generated by domestic (from residential areas), commercial (market centres, hotels, lodges and camps), industrial (tea factories), healthcare (Tenwek Hospital, Talek Dispensary, Longisa Hospital, Mulot Dispensary) and agricultural activities (agricultural packages, tins and chemical containers). These wastes which include litters refuse, garbage and rubbish accumulate in the streets and other public places like markets. During storm events much of this is washed into the rivers.

- Metals from scrap metal dump sites / rusted corrugated iron plates etc.

- Garages Oil spills which may be washed into the water courses.

- Mining activities: The Mara Region is rich in minerals including gold, limestone, kaolin and gemstone (Yanda and Majule, 2004) and the mining activities are likely to impact negatively on the Mara Wetland biodiversity. Large scale mining is carried out at Nyamongo Town, Tarime District by North Mara (Barrick) Gold Mine. This latter has been the source of major pollution of the river and ground water in 2009, since then, no serious problems have not been reported, but the watercourse downstream of the mine is unsuitable to any domestic use. In surrounding areas, there are small-scale or artisanal gold mining businesses operating either legally or illegally.

Both the large scale and the artisanal mining concerns negatively affect the swamp through the discharge of pollutants such as mercury (*for artisanal and small scale mining only, large scale using cyanide gold extraction technics*) and sediments into the nearby streams.

Due to the proximity of the mines to the Mara Wetland, mercury pollution from the small scale gold diggers and leakages from the large scale gold mine tailing dams may reach in the lower Mara River and swamp system. The mines at Buhemba may also constitute a risk, through the Buhemba stream which enters the wetland from the south.

3.5.5.2. NON-POINT SOURCE POLLUTION

Non-point source pollution is the greatest source of pollution of the Mara River. Sources of pollution are scattered across residential, agricultural, forested and urban landscape. The pollution load is transported to receiving water bodies in runoff from storm events or irrigation return flows affecting the water body conditions during times of higher surface runoff and therefore high flows. The major non-point sources of pollution are mainly related to land uses, and therefore can only be controlled by improved land use practices.

The identified non-point source pollution includes the following:

- Large-scale wheat farms. The intensive use of agro-chemicals including aerial sprays and the breaking down of soil into finer particles during wheat planting are sources of nutrients and suspended solid in mid Mara and the Amala sub-basin.
- Small-scale subsistence farmers. The upper Amala and Nyangores and the Lower Mara are dominated by small-scale subsistence farmers. Pollution is caused by poor agricultural practices (misuse of agro-chemicals, farming on steep slopes, and non-existence of soil and water conservation structures). The practice is more common in Amala sub-basin than in Nyangores, where tea bushes act as soil conservation facilities. In the Lower Mara the use of agrochemicals is still limited, but most likely growing.
- Overgrazing. This is rampant in the lower Nyangores, mid Mara, and lower Mara (outside the protected area), where cattle rearing is the most ideal agricultural activity due to the prevailing climatic conditions. The animals are watered directly from the river and create cattle tracts which facilitate soil erosion.
- Extensive soil erosion due to deforestation, encroachement of riverbanks, road construction and lack of run-off water management.

The figure below synthesizes the main causes and corresponding impacts of degradation as observed along the river basin, from the source to the outlet.

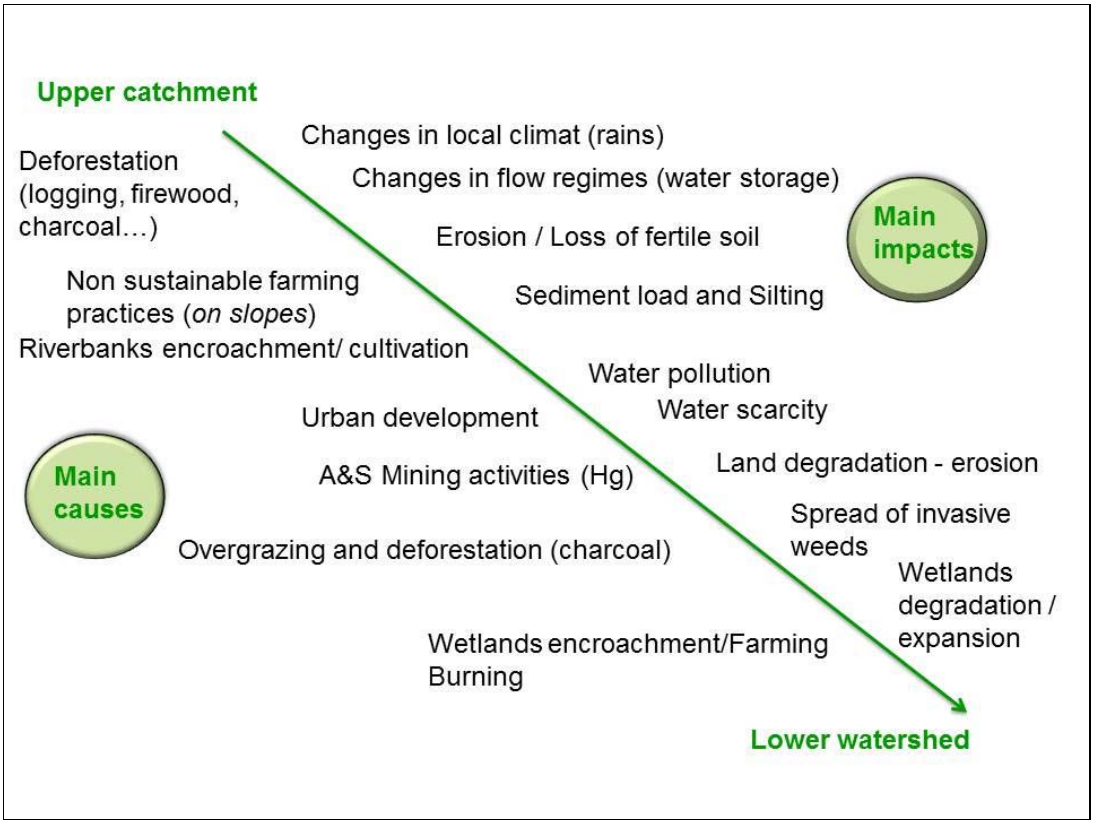


Figure 8: Synthesis of degradation causes and impacts

3.6. PRIORITY AREAS FOR PROJECT INTERVENTION

3.6.1. Selection Process

Based on the elements presented in the previous chapters, the Consultant selected areas in which activities of the Investment Program should be developed in priority. Criteria for this selection include:

a) Population density in the study area
b) Absence of management structures (National Parks and Conservancies);
c) Minimal overlapping with significant on-going projects;
d) Slopes in the study area;
e) Types of soil (agricultural capacity and sensitivity to erosion);
f) Amount of rainfall;
g) Pressure on natural resources;
h) Poverty levels;
i) Water and Sanitation issues.

The criteria above have been applied taking into account the general logical concepts implicit in Figure 5 above: the Investment Program should act on the causes that lead to the worst impacts, in terms of affected population or irreversibility of the process, and in the cases for which opportunity of success are highest. Table 7 used for decision making is presented below, with criteria corresponding to the list above; severity of issues for each criterion has been assessed from existing documents (xxx for maximum severity).

Table 7: Selection of priority areas

Criterion Sub-basin	a	b	c	d	e	f	g	h	i
Amala	xxx	xxx	x	xxx	xx	xxx	xxx	x	xx
Nyangores	xxx	xxx	x	xxx	xx	xxx	xxx	x	xx
Talek	x	xx	xx	x	x	x	xx	x	x
Mid-Mara	x	x	xx	x	xx	xx	xx	x	x
Sand	x	xx	xx	x	x	x	xx	x	x
Lower Mara	xx	xxx	xx	xxx	xx	x	xx	xx	xxx

These criteria led to elimination of all areas included in the Maasai Mara Reserve and the Serengeti Reserve, in which poverty reduction is not at stake (scarce population) and the existing management structure is a constraint on activities to be developed.

The extreme upper part of the basin in the Mau Forest area, in both Nyangores and Amala rivers sub-basins, has not been considered because forest management is already the object of other projects; in addition, the current condition is satisfactory with the "water tower" providing excellent quality water. Number of potential beneficiaries is also low. Yet some recommendations may be provided to integrate the management of the area with the rest of the basin.

The south-eastern part of the river basin, with the Sand and Talek sub-basins, was also not included in priority sites because most criteria were found at a low level of severity. Indeed watershed management activities could be implemented there and could produce a positive impact on the population, particularly around the issues of domestic water supply and drought management. But watershed development actions do not appear as urgent to prevent incoming problems, and no significant impact on other areas would be expected.

For the Lower Mara sub-basin, two zones have been identified with different characteristics and therefore needing different solutions:

- Mara Somoche, on the left (southern) bank of Mara river, covering the river basin of Somoche River and other minor streams, focused on livestock rearing and small scale agriculture, and
- Lower Tigithe, on the right (northern) bank of Mara River, with specific issues linked to gold mining and the proximity of the Masurura swamp

In such a way, the Consultant defines as priority sites for Watershed Management project implementation the following areas: mid-Nyangores sub basin, mid-Amala sub-basin, Mara Somoche sub-basin and Lower Tigithe sub-basin.

These sites and a first approach to the possible types of actions are described as follows.

Mid-Nyangores sub-basin

This site covers the part of Nyangores basin, from the edge of Transmara forest block of the Mau Forest, and downstream to the confluence of Kagawet River and Nyangores river; this downstream boundary is below the 1LA3 hydrometric station operated by WRMA. The first concern for this basin is soil erosion, for its local effects on medium- and long-term agricultural production, but also because of its impact of sediments and pollution on downstream areas.

Mid-Amala sub-basin

This site covers the part of Amala basin, in Kenya, from the edge of edge of Transmara-Maasai Mau forests of the Mau Forest and downstream to the bridge near Mulot market; this boundary is downstream of the 1LB2 hydrometric station operated by WRMA. The first concern for this basin is soil erosion, for its local effects on medium- and long-term agricultural production, pollution and also because of its impact on downstream areas.

Mara-Somoche sub-basin

This site covers the eastern part of Mara wetlands in Tanzania, on Mara River left bank, limited to the East by the Serengeti Natural Reserve and covering most of the Somoche river sub-basin. It includes

a hilly part of the sub-basin on the south. The first concerns for this area are (i) siltation and increase of inundated areas, and (ii) poverty.

Lower Tigithe sub-basin

This site covers the right bank of Mara wetlands in Tanzania, from the North Barrick Gold mine to the East and downstream along Tigithe river catchment to the inundated area of the Masurura swamp to the river outlet into Lake Victoria. The first concern for this area is linked to poverty, poor sanitation, pollution due to large and artisanal gold mining and processing which needs to be reduced in a favourable manner in spite of the difficulty in managing the expanding wetlands.

Tables 8, 9 and 10 summarize for each priority area: the physical characteristics, the administrative aspects and the main land use features.

Figure 8 below shows the location of the 4 priority areas in the Mara River Watershed.

Table 8 : Physical characteristics of the priority areas

Name	Area	Min Elev	Max Elev	Avg Elev	Max Slope	Avg Slope
	(km²)	(m)	(m)	(m)	(%)	(%)
Mid Amala	675.89	1803.2	2475.9	2075.2	63.29	12.56
Mid Nyangores	488.51	1892.6	2463.9	2201.3	64.7	17.10
Mara Somoje	1259.10	1173.2	1789.0	1438.1	77.14	5.69
Lower Tigithe	317.10	1147.6	1720.8	1252.9	80.09	6.75

Source: Egis 2012

Table 9: Administrative aspects of priority areas

River sub-basin	Area (km²)	Selected sub-basin	District/County	Towns	Country
Amala	1,420	Mid-Amala	Narok South, Bomet	Mulot; Longisa, Chemaner	Kenya
Nyangores	935	Mid-Nyangores	Bomet	Bomet, Silibwet, Mugango	Kenya
Lower Mara	5,180	Mara Somoche	Serengeti	Mrito	Tanzania
		Lower Tigithe	Tarime	Nyangoto, Kewanja	Tanzania

Table 10 : Major land use in the priority areas

	Kenya	Tanzania

Principal Land use	Mid Nyangores		Mid Amala		Lower Tigithe		Mara Somoche	
	km^2	%	km^2	%	km^2	%	km^2	%
Small-scale agriculture	157,95	38,45%	395,80	65,68%	230,02	74,85%	1010,60	89,37%
Large-scale agriculture	0,00	0,00%	89,61	14,87%	0,00	0,00%	0,00	0,00%
Irrigated areas	0,00	0,00%	0,00	0,00%	0,00	0,00%	0,00	0,00%
Tea plantations	11,71	2,85%	1,15	0,19%	0,00	0,00%	0,00	0,00%
Mining areas	0,00	0,00%	0,00	0,00%	4,91	1,60%	0,00	0,00%
Forest	241,11	58,70%	109,54	18,18%	0,00	0,00%	0,00	0,00%
Wetland	0,00	0,00%	0,00	0,00%	44,34	14,43%	0,00	0,00%
Conservancies	0,00	0,00%	0,00	0,00%	0,00	0,00%	0,00	0,00%
Protected area	0,00	0,00%	0,00	0,00%	0,00	0,00%	0,08	0,01%
Range land	0,00	0,00%	6,48	1,07%	28,04	9,12%	120,11	10,62%
Total	410,78	100,00%	602,58	100,00%	307,31	100,00%	1130,79	100,00%

Source: Egis 2012 from satellite images

For the Sustainable Wetlands Management project, , the priority area is formed by the buffer area 5km wide all around the permanent Masurura swamp, shown in Figure 9 (purple line). This selection responds to the fact that most wetland-oriented villages are located within this zone.

For the Water pollution and Sanitation project, after consultation with the stakeholders, the priority sites have been selected to include: (i) hills and plain areas, (ii) part of both countries, (iii) urban, semi-urban and rural areas, and (iv) areas of small-scale mining business. That led to the selection of the sited marked by a red dot in Figure 9:

- Bomet and Mulot (urban and semi-urban)
- Nyangoto and Kewanja (semi-urban)
- Weigita (rural)
- Tigithe basin (mining activities)

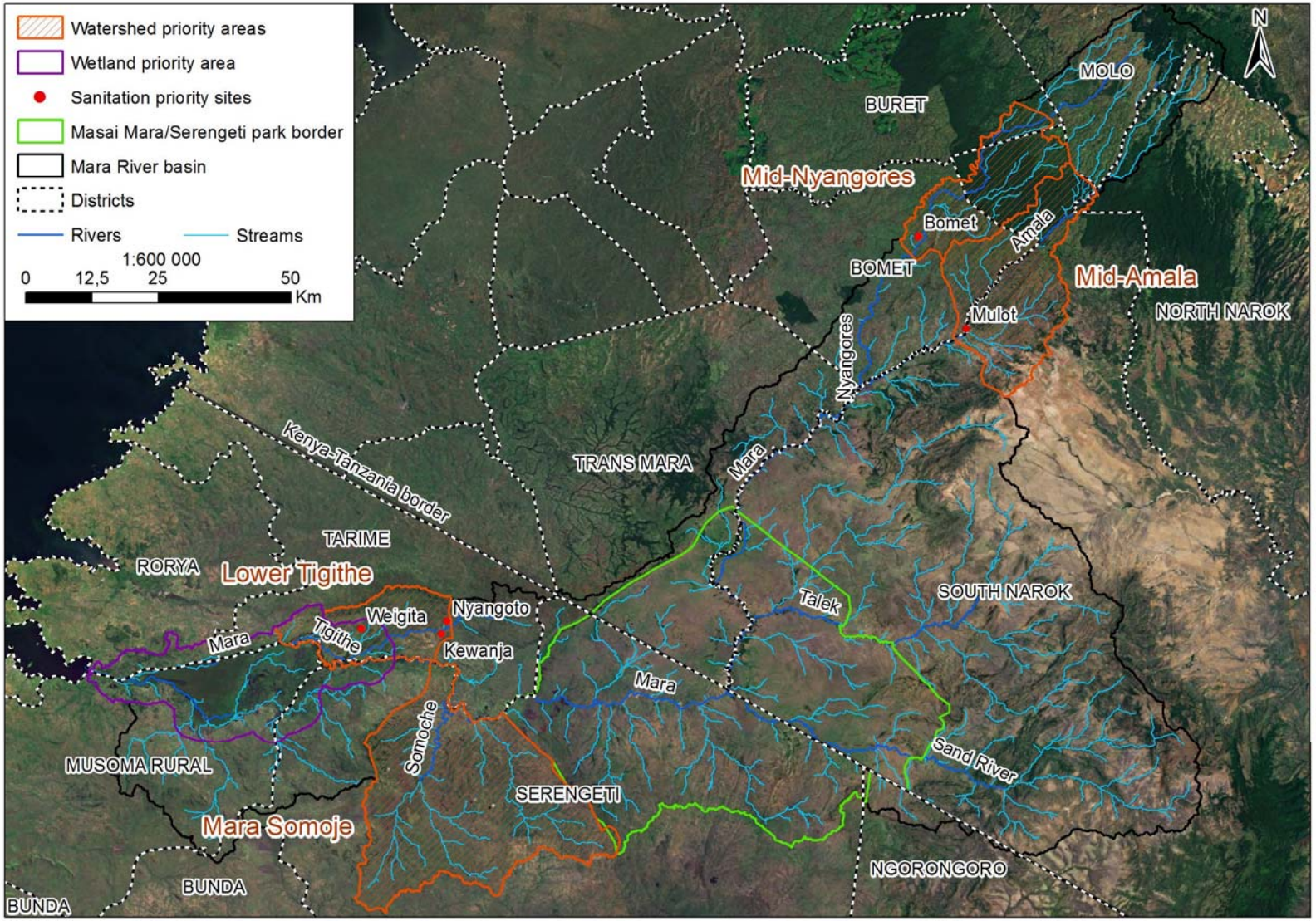


Figure 9 : Priority Areas

3.6.2. Main features, constraints and opportunities in the priority areas

3.6.2.1. MID-NYANGORES PRIORITY AREA (KENYA)

Main features and occurrence of degradation

- Prevalence of private land ownership in Kenya
- Steep slopes on the hills and very narrow valleys
- High erosion rate, witnessed by high turbidity of river water, threatening soil productivity by loss of nutrients
- Good quality soils able to support agricultural development
- Intensive farming for a variety of crops (maize, Irish and sweet potatoes, wheat, …) and tea plantations at small scale
- Decreasing incidence of forest coverage through encroachment of the Mau forest and intensive deforestation of hills for farming
- Tradition of small scale dairy activities, at family level
- Increasing population density, leading to higher demographic pressure on the land
- Development of urban centres (mostly Bomet) and market places where solid wastes and wastewater are produced and accumulated (increasing problem)
- Population increase, and specifically that of urban population, leads to higher pressure on biomass resources for fuel wood and charcoal
- Existence of a small hydropower plant at Tenwek to supply the local private hospital; the operation is hampered by recurrent siltation of the reservoir and flushing/dredging is a difficult task
- Existence of a project for multipurpose dam at Silibwet, currently at prefeasibility level

Main constraints

- Small area plots (around 1.5 ha/household) and increasing demand for farmland
- Lack of financial means for innovation and land improvement
- No access to credit facilities for small scale farmers
- Market access is hampered by the poor conditions of roads, particularly during rainy season
- Low rate of equipment for cash crop conservation and transportation to distant markets
- Lack of alternatives to inefficient coal and firewood burning
- Few farmer's cooperatives (access of markets and bargain with traders)
- Occurrence of conflicts between farmers and livestock keepers
- Low access to water and sanitation equipment
- Unsuitable waste and waste water management in Bomet
- Lack of knowledge and compliance with laws related to buffer zone along riverbanks (60 m) and afforestation of farmlands (at least 10% of the area)
- Low coverage of district or front line field officers (for advise and compliance with laws)
- Low awareness of population regarding health risks and hygiene (occurrence of fecal and waterborne disease)

Opportunities

- Springs with fresh water from hills
- Good soil fertility
- Climate and rainfall regime favorable to a wide range of cash crops

Possible actions

- Terracing and other soil conservation measures, in particular for agricultural areas with steep slopes; terrace bunds can be used for production of forage and hay or for cash crops (Napier grass…)
- Rainwater harvesting
- Promotion of hilltops tree planting and on-farm woodlots including agroforestry (fruit trees), creation of village nurseries
- Spring protection (fencing and afforestation)
- Riverbank protection (promotion of bamboo production)
- Development of fish farming (fishponds)
- Promotion of self-help capacity building groups, in the model of Farmers Field Schools (FFS), to facilitate the sharing of positive experience among farmers, first in a same area, then also with farmer groups of other villages or sub-basins
- Support to women farmers groups, for dairy products and other non-traditional economic activities (bee keeping, poultry products, handicraft)
- Selection and development of cash crops directed to the nearby tourism market, agreeing with hotels and lodges what are the repeated requirements they might satisfy, for example in vegetables
- Access to market of agricultural and other products must be facilitated
- Evaluation of process and costs for solid waste collection and disposal (selection of better suitable sites for dumping site), and waste water collection and treatment/disposal for Bomet county headquarters;
- Propose solution to decrease or at least stabilise the consumption of fuel wood and charcoal, through promotion of better stove technology, briquettes, development of biogas out of cow dung…

3.6.2.2. MID AMALA PRIORITY AREA (KENYA)

Main features and occurrence of degradation

- Prevalence of private land ownership in Kenya
- Steep slopes on the hills and very narrow valleys
- Good quality soils able to support agricultural development
- Intensive farming for a variety of crops (maize, Irish and sweet potatoes…) and tea plantations at small scale
- Decreasing incidence of forest coverage; wide areas have been cleared, and large scale tea estates have been developed on the eastern side of the sub-basin
- High erosion rate, witnessed by high turbidity of river water, threatening soil productivity by loss of nutrients; the specific case of Kuto hill needs to be examined: after forest clearing, very few years of good agricultural production are now followed by a severe loss of fertility
- Increasing population density, leading to higher demographic pressure on the land
- Development of semi-urban market places (and particularly Mulot) where solid wastes are produced and accumulated
- Population increase, and specifically in urban population, leads to higher pressure on biomass resources for fuel wood and charcoal
- Existence of a project for multipurpose dam at Norera; final design expected in March 2013
- The reasons for drying up of Ngasiat river (a left bank tributary to Amala, near Mulot market) are not clearly established

Main constraints

- Restricted surface plots (around 1.5 ha/household)
- Lack of financial means for innovation and land improvement
- No access to credit facilities for small scale farmers

- Market access is hampered by the poor conditions of roads, particularly during rainy season
- Low rate of equipment for cash crop conservation and transportation to distant markets
- Vital need of a cheap energy available today through coal and firewood
- Low coverage of district or front line field officers
- Low occurrence of farmer's cooperatives (allowing better access to markets and bargain with traders)
- Risk of conflicts between farmers and livestock keepers
- Low access to water and sanitation equipment
- Lack of waste management and storm water management in semi-rural areas (Mulot market)
- Some private lands leased by farmers for a limited time, no incentive for investment in land improvement
- Lack of knowledge and compliance with laws related to buffer zone along riverbanks (60 m) and afforestation of farmlands (at least 10% of the area)
- Low awareness of population regarding health and hygiene (occurrence of fecal contamination and waterborne disease)

Opportunities

- Springs with fresh water from hills
- Good soil fertility
- Climate and rainfall regime favorable to a wide range of cash crops
- Sensitization of population to new practices (terraces et reforestation) and previous experience with FFS through previous and ongoing projects
- Constitution of stakeholder forum (NALEP)
- Complementarity with ongoing projects for afforestation (Mau forest)
- Previous experience of tree nurseries
- Development of tea plantation as cash crop
- Lucrative wood market accessible for individual farmers (mainly eucalyptus) (# 15 USD/m^3)

Possible actions

- Terracing and other soil conservation measures, in particular for agricultural areas with steep slopes; terrace bunds can be used for production of forage and hay or for cash crops);
- Rainwater harvesting
- Promotion of hilltops tree planting and on-farm woodlots including agroforestry (fruit trees)
- Spring protection (fencing and afforestation)
- Riverbank protection (promotion of bamboo production)
- Awareness regarding protection of the Maasai and complementary actions for afforestation, promotion of native species to protect the environmental quality, organisation of forest management institutions, creation of village nurseries…
- Promotion of self-help capacity building groups, in the model of Farmers Field Schools (FFS), to facilitate the sharing of positive experience among farmers, first in a same area, then also with farmer groups of other villages or sub-basins;
- Support to women farmers groups, for dairy products and other non-traditional economic activities (bee keeping, poultry products, handicraft)
- Selection and development of cash crops directed to the nearby tourism market, agreeing with hotels and lodges what are the repeated requirements they might satisfy, for example in dairy products, fruit or vegetables;
- Evaluation of process and costs for solid waste collection and disposal for Mulot market place;
- Propose solution to decrease or at least stabilise the consumption of fuel wood and charcoal, through promotion of better stove technology, briquettes, development of biogas out of cow dung…
- Access to market of agricultural and other products must be facilitated by improvement of local roads

3.6.2.3. MARA-SOMOCHE PRIORITY AREA

Main features and occurrence of degradation

- Generalized land ownership by community in Tanzania
- Very steep slopes on the hills and large flat areas in the valley
- Loose sandy soils sensitive to erosion and of limited agricultural capacity
- Large uncultivated areas, for extensive cattle rearing
- Strong cattle rearing tradition in community ownership, particularly with the Kuria ethnic group
- Farming for a variety of crops in particular as flood recession crops (maize, sorghum, millet) on flat areas, and appearance of cash crops like Tobacco
- Very poor soil cover, based on shrubs, and pastures endangered by invasive exotic weeds (mainly *Chromolaena odorata*)
- Existence of a dam construction project at Borenga, for irrigation and bulk water supply; Feasibility Study is expected to be competed in 2013.

Main constraints

- Lack of financial means for innovation and land improvement
- No access to credit facilities for small scale farmers
- Market access is hampered by the poor conditions of roads, particularly during rainy season
- Low rate of equipment for cash crop conservation and transportation to distant markets
- Dominance of low-productive breeds for cattle and goats
- Charcoal is used as the main cooking fuel, but needs to be mostly brought from other areas because of the limited biomass available;
- Low coverage of district or front line field officers
- Low access to water and sanitation equipment
- Lack of waste management and storm water management in semi-rural areas like market places as well as urban areas
- Lack of knowledge and compliance with laws related to buffer zone along riverbanks (60 m)

Opportunities

- Best incidence of forest coverage and higher awareness of population regarding usefulness of woodland on the hills
- Potential for improvement of livestock and livestock derived products
- Occurrence of IGAs like beekeeping
- Ongoing researches and programs on invasive species *Chromolaena odorata*

Possible actions

- Preparation of Village Land Use Plans
- Control of gully erosion along and across the roads
- Control of erosion in fields through adequate cultivation practices
- Monitoring of water quality and water pollution in relationship with human and cattle use
- Selection and development of cash crops directed to the nearby tourism market, agreeing with hotels and lodges what are the repeated requirements they might satisfy, for example in water melon and other fruit
- Support to women farmers groups for traditional and non-traditional economic activities (orchard management, handicraft)
- Improvement of livestock husbandry and establishment of sheep and goats breeding centre
- Development of campaigns and other actions towards invasive weeds control (including biological control)
- Propose solution to decrease or at least stabilise the consumption of fuel wood and charcoal, through promotion of better stove technology, briquettes, development of alternative energy sources…

- Promotion of self-help capacity building groups, in the model of Farmers Field Schools (FFS), to facilitate the sharing of positive experience among farmers, first in a same area, then also with farmer groups of other villages or sub-basins

3.6.2.4. LOWER TIGITHE PRIORITY AREA (TANZANIA)

Main features and occurrence of degradation

- Generalized land ownership by community in Tanzania
- Very steep slopes on the hills and large flat areas in the valley
- Loose sandy soils sensitive to erosion subject to deep gully erosion
- Farming for a variety of crops in particular as flood recession crops (maize, sorgho, millet) on flat areas
- Farming on steep slopes (maize, beans, potatoes, …) on very small plots without soil conservation practices resulting in severe occurrence of soil erosion
- Large uncultivated areas, subject to seasonal flooding
- Gold mining, in very large sites like Barrick's North Mara Gold Mine near Nyamongo,
- Large spread of small scale mining business at household or community level
- Chemicals used in the process of gold separation from the ore, in small business and major companies, can pollute surface water and groundwater, both in the short term and with long lasting impact;
- As a new trend, farming for a variety of crops is developing, in correspondence with arrival of new inhabitants attracted by the mining development
- Limited practice of fishing or fish farming
- Probable impact of gold mining on water quality

Main constraints

- No access to credit facilities for households
- Access to market is hampered by the poor conditions of roads, particularly during rainy season
- Emergence of salt contamination of soils in annually flooded areas
- Charcoal is used as the main cooking fuel, but needs to be mostly brought from other areas because of the limited biomass available
- Low coverage of district or front line field officers
- Lack of teaching and training centres
- Low access to water and sanitation equipment and lack of financial means for improvement
- Lack of waste management and storm water management in urban and semi-urban areas (Nyamongo and Kewandja)
- Lack of knowledge and compliance with laws related to buffer zone along riverbanks (60 m) and afforestation of farmlands (at least 10% of the area)
- Low awareness of population regarding health and hygiene (occurrence of fecal contamination and waterborne disease)
- Pollution of the Tigithe river by cyanide from large scale mining activity (Barrick)
- Diffuse pollution of soils and streams (and related health risks) by use of mercury by small scale miners

Opportunities

- Important livestock at community level opening possibility for valorisation of animal dung
- Constitution of small scale miner associations and ongoing organisation of a small scale mining platform
- Valorisation of mine tailings discarded by small scale miners by medium-sized firms using cyanidation technic

Possible actions

- Preparation of Village Land Use Plans
- Development of hilltop tree planting and on-farm woodlots including agroforestry (fruit trees)
- Rainwater harvesting
- Control of gully erosion along and across the roads;
- Control of soil erosion and salinization in fields through adequate cultivation practices
- Monitoring of water quality and water pollution in relationship with human and cattle use
- Access to water and promotion of sanitation in Weigita village
- Selection and development of cash crops directed to the nearby tourism market, agreeing with hotels and lodges what are the repeated requirements they might satisfy, for example in water melon and other fruit, in accordance with soil capacity
- Support to women groups for traditional and non-traditional economic activities (orchard management, handicraft), and sustainable use of papyrus as source of IGA
- Development of campaigns and other actions towards invasive weeds control
- Propose solution to decrease or at least stabilise the consumption of fuel wood and charcoal, through promotion of better stove technology, development of alternative energy sources…
- Promotion of self-help capacity building groups, in the model of Farmers Field Schools (FFS), to facilitate the sharing of positive experience among farmers, first in a same area, then also with farmer groups of other villages or sub-basins
- Promotion of fish farming and in permanently inundated areas
- Promotion of sustainable mining practices (targeting small scale miners)

4. INTERVENTION STRATEGY

This chapter describes the implementation process as it has been planned, from the strategic view of activity packaging to the form intervention really respond to the main issues. Measures to ensure sustainability, spatial and time frame for the activities are also presented.

4.1. OVERALL STRATEGY

The intervention strategy for the integrated management of the watershed is based on the watershed characterization, sector assessment, identification and location of the major land degradation and assessment of the current capacities (in terms of human resources and means) of institutions and diverse stakeholders identified to be potentially involved in the project.

Although the MRB basin is facing a number of challenges, resource degradation in most cases is not irreversible and if timely actions are taken, degradation processes can be mitigated or even put to a standstill. Pollution can be controlled or even avoided. Options remain for both water and land resources development. Management of resources can be improved.

An integrated package of actions is required to rehabilitate and safeguard resources in the watershed and to provide sustained equitable access to these resources for its inhabitants. In addition, important trans-boundary hydrological/ecological services need to be ensured. Sustained access to water resources needs to imply respecting of downstream wetland management interests, both within the MRB basin and in downstream areas (Mara Wetland and Lake Victoria).

In other words, while using water to meet development needs, reduction of flows into Lake Victoria needs to be minimized.

Achievements to this regard will ultimately affect watershed conditions and hence improve development opportunities in the entire downstream areas in the Nile basin.

A guiding principle should be **conservation-based development**. It underlines that we want to go further than control of resource degradation, since the ultimate goal of investment is to achieve profitable development. Opportunities exist and are exploited to combine the two aspects of degradation control and development. These are most explicit in community-based resource management (CBRM), as to be practiced in catchment rehabilitation and in wetland management. In fact, the combination of resource productivity aspects (as the economic development component) and protection aspects (as the environmental component) is indispensable to motivate local communities to improve their livelihoods in a way that is more profitable to them and in the same time is providing better protection of the resource base.

The integrated package of required actions, together with the guiding principle of conservation-based development automatically lead to the overall objective formulated for the MR-MR-IWMP.

In background to all project activities is the intention to act in **support to local communities and existing groups**, which will be the actors in time to implement the Watershed Management actions. This is why they have been consulted during the project formulation process, with their recommendations and requests taken into account to the major possible extent. The sub-projects have been tailored for strengthening the farmers groups – under the names of Community Forest Associations, Community Forest User Groups, Farmer Field Schools, Wetlands Management Committees and any other Community Based Organization – and for implementation through them, particularly in rural areas.

The overall objective for the MR-IWMP is to:

> ***"Achieve equitable and sustained access to good quality water resources and to productive land resources for the variety of users, as drivers for sustainable development"***

The term integrated is used to emphasize the interrelationship of actions and the subsequent interaction of their results. Different actions could be taken in isolation, but the cumulative profitability will increase if other related actions are taken as well. The following examples are illustrative:

- The profitability of water development will be reduced if water quality cannot be put up to standard, and *vice versa*.
- Health risks due to poor sanitation undermine the capacity of people to engage in development activities.
- The profitability of increased water availability through water resource development will be higher if easy access to these new resources is also facilitated.

Actions to be taken considerably vary in character. At one end of the range are the straight-forward, easily quantifiable and well localized, engineering works, which can be implemented rapidly and will have direct results. Solid waste management and storm water drainage systems in main towns are in this category.

At the other end of the range, actions concern larger areas of uplands and wetlands or long stretches of river courses (catchment rehabilitation and wetland management). With increasing population and land pressure, treatment and management of these areas has grown far beyond the operational capacity of government agencies. Conservation on the basis of gazettement or protective regulation has become ineffective as enforcement is highly deficient.

The only alternative is to mobilize the massive human resources available within local communities for community-based resource management. Empowerment, project ownership and participatory planning are indispensable ingredients in this approach. These require a time consuming process of intensive communication, extension, training and community organization efforts as preparation to implementation. Commitment of communities to improved land husbandry has to be based on short term profitability. Subsistence farmers have a conservative attitude towards innovations. Their livelihood security is based on a short term survival strategy, and earlier experiences with innovations brought by "outsiders" have not always been positive. The implication of this will be that, contrarily to the above engineering works, it will take some time before tangible results of improved resource development can be observed. However, once results are tangible and appreciated by local communities, further dissemination will spread in an accelerated way. In addition, the stronger the basis of community organization and commitment, the greater sustainability of innovations will be achieved.

The varying character of actions to be taken implies a different approach and implementation strategy for each action. Similarly, different stakeholders will be consulted, sensitized and engaged, and different institutional arrangements will be required for each action. These will be specified for each individual activity and investment proposal.

4.1.1. Concept of integrated watershed management

The issue that needs to be addressed in any integrated Water Resource Management is that of integrating the needs of the people living within the river basin and the environmental needs of the

basin. This is complicated by the frequent conflict between private and public goods. In the Mara River for example we need to reduce deforestation which is leading to increased erosion, soil loss and turbidity of the river; it is clearly good, for both the environment and for everyone living along the river, to reduce the erosion with the consequent soil loss and water turbidity. So to reduce deforestation produces benefits for the general population along the river; this is a public good. For people living in the upper catchment with access to forested land it may well make good economic sense to plunder the forested area for wood and charcoal which can produce an income stream and leave them financially better off; this is a private good and it is perfectly rational for them to do this. They are putting their own economic welfare above that of the greater good. There is nothing odd in this; it is how a free market economy works.

It is the conflict between the public and private goods that is the cause of:

- Deforestation
- Soil erosion
- Pollution of the rivers
- Improper solid waste disposal
- Increased flash floods and landslides
- Loss of wetlands

Regulation of the activities of the population of the river basin and the production of planning documents that fail to recognize the dichotomy outlined above will not solve any of these problems. An integrated approach that identifies mutually desirable goals can be the only way forward. What needs to be addressed is how to improve the livelihoods of the people in a way that also leads to a more environmentally sustainable river basin. Regulation and planning can play a part in this but the individuals involved must see this in the context of improvement in their own welfare.

4.1.2. Agriculture, agroforestry, livelihood and management

In general terms, we are looking at a poor rural population of small farmers, many of whom eke out their on-farm income by fishing, collecting and selling firewood and raising some cattle and goats. Just feeding the family and providing basic needs is the most that the majority of them are able to achieve. One characteristic of small famers living barely above subsistence level is their aversion to risk. To engage in anything, such as trying a new crop or a way of farming they are unfamiliar with carries with it a perceived risk of failure with consequences that can be seen as devastating. This manifests itself within the project area as low yield farming and any increase in output being seen in terms of increasing the area under cultivation rather than an increase in productivity from the existing area of the land or a change of crops.

Experiences from Central Kenya, where there is evidence of high productivity, high profits, and good land management, indicate that poverty reduction, land degradation, and sustainable agriculture are intricately linked. Adoption of an ecosystem management, approach focusing on: participatory planning of land use and natural resources management at the village, local, district, watershed and county levels; empowerment of communities with proven technology, information and financial resources to make the best investment decisions; and dissemination of a good ecosystem management techniques (e.g. improved soil fertility, erosion control etc.,), are crucial to address problems of natural resource degradation and achieve sustainable farming systems.

Better farming practices also provide global environmental benefits. The “Land-use, Land-use change, Forestry Report (2000) of the Inter-governmental Panel on Climate Change (IPCC) has identified the conversion of degraded crop lands into agroforestry as the land-use practice with the largest potential

to sequestrate carbon. Improved practices united under the name of Sustainable Agriculture are also known to increase farmers' resilience to Climate Change.

4.2. MAIN ISSUES TO BE ADDRESSED

There are a number of problems that apply to the river basin. All these problems are, at least to a certain extent, interlinked, so that one specific problem can hardly be resolved or even properly addressed without facing other related issues. To give a clearer and conceptually better view to these problems, the following sections present the issues, as well as the corresponding proposed activities, sorted out into three basic action lines: actions towards environmental protection, actions towards livelihood improvement, and actions supporting better natural resources management process. Yet of course these three criteria are not independent from one another, and their "boundaries" are not explicitly marked: actions for environmental protection require an organisational and institutional support; livelihood improvement must be attained in the respect of environmental protection; monitoring social progress will involve livelihood status and management process… Even so, the sorting of all the main issues - and corresponding project activities - along the three criteria above appeared as the best solution to prepare for Integrated Natural Resources Management.

4.2.1. Environmental protection

Deforestation

One point that has an impact over most of the river basin is the use of wood for fuel and charcoal production. In this moment the largest source of energy for daily life is wood, either from forest areas or from isolated trees and shrubs, and the growing demand endangers the forest cover and biomass in general. The main response to this issue must be reversing the current trend by promoting afforestation of areas with limited agricultural potential (particularly where slope are marked) and agroforestry to combine planting of trees (for wood but also for fruit production) with other crops. This is the central action expected in the context of Integrated Watershed management, because of the combination of actions and outcomes involved.

Additional actions at other levels can also be recommended to moderate the deforestation process. An approach can be found through **alternative sources of energy**. A step forward here would be to **increased electricity coverage** from the 5 percent coverage at present to cover a far greater percentage of the people in the basin, through Kenya Power (KPLC) in Kenya and Rural Electrification Agency (REA) in Tanzania. Possible solutions may involve developing the mini-hydro potential of the basin particularly by the utilization of dams that are in existence but may well need rehabilitation. Installation of solar panels at household level may also bring alleviation of the pressure on wood. An additional approach, far easier to implement and indeed already supported by NGOs and other institutions, is to promote the use of fuel efficient stoves. This approach could also reduce the demand for wood and charcoal.

Land and natural resources degradation

Soil degradation in the MRB is linked to soil fertility depletion and soil erosion, long-term cultivation with diminishing fallow periods, limited crop rotation practices and low fertilizer inputs. This causes low soil stability and particles are easily transported during rain. Although farmers are aware of reduced soil fertility and its effects, their capacity to address the issues is limited, leading to poor yields.

Much of the MRB is considered to have good potential for agriculture, with medium elevations (1100 to 1600 m above sea level) having deep, well drained soils, and relatively high rainfall (1200 - 1800 mm per year) that permits two cropping seasons in some parts. Currently, crop productivity is very low with typical output from a 'good' rainy season being less than 1 ton of maize per hectare, although the potential is as high as 5 to 6 tons.

As is the case with soil fertility deterioration, soil erosion occurs everywhere in the MRB basin, even in undulating terrains. Soils on steeper upper slopes have been cultivated for long without adequate soil conservation measures and clean weeding farming practices. As a result the soil structure within the upper slopes is more deteriorated leading to more soil erosion than elsewhere in the basin.

Water quality degradation and increase of sedimentation

The water quality in the MRB is affected by deforestation, intense cultivation (with increasing removal of vegetation cover and soil loss), cultivation of riverbanks, poor solid waste management, over-exploitation of biomass, high population density and growth rates, poor sanitation, land fragmentation, water pollution (surface water and groundwater), flooding, extraction of sand for construction, settlement (particularly along the river flood plains) and urban development. In towns located along the rivers and not provided with sewerage system, the streams are affected by effluents from garages, overflowing pit latrines and wastewater from hotels.

As a consequence of the above pollution sources, the common water quality problems with the MRB Rivers are poor colour, high turbidity and silt load, and high faecal coliform content.

Waste disposal, storm water drainage and wastewater treatment

Solid and human waste disposal polluting the rivers can be divided into two parts: Point and non point source pollution which emanates from waste from urban areas and waste from agricultural farms. Dealing with urban waste is most easily dealt with and is largely an issue of securing finances for management of the sewerage and waste disposal. Nothing in urban waste disposal is inherently complex nor does it require much selling to the targeted population. The one thing that particularly requires more effort is storm water drainage and wastewater treatment.

Pool Rural Sanitation

Within the rural areas especially in lower Tigithe, populations are concentrated along waterlogged prone areas. Construction of pit latrines is a challenge and open defecation is still practised, causing faecal coliform pollution in the watercourses. The impact of such practices has not been severe during long times, but with the increasing demographic pressure caused by population density growth throughout the basin, combined with the decrease of the vegetal cover to process the organic load, the problem is turning into a serious concern. It should not require too much effort to implement a WATSAN project with the obvious benefit to both decreased waterborne diseases and health of the communities involved.

All of the above involves commitment of resources. If people sense that there is a real interest in their welfare, if sub projects are identified that improve welfare and health and increase income through lower medical expense and lower number of sick person-days, and then implemented with community participation; then areas that require attention but which have benefits outside of the community might be able to attract attention and support.

Climate Change

Integrated ecosystem management approaches will draw on agroforestry and other land management techniques that also deliver benefits in the area of carbon sequestration. The PCC estimates of carbon accumulation rates range from 2 to 9 MT/ha/year, depending on the climate and the nature of the agroforestry practice. Although an important factor in reducing global levels o f Greenhouse Gases (GHG), the potential for carbon sequestration is generally ignored at national and local levels in developing countries. Project activities incorporating carbon benefits have the potential to link global climate change priorities to local initiatives. Diversification of crops and sources of income also increase the farmers' resilience to climate change.

4.2.2. Income and welfare

The project is rated as a poverty alleviation project, so the first issue is one of income; if we are to deal with the issues of natural resources management it has to be in the context of raising individual income and welfare. It is the actions of the people within the basin which are the primary cause of the issues to be addressed. Desirable changes can come about only if individuals see it as being of direct benefit to them. Any argument about "the greater good" is unlikely to lead to change in behaviour.

The solution to the issue of low output levels from smallholder farming leading to encroachment of ever expanding areas of land must be to shift from extensive **low yield farming** to intensive higher yield farming so the farmer is able to increase the on-farm income without expanding the area of land farmed. In addition, other **sources of income** will need to be identified.

4.2.3. Watershed management

Sharing knowledge

Some knowledge gaps remain, especially in relation to water resources management: These would be alleviated by extension of the water monitoring network.

Action coordination

As explained above, the proposed MR-IWMP will not be unique responsible for all actions actually required in the basin. This is because other parties are already following up prevailing issues. It is stressed again that most actions are interlinked. Omission of certain actions may reduce the profitability of others. Similarly, delayed results in one action may hamper planning of other actions. It is referred to the example of an improved water monitoring network and data base preparation, results of which are needed for planning of water resource management actions, e.g. by WRUAs in sub-catchment management planning.

These constraints can probably be minimized if the same PMU follows up on implementation of awarded investment proposals and can assist in harmonized timing of implementations.

Legal and regulatory framework

The MR-IWMP will be confronted with a few constraints, described in the stakeholder analysis. Both participating countries have shown general preparedness to cooperate in trans-boundary issues. However, implementation activities on the ground touching contiguous areas on either side of the border may be hampered by incompatibility in regulations or incompatibility in directives through national level projects. People being stopped from environmentally damaging activities on one side of the border may move to the other side and cause damage there if regulations are less severe.

If legislation is difficult to change in a short term, the MR-IWMP project could assist in formulating local bye-laws to achieve compatibility in regulations.

Definition of wetland areas

Delineation of wetland units has an intrinsic constraint. Determination of wetland types and their extent is bound to be tentative. A significant proportion of wetlands are classified as seasonal. Under the peculiarities of the climatic regime their seasonality is irregular. Besides, due to long term encroachment, the natural status of wetlands is uncertain. A wetland rehabilitation option would often pose problems, because ecologically it is not clear what it is to rehabilitate. In addition, most gross area estimates of wetlands in both Kenya and Tanzania are based on aerial surveys done for

topographical maps. The extent of such wetter areas in these maps is often sociologically defined by a local community customary usage rather than by clear ecological features.

For the purpose of this study, delineation of wetlands is done as a compromise between the units shown on the topographic maps, and those identified from Google Earth™ imagery.

Additional sub-sectors

Despite efforts to comprehensively address all watershed issues in the MRB, a few sub-sectors remain for which more complete measures are still expected. They can be given a place within the current program, or be developed separately. These are related mainly to water sanitation and rural water supply, groundwater development and hydropower.

Water supply and sanitation are key development indicators, and are among the highest Government priorities in both countries, with good budgetary allocations. Yet as of now their coverage is still unsatisfactory in the basin, in particular in rural areas and more so in Tanzania than in Kenya. Poor sanitation conditions are one of the two main non-point sources of pollution and would deserve much more attention than feasible with the limited time for the study and available specializations in the study team. Inadequate efforts to this regard will jeopardize results of other activities of water pollution control..

Programmes are being implemented for development of groundwater through spring protection and drilling of shallow and deep wells. Part of the shallow groundwater resources is easily threatened by pollution from the common non-point sources of chemical pollution (agricultural chemicals, cattle keeping and poor sanitation); deeper ground water reportedly is of good quality in most cases. It appears that the role of groundwater in the overall hydrological system is neither well known nor quantified, which limits their sustainable development in areas in which such possibilities may exist. Additional studies on productivity of ground water resources would help in improving water balance, e.g. for the purpose of water supply development, or with regard to the potential for groundwater recharge, with the different alternative techniques collected under the general name of Rain Water Harvesting.

4.3. SUSTAINABILITY OF ACHIEVEMENTS

The present proposals are formulated for a limited period of time, i.e. for a first phase of 5 years. It should be noted that activities under the Watershed Management Project (project investment 1) and the Sustainable Wetland Management Project (project investment 2) would have to continue for much longer periods in order to have a noticeable and sustainable impact on the watershed conditions. An agreement in principle from donors on possible longer-term commitments is more or less a prerequisite for successful implementation.

The first phase implementations in Watershed Management and Wetland Management are expected to produce noticeable impact at local level, but this will be an impact in a limited area of the MRB only, and will not be sufficient to fully achieve the IWM objectives. Implementation in the first phase, with the established institutional network and operational momentum, will act as a lever for up-scaling during following phases. On the contrary, given the magnitude of the problem of degrading resources in the MRB as a whole, termination of implementation after the first phase, would very likely have repercussions on stakeholders motivation to carry on without external support in remaining priority areas. In that case, impact in the MRB as a whole will not be satisfactory.

The Watershed Management Project and Wetland Management Project are therefore proposed as a long term project (15-20 years) with a first phase of five years. The focus of a second and third phase would be on further up scaling of implementations and thus impact on overall environmental conditions. Detailed contents of second and third phases should be based on lessons learned from the success and failure experienced in the first phase, building on the results of the project Monitoring and Evaluation.

Maintenance of on-site implementations and their impacts on resource conservation would be taken care of by the farmers as increased productivity is, first of all, in their interest.

The Sanitation projects provide for operation and maintenance, in the short, medium and long term. They include recommendations for maintenance responsibilities. These will still have to be materialized by the Town/County Councils.

4.4. SCOPE OF THE PROJECT PROPOSAL

The MR-IWMP project proposal is composed as an integrated package of 4 complementary sector projects and 11 sub-projects targeting a specific sector of intervention in the watershed, as shown on Figure 9 below.

Figure 10: Packaging of complementary sector projects for MR-IWMP

Each and every project or sub-project is considered under a triple focus, which aims at realising the objectives:

- A focus on the **Environmental Conservation** of the watershed and wetlands, which is a major long-term concern addressed by the programmes for the Nile Basin in general;
- A focus on **Income Generation**, to address the immediate needs of the inhabitants and also to ensure their participation in the conservation process;
- A focus on **Institutional Strengthening**, including creation and operation of local organisations, capacity building, care of social stability and gender issues, to increase the chances of sustainability of the efforts in conservation and livelihood improvement.

Additional cross-cutting projects are presented for funding. These are catering for watershed management actions (studies, fund allocation) deemed necessary for the achievement of specific objectives for the entire MR- IWMP.

Past or current on-going projects are occurring in the watershed and the MR-IWMP has to be implemented in coordination and complementarity with them to ensure a fluent continuity vis-à-vis community involvement.

4.5. LOCATION OF IMPLEMENTATION AREAS

To best meet the objectives and expected results of the MR-IWMP, the different types of activities are proposed adapted for diverse targeted watershed zones of common characteristics and constraints, as presented in Table 11 below.

Nevertheless during execution, the sub-projects and related activities will be proposed to communities within the priority areas for project implementation. According to the specific issues to address in their environment, communities will be interested by corresponding sub-projects and the repartition of activities will be moving according to their choice.

Cross-cutting activities will be implemented separately.

Table 11: Summary of activities, issues and outcomes/outputs

Activity	Main issues addressed	Main outcomes/outputs	Investment proposal	Targeted zones
Afforestation	Deforestation, land degradation, erosion and loss of fertile soil Changes in the flow pattern, Local climate change	Village-nurseries Creation of woodlots Afforestation on steep slopes (hills)	**Sub-project 1A**	Upper basin Isolated hill tops Small woodlots
Agro-forestry development	Deforestation, soil fertility, income generation and diversification of livelihoods, community health	Village nurseries Orchards, plantation of fruit-trees and leguminous on farmland	**Sub-projects 1B, 1C, 2A**	Scattered through the basin, including near wetlands
Soil and water conservation	Erosion, land degradation, loss of fertile soil, decrease of farm land productivity and related income, Sediment load and silting in the watercourses, flooding and expansion of the Mara Wetland,	Introduction soil stabilization technics	**Sub-projects 1B**	Steep slopes where common effort is required to tackle erosion
Farming practices improvement	Decrease of farm land productivity and income Sediment load and silting in the watercourses, flooding and expansion of the Mara Wetland,	Introduction of Sustainable agriculture practices through FFS Creation of cooperatives	**Sub-projects 1C**	Medium and gentle slopes, by individual farmers action
Livestock improvement	Overgrazing Livestock low productivity	Improvement of breeds Enforcement of veterinary support	**Cross-cutting activity 4C**	South Narok and Serengeti
Riverbank protection and rehabilitation	Loss of biodiversity Sediment load and silting in the watercourses, flooding and expansion of the Mara Wetland	Enforcement/application of law Rehabilitation of riverbanks (pilot plots) Creation of trough for cattle	**Sub-projects 1D**	Scattered through the basin
Spring protection	Loss of biodiversity Availability and quality of water	Spring location and fencing Creation of community roughs and fountains	**Sub-projects 1D**	Local spring areas, mostly in upper basin
Wetland protection and sustainable management	Wetland conservation	Village land use mapping Wetland village units management plans	**Sub-projects 2A**	Mara wetland complex

Integrated aqua-farming development	Income generation and diversification of livelihoods, improvement of food security	Introduction of integrated aqua-farming units (cash-crops and subsistence crops, fruit trees, fish ponds, fodder production through FFS Creation of cooperatives	**Sub-projects 2A**	Buffer zone around Mara wetland
Development of and milk based products	Income generation and diversification of livelihoods, improvement of food security	Introduction of new practices for processing milk-based products through FFS, Creation of cooling centers& cooperatives	**Sub-projects 2A**	Amala and Nyangores, and Somoche
Valorization of wetland biomass	Wetland degradation, Income generation , diversification of livelihoods, Deforestation	Introduction of new tools (briquette press) and development of briquette-making units	**Sub-projects 2A**	Communities near the Mara wetland
Development of eco-tourism around wetland	Income generation and diversification of livelihoods	Building partnerships with tour operator for village scale eco-tour for bird watching, wetland discovering, fishing… Creation of infrastructures (pontoons, villager accommodation…	**Sub-projects 2A**	Communities near the Mara wetland
Pilot projects for sanitation	ater quality , hygiene	Awareness campaigns Creation of public toilet-blocks and taps Support of DEWATS dissemination	**Sub-projects 3A**	Bomet, Mulot, Nyangoto, Kewanja, Weigita
Pilot projects for waste management	ater quality, hygiene,	Awareness campaigns Organization of collection, transport and dumping of wastes	**Sub-projects 3B**	Bomet, Mulot, Nyangoto, Kewanja
Promotion of cleaner and more safety AS mining practices	Water pollution, fauna contamination, soil pollution Community Health and safety	Awareness campaigns Dissemination of new tools (….)	**Sub-projects 3C**	Lower Tigithe
Market research and labeling for Mara	Income generation and diversification of livelihoods	Identification of accessible markets for MR existing and new products	Cross-cutting activity 4B	Whole basin

Watershed products		Feasibility study and initiation of MR products labelisaton		
Dissemination of alternative energy technology	Deforestation, land degradation Welfare improvement	Dissemination of new technology	**Cross-cutting activity 4A**	Whole basin

4.6. PLANNING HORIZONS

The first implementation phase for investments, object of the current study, will have duration of 5 years. Proposed costs estimates and further breakdown concern only this first investment phase.

Following phases of implementation are also suggested, for which cost estimates have not yet been made, showing that

- the sector sub-project related top agricultural practices would require the longest total input to have full impact on watershed conditions, probably 20 years,
- Water and soil conservation and Wetland Management activities would reach full results with a total investment period of 10-15 years,

Implementation of the physical infrastructure part of the sanitation pilot projects in rural areas can be effectuated in a short time frame; putting into practice the related maintenance procedures would require about two years.

The sanitation pilot project in Bomet and preparation of the final plan requires more detailed topographic and geotechnical surveys. Surveys and final planning can both be undertaken shortly, after which the plan and related maintenance procedures can be implemented.

The Solid Waste Management pilot projects provides for implementation and maintenance during the first five years.

The duration of eventual implementation is tentatively indicated for cross-cutting activities, but cost estimates depend on findings of these activities.

For the purpose of financial or economic analysis, the benefits will be considered over a period of 20 years compared to the 5 years investment period. If further investments are realized, the additional or marginal benefits will need to be considered separately.

5. INSTITUTIONAL SETUP AND ARRANGEMENTS

This chapter presents successively an indicative future role of main stakeholders in the sub-projects design and implementation (stakeholder involvement) and then a proposed option for institutional arrangement.

With its specific characteristics of being transboundary, the Mara River Watershed project needs to fit in an institutional set-up that can guarantee at the same time a high quality of coordination among the partner countries, and a good level of independence for each of them in their operation and timing, to harmonize regional, national and local objectives and priorities. Another relevant aspect of the institutional set-up is the intention, from both governments, to support decentralization and local level decision-making.

The sensitivity of the balance between authority of national institutions (Ministries in first place) and strong coordination ensuring transboundary decisions leads the Consultant to propose a solution to deal with objectives and constraints.

The selected option, prioritizing transboundary cooperation for implementation and integrating the governmental agencies in the mechanism, is focused on effectiveness of implementation at the district/sub-county and lower local levels; the intention is to avoid possible delays due to heavy bureaucratic process through the full scale of administration in each country.

The proposed mechanism is strongly based on the existing frame of stakeholder's organizations.

5.1. STAKEHOLDERS INVOLVMENT

The proposal for project institutional organization is based on a participative identification of main stakeholders to be involved in the investment program by sub-projects.

Stakeholders analysis has been made first by NIRAS during baseline studies. Findings are summarized in the annex 2 of the thematic report (December 2011) dedicated to Institutional setting.

Identification of the main stakeholders involved in the MR-IWMP was then made during workshops with technical officers from the two countries in November 2012. Stakeholders are ranked in 3 categories as presented in the tables here-after: main agency responsible for the overall sub-project development (category 1), other agencies involved in project design and eventually M&E (category 2), and potential partners like research institutes or on-going projects programs (category 3).

Projects being mainly composed with community based activities, CBOs and other associations, as important target group, are systematically mentioned as main stakeholders.

Mention of stakeholders in that table is indicative only and designation should be revised during the executive design phase of projects and sub-projects.

Table 12: Indicative involvement of main stakeholders in MR-IWMP

PROJECT/SUB-PROJECT	MAIN ACTIVITIES	MAIN STAKEHOLDERS KENYA			MAIN STAKEHOLDERS TANZANIA		
		1 Overall develop.	2 Design M&O	3 Potential partner	1 Overall develop.	2 DesignM&O	3 Potential partner
1A. Afforestation	Campaign for communities to plant multipurpose trees (mixing indigenous and fast-growing exogenous species) in communal or private woodlots, hilltops, schools and along roadsides Support to development of private or community tree nurseries Technical assistance to farmer groups to apply forestry practices within their land, improvement of organizational capacities, seeds/seedlings supply Access to revolving funds for farmer's investments on private lands *Implementation*	KFS WRUAs, CBOs CFUs,	MoA NEMA WRMA	ENSDA KEFRI ICRAF KWS WWF	MNRT WUAs CBOs		TAFORI TFSA SUA IRA Vi Agroforestry
1B. Soil & water conservation	Identification of targeted sites; creation of soil & water conservation committees with related land owners; Promotion of biological erosion control measures; Technical assistance to S&W Conservation committees to apply rehabilitation technics (civil works and biological technics) Design and implementation of pilot operations projects (civil works, biological technics, reforestation, organization for maintenance) Access to revolving funds for farmer's investments on private lands Capacity strengthening (extension staff/NGOs) and planning tools for communities *Implementation*	MoA WRUAs CBOs CFUs,	NEMA WRMA MLD	KARI KEFRI	MAFC WUAs WUAs CBOs	MW	UA

PROJECT/SUB-PROJECT	MAIN ACTIVITIES	MAIN STAKEHOLDERS KENYA			MAIN STAKEHOLDERS TANZANIA		
		1 Overall develop.	2 Design M&O	3 Potential partner	1 Overall develop.	2 DesignM&O	3 Potential partner
1C. Promotion of sustainable agriculture	Promotion of conservation agriculture practices, capacity strengthening (extension staff/NGOs), implementation of FFS Support to artisanal manufacturers and suppliers for tools, machinery and seeds Access to revolving funds for new investments (practices, tools) *Implementation*	MoA CBO, WRUAs WRUAs CBOs	WRMA MoLD MoFD	ICRAF ICIPE KARI ILRI	MAFC WUAs CBOs		SUA UKIRIGURU RI MABIKI TAFIRI
1D. Riverbank & Spring protection	Promotion of riverbanks and springs protection (existing laws and regulations, promotion of new practices including reforestation with multipurpose trees); Development of community nurseries Design and implementation of pilot rehabilitation/protection projects (civil works, biological technics, reforestation, organization for maintenance) Access to revolving funds for new investments *Implementation*	WRMA WRUAs CBOs CFAs,	NEMA	KFS KEFRI	MoW WUAs CBOs	LGAs MNRT MLDF	Vi Agroforestry

PROJECT/SUB-PROJECT	MAIN ACTIVITIES	MAIN STAKEHOLDERS KENYA			MAIN STAKEHOLDERS TANZANIA		
		1 Overall develop.	2 Design M&O	3 Potential partner	1 Overall develop.	2 DesignM&O	3 Potential partner
2A. Sustainable wetlands management	Promotion of wetland's ecological conservation and community driven sustainable management (wetland management plans) through wetland village unit committees GIS development for wetland demarcation and land use mapping Invasive species eradication Promotion of improved land farming practices like integrated aqua-farming through implementation of FFS Promotion and technical assistance for IGAs development (Agroforestry, fishery, bee keeping, dairy products, papyrus briquettes and other aquatic plants based products…) Promotion and technical assistance for the development of eco-tourism projects Access to revolving funds for new investments (practices, tools) *Implementation*	NEMA WRUAs CBOs	MoA MoLD MoFD KWS	ENSDA KARI KEFRI ICIPE KDB	MoW WUAs CBOs	MNRT MLFD MAFC ML LGAs	ARU RRB NLRI TAFIRI MATIU
3A. Water supply and sanitation	Design and implementation of pilot sanitation projects in urban/semi-urban areas and in rural areas Promotion of simplified condominial DEWATS and individual latrines or ecotoilets Access to revolving funds for new investments *Implementation*	Municipal and/or County councils WRUAs CBOs	NEMA MoPH	Care int. USAID LVEMP	MoHSW WUAs CBOs	LGAs MoW	Care int. WaterAid LVEMP
3B. Solid waste Management	Design and implementation of pilot projects including dump site Technical and financial support to communities for primary collect organisation and waste segregation and collection points management Promotion and support to recycling activities Access to revolving funds for new investments *Implementation*	Municipal and/or County councils WRUAs CBOs	NEMA MoPH	LVEMP	VPO Environment WUAs CBOs	LGAs	LVEMP

PROJECT/SUB-PROJECT	MAIN ACTIVITIES	MAIN STAKEHOLDERS KENYA			MAIN STAKEHOLDERS TANZANIA		
		1 Overall develop.	2 Design M&O	3 Potential partner	1 Overall develop.	2 DesignM&O	3 Potential partner
3C. Alternative AS Mining practices	Awareness campaign for ASM communities on field Dissemination of new practices and tools for cleaner techniques and reduction of Hg exposure Support to artisanal manufacturers and suppliers for new tools and machinery Organization of processing centers equipped with cleaner techniques Access to revolving funds for ASM for investment in improved techniques and equipment *Implementation*	-	-	-	MoEM WUAs CBOs	Resident Mine Office NEMC MoHSW	STAMICO LVEMP GMP TMAA GAP
4A. Energy saving alternative energy technology	Promotion of improved stoves (Jikos), biomass briquettes and biogas digesters Access to revolving funds for new investments *Implementation*	MoA WRUAs CBOs	MoE MoLD	KIRDI ENSDA KENFAP	MoCD WUAs CBOs	LGAs MNRT MoEM	SIDO
4B. Market research & development of MR label	Market research for local products (e.g. for touristic infrastructures) Identification of products candidate for labeling Steps to establish a PDO /PGI • *Implementation*	MoA WRUAs CBOs		GIZ	MoCD WUAs CBOs		
4C. Livestock improvement	Baseline survey of livestock situation in the MRB and identification of expected improvements Selection of new breeds and implementation of breeding center(s) Support to development of veterinarian services (government extension services or private services) *Implementation*	MoLD WRUAs CBOs	MoA	KARI ILRI	MoLFD WUAs CBOs	MoAFC	NAIC NLRI

5.2. PROPOSED OPTION FOR Institutional Setup

The general scheme for the proposed institutional arrangement is presented in Figure 8 and described here-after for the different levels from regional level to community level and for transboundary coordination.

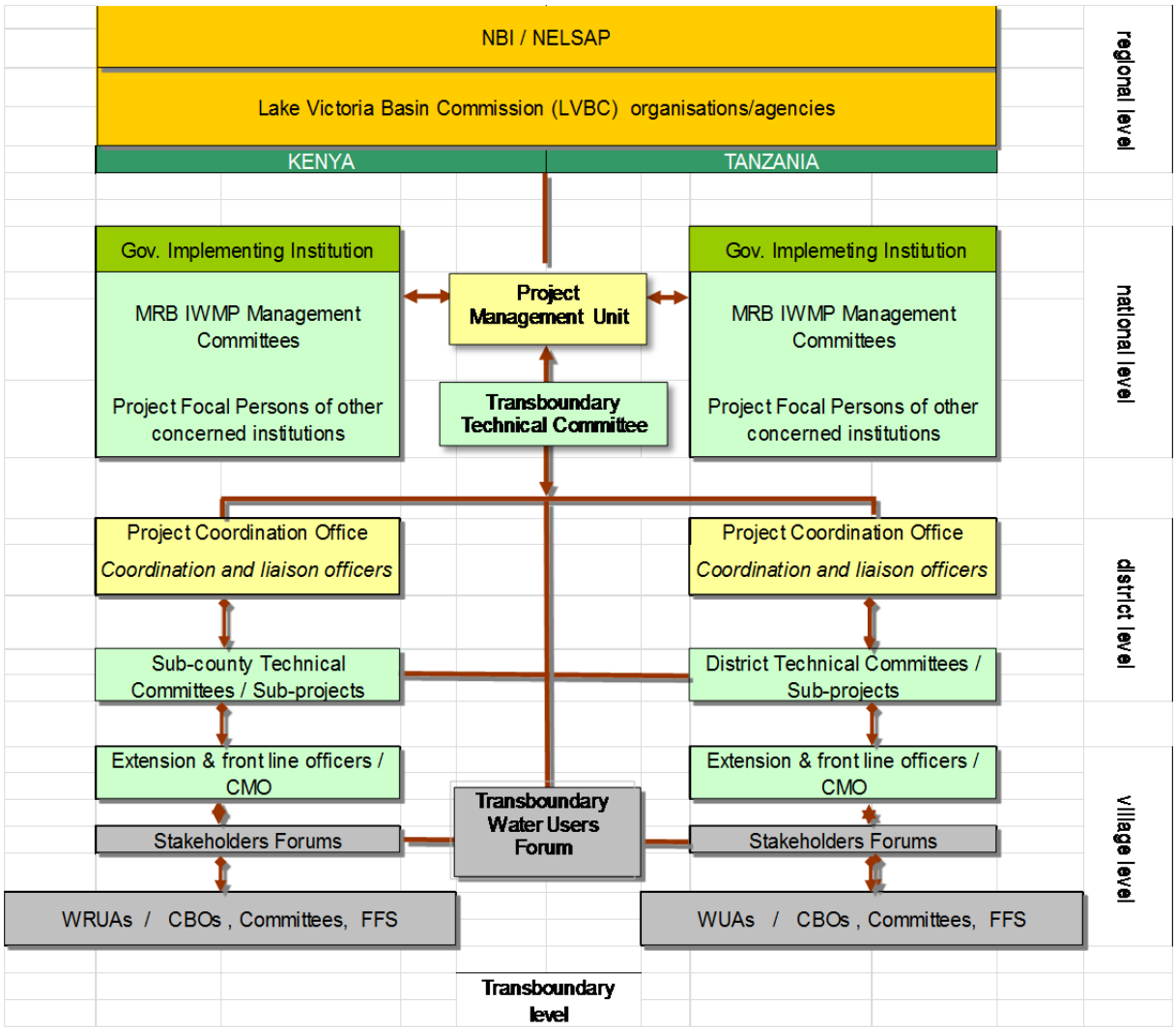


Figure 11: Proposed Option for Project Organization

5.2.1. Regional framework

NELSAP has developed a Resource Mobilization Framework which defines mechanisms that will enable NELSAP to secure sustained access to adequate resources necessary for implementing approved investments in fulfillment of the Nile Basin Initiative's shared vision.

The EAC established the lake Victoria Basin Commission (LVBC) as a mechanism for coordinating the various interventions on the lake and its basin and serving as a centre for promotion of investments and information sharing among the various stakeholders.The Mission of the Lake Victoria Basin Commission is to promote, facilitate and coordinate activities of different actors towards sustainable development and poverty eradication of the Lake Victoria Basin.

Therefore, LVBC together with NBI/NELSAP will play a very crucial role in providing the overall regional framework under which the proposed investment programs will be implemented.

5.2.2. Governmental project implementing

5.2.2.1. IMPLEMENTING INSTITUTION

On the Kenyan side, the Mara River Basin is part of Lake Victoria South Catchment Area (LVSCA). Therefore, the Catchment Area Advisory Committee for the LVSCA will play a key advisory role in all project activities related to conservation, use, and allocation of water resources in the basin.

The Water Resources Management Authority (WRMA) is responsible for the sustainable management of the country's water resources. Therefore, WRMA will be the lead agency in the implementation of all water resources management project activities in the Kenyan part of the basin. WRMA is also coordinating and assisting in creation of Water Resources Users Associations (WRUAs) for decentralized water resource management. A very active WRUAs Board with 3 major sub-catchments and 33 sub-catchments group committees has been established along the Kenyan Mara River.

Hence, at the local level, these WRUAs will play a major role in all project activities related to the management and utilization of the water resources within their localities. The WRUAs will also serve as fora for resolution of conflicts arising from competing water uses in their localities.

In Tanzania, the Lake Victoria Basin Water Office (LVBWO) under the Ministry of Water will play the lead role in the implementation of all water resources management project activities in the Tanzanian part of the basin. Water Users Associations (WUAs) have been formed in Tanzanian part of the basin, equivalent to WRUAs in Kenya. There are currently 14 WUAs formed by WWF program.

Since **WRMA-LVSCA** (Kenya) and **MoW-LVBWO** (Tanzania) are responsible for core tasks in water resource management, it is quite logical that these institutions also take the lead in planning and coordinating MR-IWMP activities in their part of the Mara River Basin. They will be the **implementing institutions.**

5.2.2.2. COOPERATION WITH OTHER SECTORAL MINISTRIES AND INSTITUTIONS

WRMA-LVSCA (Kenya) and MoW-LVBWO (Tanzania) as implementing institutions for the MR-IWMP are leading a **MR-IWMP Management Committee** gathering the different Ministries or other Institutions involved in the Project Implementation. For example other Ministries like Ministries of environment, agriculture, livestock or fishery development, energy and mines, public health, tourism…) or Institutions concerned by the project like research institutes in forestry, agriculture, livestock….

One Project focal person will be designed in these partner Ministries/Institutions for representation in the Committee.

Role and responsibilities of such Committee will be declined through **Memoranda of Understanding** (**MoU**) in each country.

5.2.3. Delegation of technical and financial executive management at transboundary level

The project implementation is delegated to a specific **Project Management Unit (PMU)** responsible for the technical and financial executive management of the projects and sub-projects.

The PMU will ensure the **planning, implementation and monitoring** of the activities.

The PMU will be led by a Project Coordinator, assisted by a financial manager, a GIS specialist, a M&E specialist and necessary support staff.

For technical issues or specific projects to be carried out, the MR-IWMP PMU will call upon technical officers from the sector concerned, to form a **Transboundary Technical Committee**.

For example:

- for water resource issues, technical officers will come from WRMA and the LVBWO concerned
- for watershed management, they will come from MoA/MoAFC, NEMA/NEMC and KFS/MNRT
- for sanitation or solid waste management, these will be engineers from the Municipal Councils concerned or technical officers from MoPH
- …

In this same level, a specific place will be given to NGOs working at regional level and international institutions active on both partner countries in the basin, like the WWF.

5.2.4. Project coordination offices at District / Sub-county level

Settled in the project area, two coordination offices in charge of liaising with MR-IWMP PMU will be hosted respectively by LVSCA of WRMA in Kenya and the LVBWO in Tanzania ensuring the District / District council coordination of activities in the Watershed. Recommended locations may be Bomet or Mulot in Kenya and Musoma in Tanzania.

The staff will be composed with a compact team of sectoral coordination officers (based in one national office) working closely with liaison officers (based in the other national office).

These two project coordination offices will ensure the required level of coordination and harmonization of interventions in the area and with all the representatives of the governmental line agencies gathered in a district**/subwatershed technical committee**, assuring the needed coordination and harmonization of interventions on field, in liaison with extension and front-line officers.

Particular attention will be given to involve existing committees in the capacity building and implementation process. This will prevent overlapping of responsibilities and lack of interest from currently active groups. In addition, this step will involve LGAs and help create sense of ownership.

In the same line, the Community Mobilization Officers would be favorably chosen among staff of ONGs or organizations already active in the sub-project sector, reinforcing the creation of synergies between programmes and projects.

They will have the general role of pushing forward the Integrated Program rationale in the middle of the many community-level project activities.

This organization os tentatively represented in Figure 10 below.

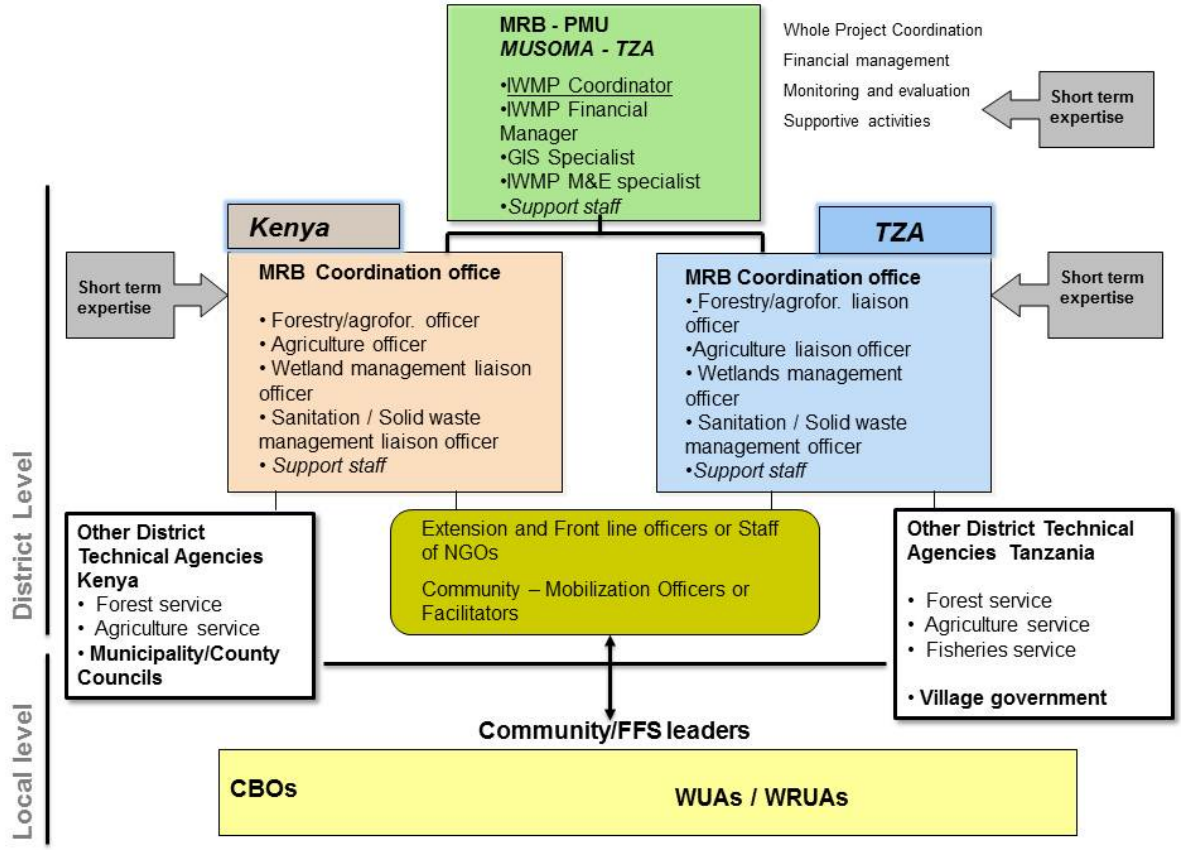


Figure 12: Tentative organization for the Project management

5.2.5. Knowledge transfer and project implementation at Community level

5.2.5.1. CONSTITUTION OF ADEQUATE CBOS

Depending on the projects, the approach for implementation of the projects through communities will be different. The main objective is to involve communities and generally local stakeholders in the decision process, planning, implementation on field and monitoring. Therefore we propose different specific mechanisms adapted to project or sub-project as described below. Nevertheless and as often as possible, the existing CBOs will be mobilized for project implementation on field.

- **For Village Land Use Plan:** participative approach at the scale of the village through constitution of **Village committees** including representatives of all interests with gender representation (women, young people…)
- For sustainable agriculture practices component and agroforestry mainly implemented on private plots the concept of **Farmer Field Schools** (FFS) will be preferentially applied.

- For reforestation activities, intervention will be implemented directly with already existing, or newly created for the Project, **Community Forest Associations** (CFAs) or **Community Forest Users Groups** (CFUGs).
- **For soil & water conservation** concerning several owners and communal lands, activities could be proposed to a "**Soil & Water Conservation Committee"** composed with stakeholders concerned by a specific degraded areas (under WUAs/WRUAs)
- For wetlands management, the creation of a sound local institutional structure called "**Wetland Village Unit Committees" (**WVUCs) is proposed for implementation and subsequent management and maintenance of newly created assets. Those Groups or Committees will be composed of representatives of the main stakeholders and resource users and charged with management of wetland management units of about 25-30 km². The use of FFS for introduction of new integrated aqua-farming practices will be supported.
- **For Miners:** already existing or newly created **Miners associations**
- **For sanitation and waste management** creation of **Committees** for O&M of sanitation structures and for waste management

5.2.5.2. FARMER FIELD SCHOOLS (FFS)

FFS is described as a platform or 'School without walls' for improving decision making capacity of farming communities and stimulating local innovation mainly for sustainable agriculture, but that can be applied to any other activity proposed by the IWMP like soil conservation and erosion control, wetland management, afforestation.

It is a participatory approach to extension, whereby farmers are given opportunity to make a choice in the methods of production through discovery based approach.

A Field School is a Group Extension Method based on adult education methods. It is a "school without walls" that teaches basic agro-ecology and management skills that make farmers experts in their own farms.

It is composed of groups of farmers who meet regularly during the course of the growing seasons to experiment as a group with new production options. Typically FFS groups have 25-30 farmers. After the training period, farmers continue to meet and exchange information, with less contact with extensionist.

FFS aims to increase the capacity of groups of farmers to test new technologies in their own fields, assess results and their relevance to their particular circumstances, and interact on a more demand driven basis with the researchers and extensionists looking to these for help where they are unable to solve a specific problem amongst themselves.

In summary therefore a Farmer Field School (FFS) is a forum where farmers and trainers debate observations, apply their previous experiences and present new information from outside the community. The results of the meetings are management decisions on what action to take. Thus FFS as an extension methodology is a dynamic process that is practiced and controlled by the farmers to transform their observations to create a more scientific understanding of the crop / livestock agro-ecosystem. A field school therefore is a process and not a goal.

FFS also contribute to the following objective;

1. Shorten the time it takes to get research results from the stations to adoption in farmers' field by involving farmer's experimentation early in the technology development process.

2. Enhance the capacity of extension staff, working in collaboration with researchers, to serve as facilitators of farmers' experiential learning. Rather than prescribing blanket recommendation that cover a wide geographic area but may not be relevant to all farms within it, the methods train extensionist and researchers to work with farmers in testing, assessing and adapting a variety of options within their specific local conditions.

3. Increase the expertise of farmers to make informed decisions on what works best for them, based on their own observations of experimental plots in their Field schools and to explain their reasoning. No matter how good the researchers and extensions, recommendations must be tailored and adapted to local conditions, for which local expertise and involvement is required that only farmers themselves can supply.

4. Establish coherent farmer groups that facilitate the work of research and extension workers, providing the demand of a demand driven system.

5.2.5.3. LOCAL LEVEL AND TRANSBOUNDARY STAKEHOLDERS FORUM

The **Mara River Transboundary Water Users Forum** is a voluntary body, which was formed as a platform to dialogue and spearhead the transboundary water resources management initiative. It was first convened by WWF and LVBC in 2008.

The Forum has developed a constitution, pursued official recognition by the LVBC and developed a work plan to guide efforts in the basin. However, there is no legal framework in Tanzania that supports the institution.

Existence of this Stakeholder Forum will be used as an opportunity to allow participation of stakeholders in the decision making process, at the level of both the Mara River basin, as well as in districts and local level where a number of IWM interventions are foreseen.

Sector related stakeholder forums are organized at district/division level for ongoing activities and upcoming issues. Technical Management Committees as well as Stakeholder Forums are foreseen at Sub-catchment level. NBI has supported the creation of Nile Basin Discourse Forums at national and regional level to provide a platform where opinions of the broader public can be brought forward.

Stakeholder's interests would be respected at different levels. A rather favorable practice of stakeholder involvement in planning activities has already been established in both partner countries through Kenyan WRUAs or Tanzanian WUAs and a number of other Community Based Organizations.

The project will build on the existing frame of stakeholders and community organizations to implement the project at the local level.

Because of the multitude of activities to be deployed under MR-IWMP, it would be good to have Watershed Management Stakeholder Forums in both partner countries, both at the level of the MR sub-basin, as well as in districts where a number of IWM interventions are foreseen.

5.2.6. Support of Short term expertise

In some cases, preliminary studies, design of projects or identification of mechanisms to carry out activities would have to be supported by specialized short term expertise.

Such technical support will be undertaken through the mobilization of international and/or national consultancy.

5.2.7. Funds management

Successful implementation of the MR-IWMP depends on the availability of adequate resources. As a primary coordinating institution responsible for the implementation of the project, LVBC should catalyze the mobilization of necessary funds. These resources shall be mobilized from national sectoral budgets, bilateral or multilateral donors and the private sector. Organizations such BMZ, NORAD, SIDA, USAID, EU, WB… and any other donor organization interested in sustainable development.

Depending of the anchorage of projects, resources for implementation of the Mara River IWM Projects will be mobilized as part of the overall Lake Victoria recurrent and development Funds or as part of the overall Nile Basin development funds which will be administered through the existing Nile Basin Trust Fund.

The PMU will have the delegated charge of the financial management of the project under control of the MR-IWMP national implementing authorities i.e. Ministry of Water in Tanzania and Ministry of Water and Irrigation in Kenya.

Funds will be delivered for the project implementation according to successive annual plans and budgets established by PMU for each sub-project.

5.2.8. Information exchange

Fully transparent information exchange has been mentioned as one of the building stones for successful transboundary cooperation. It is also the best tool for building mutual confidence. Information to be exchanged, would, among others, include:

- annual status reports with summarized key data from hydro-meteorological and water quality monitoring databases,
- full data ranges on water quantity and quality from border river gauging stations,
- annual reports or progress reports on either part of joint watershed management activities or on interventions in one partner country with a bearing on the watershed conditions in the other.

The option also exists of a website with selective access where all information from either partner country is stored.

6. OUTLINE OF INVESTMENT PROPOSAL

This chapter summarizes the Investment Proposal, starting with the general structure and the proposed project management structure, then introducing the different projects, sub-projects and activities; a synthesis of the activities involved, the quantities and corresponding costs estimated for each project and finally for the total Investment Programme.

6.1. STRUCTURE OF THE INVESTMENT PROPOSAL

The investment proposal is using an integrated watershed management approach and is composed with 2 main complementary projects and one transversal project including more supportive activities.

The structure of the project is based on local projects giving a view to integrated watershed management through introduction of actions responding to the main issues identified in the basin.

According to the Intervention strategy declined in chapter 4, the MR-IWMP project proposal is composed as an integrated package of 2 complementary projects composed with sector sub-projects targeting a specific line of intervention in the watershed and 1 additional transversal project deemed necessary for the achievement of specific objectives for the entire MR- IWMP.

To ensure support and effective participation of a maximum number of farmers and farmers' organisation, each local project must bring explicit and visible progress in the 3 crucial fields of:

- **Environmental conservation** of the watershed and wetlands (environmental protection, mitigation of causes and effects of erosion, support to biodiversity…) which is a major long-term concern addressed by the programs for the Nile Basin in general
- **Income generation** improvement to address the immediate needs of the inhabitants and also to ensure their participation in the conservation process (livelihood diversification, improvement of agricultural yields, and support to access to market for the products and to micro-credit for individual or group initiatives…)
- Improvement of the **watershed management/institutional strengthening** including social aspects, organisational strengthening and capacity building i(creation and operation of local organizations, capacity building, care of social stability and gender issues…) to increase the chances of sustainability of the efforts in conservation and livelihood improvement.

Projects are sized for a first implementation phase of **five years**; further phases will be established later for successive periods of 5 years**.**

The figure below summarizes the link between each of the sector subproject and this targeted objectives.

The Project Management is proposed as a separate part of the investment covering the 3 investment projects.

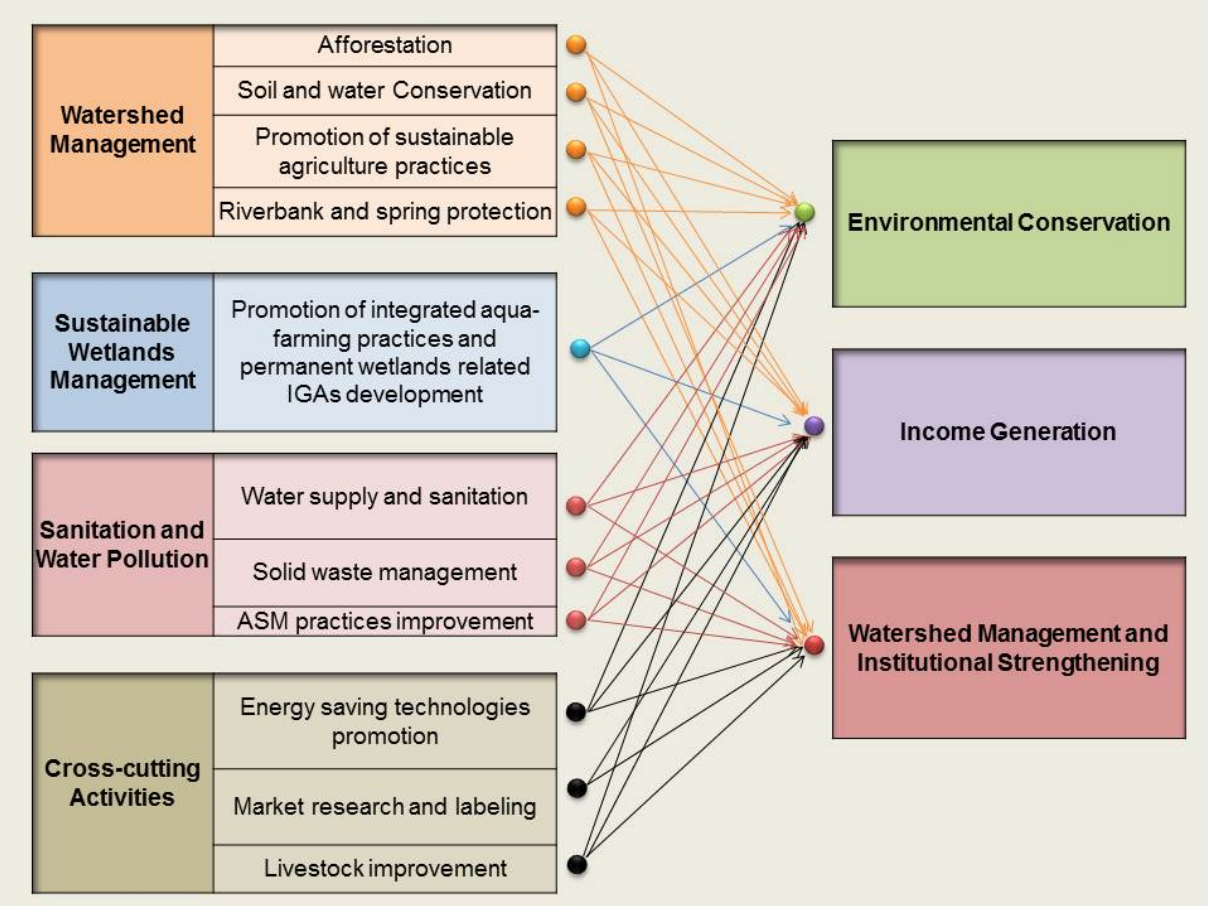


Figure 13: Links between sector subprojects and targeted objectives.

Depending of the main constraints and degradation to address on the sites of intervention in the priority areas and in the two countries the three main projects will be composed from the panel sector sub-projects but according to demand and needs of the communities.

Therefore, the sub-projects will be scattered across the whole Mara river basin, and many similar activities will be repeated in different locations (for example: development of tree nurseries, or plantation of fruit orchards).

This point is crucial to create and strengthen links and exchanges between stakeholders and beneficiaries all along the watershed.

The 3 main investment projects and supportive activities are shortly described below and detailed in Annexes 1 to 4.

6.2. PROJECT MANAGEMENT

6.2.1. Project management unit

The Project Management is proposed as a separate part of the investment covering the different components.

Separate cost estimation is reserved for the Project Management with a proposed implementation period of 5 years. Although depending of the institutional setting option chosen for the project implementation, the budget includes management costs at the national and transboundary level and the coordination offices in the MRB watershed.

The institutional framework for the PMU is described above in Section 5.1.

Costs for this item have been calculated on the following basis:

- Costs have been established conservatively, for the most expensive option;
- The PMU is formed by a Project Manager with experts in Financial Management, Monitoring & Evaluation, Procurement and GIS, with the necessary supporting staff;
- Two Coordination Offices are set up, one in each country, with one Coordinator (with watershed background for one, and wetlands management for the other), one liaison officer, one accountant and one GIS operator who may be contracted on a part-time basis (indicatively: half time), plus the required supporting staff;
- Vehicle running costs and office running costs have been estimated and included;
- All costs have been considered for duration of 5 years.

6.2.2. Project Management Cost estimate

Investment Project / sub-projects	Cost USD
IWRM Project Management	**USD 3,084,000**

Details of cost estimate are presented below.

Activity	Unit	Quantities						Unit Cost	Totals USDx'000					
		year 1	year 2	year 3	year 4	year 5	Total	($x'000)	year 1	year 2	year 3	year 4	year 5	Total
Project Management Costs														
1. PMU Staff.														
1.1 Professional staff.														
Project manager.	pmonth	12	12	12	12	12	60	6,00	72,00	72,00	72,00	72,00	72,00	360,00
Financial Manager	pmonth	12	12	12	12	12	60	4,00	48,00	48,00	48,00	48,00	48,00	240,00
Procurement Officer	pmonth	12	12	12	12	12	60	4,00	48,00	48,00	48,00	48,00	48,00	240,00
M&E Specialist	pmonth	12	12	12	12	12	60	4,00	48,00	48,00	48,00	48,00	48,00	240,00
GIS Specialist	pmonth	12	12	12	12	12	60	2,00	24,00	24,00	24,00	24,00	24,00	120,00
Subtotal 1.1									240,0	240,0	240,0	240,0	240,0	1 200,0
1.2 Administrative staff.														
Administrative assistant.	pmonth	12	12	12	12	12	60	0,50	6,00	6,00	6,00	6,00	6,00	30,00
Accountant.	pmonth	12	12	12	12	12	60	0,50	6,00	6,00	6,00	6,00	6,00	30,00
Secretary (2 persons).	pmonth	24	24	24	24	24	120	0,50	12,00	12,00	12,00	12,00	12,00	60,00
Driver (2 persons).	pmonth	24	24	24	24	24	120	0,50	12,00	12,00	12,00	12,00	12,00	60,00
Subtotal 1.2									36,0	36,0	36,0	36,0	36,0	180,0
2. PMU operating costs.														
2.1 Office														
Office operating expenses.	month	12	12	12	12	12	60	1,0	12,00	12,00	12,00	12,00	12,00	60,00
Subtotal 2.1									12,0	12,0	12,0	12,0	12,0	60,0
2.2 Transport														
vehicle operating costs.	month	36	36	36	36	36	180	0,8	28,80	28,80	28,80	28,80	28,80	144,00
Subtotal 2.2									28,8	28,8	28,8	28,8	28,8	144,0
3. Coordination-Office Staff.														
3.1 Professional staff.														
Coordinator (2 persons: 1 SWMP /1 WMP)	pmonth	24	24	24	24	24	120	2,0	48,00	48,00	48,00	48,00	48,00	240,00
Liaison officer (4 persons)	pmonth	48	48	48	48	48	240	2,0	96,00	96,00	96,00	96,00	96,00	480,00
GIS Specialist (2 persons, 1/2time)	pmonth	12	12	12	12	12	60	1,0	12,00	12,00	12,00	12,00	12,00	60,00
Subtotal 3.1									156,00	156,00	156,00	156,00	156,00	780,00
3.2 Administrative staff.														
Accountant (2 persons)	pmonth	12	12	12	12	12	60	0,5	6,00	6,00	6,00	6,00	6,00	30,00
Secretary (2 persons).	pmonth	24	24	24	24	24	120	0,5	12,00	12,00	12,00	12,00	12,00	60,00
Driver (2 persons).	pmonth	24	24	24	24	24	120	0,5	12,00	12,00	12,00	12,00	12,00	60,00
Subtotal 3.2									30,00	30,00	30,00	30,00	30,00	150,00
4. Coordination-Office Operating costs.														
4.1 coordination Offices														
Office operating expenses (2 offices)	month	24	24	24	24	24	120	0,1	2,40	2,40	2,40	2,40	2,40	12,00
Subtotal 4.1									2,40	2,40	2,40	2,40	2,40	12,00
4.2 Transport														
Vehicle operating costs: 6 (3 vehicles/office)	month	72	48	48	48	48	264	0,8	57,60	38,40	38,40	38,40	38,40	211,20
Subtotal 4.2: Coordination offices operating costs									57,60	38,40	38,40	38,40	38,40	211,20
5. Equipment for the PMU & coordination offices														
Construction/rehabilitation of office space.	office	3	-	-	-	-	3	10,0	30,00	0,00	0,00	0,00	0,00	30,00
office equipement (cell.phone, computer, printer...) and furniture	set	21	-	-	-	-	21	1,5	31,50	0,00	0,00	0,00	0,00	31,50
Training extension material	Lupsum	5	10	10	10	10	45	1,0	5,00	10,00	10,00	10,00	10,00	45,00
vehicle: 6 (3 PMU + 3 per coordination office)	4x4	6	-	-	2	-	8	30,0	180,00	0,00	0,00	60,00	0,00	240,00
Subtotal 5									246,5	10,0	10,0	70,0	10,0	346,5
Total Project Management									809,3	553,6	553,6	613,6	553,6	3 083,7

6.3. PROJECT NO. 1: WATERSHED MANAGEMENT PLAN

6.3.1. Project summary

The focus of the Watershed Management Project is on projects that will benefit the farmers through provision of alternative livelihood activities and improvement of incomes and, at the same time are likely to have maximum impact on watershed conservation as well.

The proposed related sub-projects involve activities on improving human welfare encompassing poverty alleviation, increasing cash income within the confines of the farmlands, and thereby easing pressure off natural ecosystems and improving food and nutritional security.

Reversing environmental degradation activities will involve soil improvement (replenishment of soil fertility, conservation of soil, conservation agriculture), enhanced biological diversity on farm and off farm and increased carbon storage.

The proposed sub-projects ensure land use activities will avoid environmental degradation without compromising the ability for economic activity. These related activities and subprojects will form part of an integrated watershed management for the area.

The development of Watershed Management Project has involved considerable input from the community and key stakeholders; and while the proposed projects will not address all the environmental issues, they will be designed to encompass the range of key focus areas identified by the stakeholders and implement the larger scale actions required to address the more significant threats to the MRB.

It is stressed that the following sub-projects are proposed for different areas and different situations, which differ one from another in terms of erosion hazards, prevailing land use, land cover and land tenure. This means that different approaches and implementation strategies are followed which best suit prevailing conditions.

Below are summarized some activities proposed in the sub-projects for the different configurations of the watershed from areas with the steepest and higher erosion hazards to the lowland areas.

<u>Afforestation</u>

- Tree nurseries development (exotic & indigenous species)
- Development of briquette making units
- Land preparation and erosion control
- Community plantation forestry promotion
- Private woodlots promotion
- Support establishment of community tree nurseries
- Development of Briquette making
- Soil and water conservation
- Hilltop reforestation
- Support Community forestry

<u>Water and Soil conservation / erosion control</u>

- Erosion process stabilisation through land preparation and biological techniques:
- Terraces, cut off drains
- Contour lines of grass strips
- Retention ditches

- Management of runoff water
- Promotion of rain and run-off water harvesting

Agroforestry

- Integration/conservation of trees on farmland:
- Fruit tree /orchards
- Fertilizer trees (leguminous- nitrogen fixing trees)
- other high value trees such as oil palm, mulberry (silk worms), coffee …
- Planting of multi-purpose trees in communal woodlots, degraded lands along roadsides and watersides, riverbanks and around dwelling areas

Sustainable agriculture practices

- Zero tillage / minimum soil disturbance & seed drilling technics
- Crop under soil cover (mulch, cover crop-legumes like lablab mucuna, grass fodder)
- Crop rotation / intercropping
- Development of cash crop production
- Selection or perennial crops instead annual,
- Selection of good cover crops instead of open cover
- Use of organic matter as fertilizer instead of chemicals
- Crop residue trash lines / on-site composting
- Improve livestock husbandry
- Support of service providers, local hire services, manufacturers of machinery (sub-soiler, ripper, direct seeder-jab planter)
- Dairy sheep & goat breeds improvement

Other IGAs

- Development of milk products
- Bee-keeping
- Poultry rearing
- Vegetable and fruit gardens
- Promotion of fruit orchards in the priority areas in Tanzania

Cross-cutting activities

- Energy saving technologies promotion / Promotion of improved stoves, solar stoves and biogas digesters
- Market research for watershed products and development of a Mara river label
- Livestock breeds improvement

6.3.2. Sector Sub-projects

The will be composed of four broad sub-projects, the specific objectives of which are indicated below

Sub-project 1A: Afforestation/reforestation

This sub-project addresses specifically the trend to deforestation in some areas, and the demand for wood and charcoal throughout the Mara River Basin, with an approach through community groups to lead the actions in the medium and long term.

- Mechanisms for community management and sustainable valorization (timber and non-timber products) of forests and woodlots are settled and operational;
- Farmers professional environment is operational: farmers are organized and have access to technical advices, techniques, tools and seedlings;
- Farmers professional network is operational: farmers are included in the decision making process for woodlands and forests management;
- Awareness towards usefulness of sustainable forest management is improved;
- Gazetted forests are protected in the watershed.

Sub-project 1B: Soil and water conservation

This sub-project comprises of actions directed towards soil and water conservation and development of agroforestry, specifically as actions undertaken by communities and local groups (and not through individuals); they are designed for group actions addressing common preoccupations.

- Erosion process is stabilized in the intervention areas
- Farmer's professional environment is operational: farmers have access to technical advices, suitable tools, service hiring, inputs supply and revolving funds for their investments and access to market for their products trading
- Soil and water conservation practices are adopted by farmers; livelihood productivity is increased and better secured
- Farmer's income are diversified and increased and food security is improved
- Existing infrastructures for water harvesting and small irrigation and other purposes are restored and operational
- Farmer's professional network is operational and farmers are included in the decision making process

Sub-project 1C: Promotion of sustainable agricultural practices

Complementary to the Soil Conservation and Forestry sub-project above, this sub-project is directed towards farmers, and comprises of field actions expected to give direct benefit to the land owners (be it on private land as in Kenya, or community land as is usual in Tanzania). This includes both soil preparation and conservation (tilling, individual plot bunds and their vegetation, minor water retention works…), and agronomic aspects (type of crops, crop combination, crop sequencing…). Part of the activities under this sub-project may be similar to those proposed under Soil Conservation and Forestry, but the implementation model will be clearly different because of the focus on plot level action.

- Target intervention areas are identified and techniques to be promoted are selected and disseminated
- Farmer's professional environment is operational: farmers have access to technical advices, suitable tools, service hiring, inputs supply and revolving funds for their investments and access to market for their products trading
- Conservation Agriculture techniques practices, treatments and cash crops are adopted by farmers in the watershed; Livelihood productivity is increased and better secured
- Farmer's income and food security are improved

- Farmer's professional network is operational and Farmers are including in the decision making process

Sub-project 1D: Riverbank and spring protection

This sub-project is directed to limiting sediment load in the river caused by river bank erosion, and to protect springs against human and animal action; these activities are meant for implementation at community or other local group level.

- Awareness and capacities of communities and technical officers towards riverbank and spring protection and restoration have increased
- Representatives pilot areas are restored for sensitization and promotion of good practices

6.3.3. Project no.1 Cost estimate

The estimate of costs for the Watershed Management Project over a 5 year period is presented below:

Sub-project	Cost ('000 USD)
Afforestation	9,097
Soil Conservation and Agroforestry	4,359
Sustainable Agriculture	5,553
Riverbank and Spring protection	2,602
Total	21,612

Details of the cost estimate are given in Annex 1.

6.4. PROJECT NO. 2: SUSTAINABLE WETLANDS MANAGEMENT

6.4.1. Project summary

The Sustainable Wetlands Management Project (SWMP) is composed as one single integrated project covering improved management, sustainable development of income generating activities related to wetlands but also including the conservation of wetlands, both permanent and seasonal.

The main foreseen outcomes of the SWMP are:

- Halt ecosystem damaging encroachment of permanent wetlands
- Develop equitable uses of larger seasonal wetlands
- Development of alternative sources of livelihood
- Ensure capacity building for Community to implement proposed alternative livelihood options.
- Improve technical resources and extension services

- Improve structure for planning and monitoring catchment rehabilitation activities, and for sensitization, training and mobilization of communities

The actions are designed to address the perceived misuse or degradation of wetlands in the Wetland Priority area (Mara Wetland complex in Tanzania). With **17 villages/hamlets** targeted by the project, a majority of villages in the wetland surroundings are included in the project in the four districts of Musoma Rural, Serengeti, Tarime, and Rorya.

The focus of the SWMP is on activities that will have maximum impact on watershed conservation and wetland functions as well as they are compatible with the components of Income Generation and Watershed management.

A great part of the Wetland Priority area will be concerned with the latter two of the wetland categories described below, namely

- **Seasonal floodplain wetlands**: they provide the best opportunities for community development in the form of improved farming practices and diversification of livelihoods notably through establishment of integrated aqua-farming and development of complementary IGAs based on honey production, milk products, orchard…

- **Permanent wetlands** (including shallow wetlands, deep wetlands and free water): they require a stronger emphasis on conservation because of its important ecological function in the MR basin as a whole. Activities will be oriented mainly towards improvement of fishery and fish production activities, valorization of wetland's products like papyrus, and development of small scale touristic activities in link with the two National parks of Serengeti and Maasai Mara.

Typical examples of improved sustainable livelihoods supported by the SWM Project are given in the table 13 for each category of wetland.

Table 13 : Possible activities for the different wetland categories

	Deep PW /free waters	Permanent wetlands	Seasonal wetlands (flood plains)	All areas
Main proposed activities	Conservation Eco-tourism development (bird-watching, boat tour..)	Increase of captured fish through enlargement of the fish breeding and refugia areas (cutting channels in the existing wetlands) Expand the extent and type of fish culture systems Improve or establish sustainable papyrus/reeds/typha cropping cut areas	Introduction of integrated aqua-farming practices (integrated fish-farm units) Improved farming practices like: Ditches dug in the floodplain to increase the retention period of floodwater (more time and water for seasonal crops) Ridge & furrow cultivation Agroforestry / Fruit trees orchard cultivation Creation of communal woodlots for firewood Optimum use of seasonal grazing of the draw down areas Improving the type and extent of fodder production Invasive species control	Organization of commercial beekeeping production Development of dairy sector (village-based cooling center) Development of hand-made products with papyrus (mats baskets, hats..) Development of briquette making units
Cross-cutting activities	*Energy saving technologies promotion / Promotion of improved stoves, solar stoves and biogas digesters* *Market research for watershed products and development of a Mara river label* *Sheep & goat breeds improvement*			

The project designed for wetlands management aims at better wetland conservation and valorization through a more intensive stakeholder involvement in planning and implementation, resulting in a stronger sense of project ownership and a higher commitment to sustainable models of resource utilization.

In Tanzania all land is public property, with three types of land ownership among others 'Village land' categorized as all land inside the boundaries of villages, which is concerned by the project. Considering this way of land tenure, a pre-requis to SWMP implementation is a participatory land use planning exercise undertaken at the scale of the village and inter-villages in the Wetland Priority Area.

The project will then be implemented at the village scale within wetland's village units of varying extent, preferably divided into logistically manageable portions of about 20-30 km². The project area is sized to cover **17 basic Wetland's Village Units.**

FFS will be preferentially implemented for new farming practices and IGAs training.

One of the basic concepts developed for the villages standing in the buffer zone around the wetlands is that of aqua-farming, which means a set of different activities including use of standing water. The different activities within the "aqua-farming package" include: fish farming, orchard development, dairy cattle development at small scale (cows or goats) and milk products production, gardening, beekeeping…

Annual implementation plans will be built on the base of the aggregated baseline surveys or 'preliminary resource surveys' for each wetland management unit organized as initiation of the stakeholder consultation and sensitization process.

The project will provide the necessary inputs for implementation including planning tools, at community level and at the level of coordinating government institutions (Ministry of Water in Tanzania and NEMA in Kenya), and inputs required for installation of improved livelihoods, which cannot be provided locally. Notably, the Project is providing subsidiaries for basic equipment necessary for development of IGAs like biomass briquettes making, milk products processing, village nursery establishment…

For the purpose of increased project ownership, participating communities will as much as possible provide inputs themselves: they would provide manual labour, and will be trained to produce their own planting material for biological measures such as tree production. GIS will be an important planning tool.

Revolving founds to help communities developing new investments like aqua-farming integrated units specifically fish ponds and commercial fruit orchard or small infrastructures for touristic project are integrated in the budget.

6.4.2. SWM Sector Project

This project is roughly divided into two parts, with some activities undertaken in permanent wetlands and others to be implemented on and around floodplains. All proposed activities are complementary and could be implemented in an integrated manner at the village scale.

The Wetland Management project comprises of the following components with their content:

In order to address the main issues identified in the wetland priority area and reach objectives declined in section 4, four complementary components have been designed:

Component 1: Preliminary and supportive Activities

- Complementary study of wetlands typology and mapping
- Participative identification of intervention areas (*delineation of wetland's village units)*
- Participative formulation of land use mapping at the village scale
- Preliminary resources survey and identification of techniques/practices and innovating management measures to be promoted
- Invasive control techniques survey and identification of techniques/practices to promote

Component 2: Capacity Building for Community driven wetlands management

- GIS development, facilities upgrading and training for database
- Creation of Wetlands Management Committees and Watershed platform

- Drafting management Plans for each Wetland's Village Unit
- Training sessions for technical officers and extension staff and CBO's leaders
- Implementation of FFS and stakeholders forum
- Production and dissemination of technical and communication supports

Component 3: Sustainable integrated aqua-farming practices promotion

- Development of village nurseries to support agro-forestry
- Community support for implementation of improved techniques and practices for honey production and milk products development
- Support for labelling and marketing of products and commercial community-private association for local products (fruit, honey, dairy products, *…) in link with cross cutting activity no.2*
- Support of suppliers, providers of local hire services and manufacturers of tools and machinery
- Revolving funds for establishment of new activities (integrated fish-farming units, fruit orchard commercial production, bee keeping, dairy processing units.)

Component 4: Permanent wetlands related IGAs development

- Investigate tourism development opportunities
- Building networks and partnerships with farmers or CBO's
- Support of suppliers, providers of local hire services and manufacturers of tools and machinery
- Revolving funds for establishment of new activities and small businesses (boats or wood pontoon for touristic activities, briquettes processing units …)
- Support access to market and commercial community-private association (touristic offer, handicraft products, papyrus briquettes …) *in link with cross-cutting activity no.3*

6.4.3. Project no.2 Cost estimate

Estimate of total cost for Wetlands Management Project over a period of 5 years is presented below; details are given in Annex 2

Investment Project / sub-projects	**Cost ('000 USD)**
Sustainable Wetlands Management project	7,134
Total	**7,134**

6.5. PROJECT NO. 3: WATER QUALITY AND SANITATION PROJECTS

6.5.1. Project summary

A set of sanitation and waste management activities will be prepared and implemented at small scale with the communities through community sensitization, mobilization and participatory methods to ensure that they feel empowered and in turn are willing contributors to the activities. In fact, the strategies to be developed for improvement of sanitation conditions and proper waste management are key elements of community development plans.

The main foreseen outcomes of the Sanitation and Waste Management Project are:

- Improve health and living conditions of the MRB inhabitants;
- Develop improved access to clean water in the MRB;
- Develop improved access to sanitation facilities for the MRB inhabitants;
- Develop sustainable solid waste management;
- Contribute to the development of alternative energy sources (biogas production);
- Decrease water pollution and improve water quality through improved mining practices;
- Enhance public awareness and community participation;
- Ensure capacity building at local government authority (LGA) level and community level;
- Improve technical resources and extension services;
- Improve structure for planning and monitoring of project activities, and for sensitization, training and mobilization of communities.

The priority project intervention areas for the Water Pollution and Sanitation Project are the fast-growing urban centres of the MRB, mainly those located in proximity to the mayor tributaries of the Mara River.

Pilot towns/villages have been selected in the three sub-basin priority areas as representing a typical situation in the MRB. The pilot areas are:

- Bomet Town (semi-urban with peri-urban areas): Sanitation sub-project and solid waste management sub-project
- Mulot Town (semi-urban with peri-urban areas) : Sanitation sub-project and solid waste management sub-project
- Nyangoto and Kewanja Villages (semi-urban area) : Sanitation sub-project and solid waste management sub-project
- Weigita Village (rural area) : Sanitation sub-project

Each pilot town/village can be sub-categorized in zones/clusters depending on specific characteristics. For each zone/cluster, possible options/measures are proposed concerning sanitation and solid waste management.

- A separate sub-project has been defined for promotion of alternative mining practices. The intervention area for this sub-project is located in the Tigithe sub-basin.

Main activities proposed in the first two sub-projects focused on water supply and sanitation and solid waste management are related to WASH awareness campaigns, introduction of appropriate sanitation facilities (water-supply and toilets) and organization for operation and maintenance and organisation of waste collection, deposit, and as far as possible re-cycling. Immediate and medium-term options for Decentralised Wastewater Treatment Systems (DEWATS) only are proposed. Options for centralised systems are not included in the project.

For urban and semi-urban sites, poor-flush toilets with on-site treatment by septic tank for individual houses or connected to simplified "condominial" sewerage system for clustered households to be connected to a shared DEWATS (septic tank, Imhoff tank or anaerobic baffled reactor) are recommended. The effluents from these treatment systems are further treated through ground percolation (more frequently). Location and maintenance of a suitable site for these effluents and organization of collection is part of the program. In parallel, the project will technically and financially support the building of public toilet blocks at market place in each of the priority site.

Collection, transport and deposition of solid wastes are organized at the local level, including identification of the dumping site, through mobilization of CBO in conjunction with local authorities. Segregation and re-cyclinga activities will be supported through partnerships with specialized firms and could be promoted as an IGA.

For rural village like Weighita, a whole sanitation approach will be developed including a participatory hygiene and sanitation transformation (PHAST) approach, identification of suitable options for water supply and sanitation facilities. Individual latrines are recommended and particularly eco-toilets where water-table is very close to the surface (this is the case in that village). These Eco-toilets could be linked to introduction of biogas reactor. The project will technically and financially support the building of public toilet blocks, water taps and troughs for livestock.

The third sub-project dedicated to **promotion of Alternative Mining Practices** is focused on both artisanal and small-scale miner communities and could contribute to improvement of health, environmental and social conditions of the sector in the targeted area. Main activities proposed in that sub-project are related to community awareness campaigns and training campaigns carry–out with a Demonstration Transportable Unit to promote cleaner technologies in artisanal and small-scale gold mining.

6.5.2. Sector Sub-projects

The Water Pollution and Sanitation Project is composed with 3 sub-projects dedicated to a) water supply and sanitation, b) solid waste management and c) promotion of alternative artisanal and small scale mining practices

6.5.2.1. SUB-PROJECT 3A: WATER SUPPLY AND SANITATION

For **Water supply and Sanitation**, the following steps and activities are proposed for each local project:

<u>Component 1</u>: Preliminary activities

- Participative identification of intervention areas
- Feasibility study and design for Sanitation Plan in each pilot area (DEWATS equipment and development of dumping sites for septage)

Component 2: Community awareness and capacity building

- Public campaigns for WASH education
- Creation of O&M committees
- Training sessions, workshops and visits for CMO, DTO/LGA officers and committee leaders
- Assist community groups to apply new technology: technical advice, improvement of organizational capacities (for households, LGA and government extension agencies)
- Production and dissemination of technical and communication support

Component 3: Development of sanitation pilot projects in urban & semi urban areas (Bomet, Mulot, Nyangoto and Kewanja)

- Technical and financial support to communities for the construction of public taps and toilet blocks (including showers and laundry) connected to a DEWATS at market place (providing of raw material and equipment)
- Technical and financial (subvention for raw material and equipment) support to individuals or clustered households for the construction of individual or simplified condominial DEWATS

Component 4: Development of pilot water points/standposts and sanitation facilities in rural area (Weigita)

- Geophysic survey of the water table to identify safe water sources
- Technical and financial support to communities for the construction of raised latrine pits or ecotoilets and standposts, water troughs for livestock (providing of raw material and equipment)

6.5.2.2. SUB-PROJECT 3B: SOLID WASTE MANAGEMENT

For **solid waste management** the following steps and activities are proposed for each local project:

Component 1: Preliminary activities

- Participative identification of intervention areas
- Feasibility study and design for Solid Waste Management Plan in each pilot area (including location and development of dumping site)

Component 2: Community awareness and capacity building

- Public campaigns for environment, health and hygiene education
- Creation of Management Committees for solid waste collection/dumping site O&M
- Training sessions, workshops and visits for CMO, DTO/LGA officers and committee leaders
- Assistance to community groups: technical advice, improvement of organizational capacities (for households, LGA and government extension agencies)
- Production and dissemination of technical and communication support

Component 3: Development of waste management pilot projects

- Technical and financial support to communities for primary collect organisation and waste segregation (including street cleaning operations) and collection points management
- Support creation or partnership with small business for secondary waste transportation and dumping site O&M
- Support to market research and partnership building with specialized firm for waste recycling

6.5.2.3. SUB-PROJECT 3C: PROMOTION OF ALTERNATIVE MINING PRACTICES

In order to address the different issues, 3 complementary components have been designed:

Component 1: Preliminary Activities

- Participative identification of miner communities that could be targeted by the project
- Preliminary identification of innovating techniques/practices to be promoted

Component 2: Capacity Building and awareness campaign

- Community organisation and implementation of miners associations
- Training sessions for technical officers and extension staff and ASM association leaders
- Production and dissemination of technical and communication supports
- Awareness campaign for ASM communities on field

Component 3: Sustainable practices promotion

- Organisation of processing centers equipped with cleaner techniques
- Building partnerships with medium scale miners (re-treatment of tailings)
- Support of suppliers and manufacturers of tools and machinery
- Revolving funds for establishment of improved techniques and equipment

6.5.3. Project no.3 Cost estimate

Total cost for Water pollution and Sanitation Project over a period of 5 years is estimated below

Investment Project / sub-projects	**Cost ('000 USD)**
Water supply and sanitation	2,434
Solid waste management	765
Alternative mining practices	1,262
Total	**4,461**

Detailed calculations are presented in Annex 3.

6.6. PROJECT NO. 4: CROSS-CUTTING ACTIVITIES

The project related to supportive activities is composed with the 3 following components:

6.6.1. Energy-saving and alternative energy technologies promotion

The main source of energy in households in the MRB is firewood and charcoal. This leads to clearing of forests. The project no1 is including awareness of population towards forest and woodlands usefulness and is promoting afforestation activities.

The promotion and dissemination of energy saving or alternative energy technologies is a complementary action that will address both forests/woodlands conservation and livelihood and welfare improvement.

Indeed, promotion of fuel wood energy saving methods and alternative energy technologies to communities is expected to conserve the forest by reducing the amount of fuel wood collected.

It is expected to also improve livelihoods and enhance productivity, because less time will be spent on fuel wood collection, an exercise normally performed by women and children. It could be implemented directly by individuals or through small scale private or community business.

Under this cross-cutting activity, the project will promote several alternative technologies:

- Improved stoves
- Biomass briquettes
- Biogas digesters

6.6.1.1. PROMOTION OF IMPROVED STOVES (LIKE JIKOS)

A more efficient use of fuel wood would therefore lead to less destruction of forests. This together with use of more efficient charcoal kilns would significantly reduce the deforestation in the MRB.

Making of improved stoves, like Jikos, is a skill that local groups can be easily trained on. Hence, it is offering an opportunity for earning an income though making, selling and installing of the jikos. If modified to include an oven, these jikos can be used for baking further opening up opportunities for income generation and employment creation.

Introducing of models of firewood saving stoves can be favorably combined with use/marketing of biomass briquettes (made from papyrus for example), as described below.

6.6.1.2. BIOMASS BRIQUETTES MAKING

The possibility of using all sort of biomass and not only wood for energy production and burning in stoves (as wood or as charcoal) is an opportunity to lighten the pressure on tree and forest resources, using wastes (wood chips, saw dust) or vegetation of limited use (wetland weeds like papyrus and possibly more) and turning them into a good fuel for households and institutions, is a very attractive alternative for watershed management.

6.6.1.3. PROMOTION OF BIOGAS DIGESTERS

Biogas typically refers to a gas produced by the biological breakdown of organic matter in the absence of oxygen.

Organic waste such as animal manure, kitchen waste, crop wastes, can be converted into a gaseous fuel called biogas. Biogas is produced by the anaerobic digestion or fermentation of biodegradable materials such as biomass, manure, sewage, green waste, plant material, aquatic weeds (…) and crops. Biogas comprises primarily methane (CH4) and carbon dioxide (CO2) and may have small amounts of hydrogen sulphide (H2S), moisture and siloxanes.

The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel for any heating purpose, such as cooking.

Biogas can be produced using anaerobic digesters. Basic technology for biogas digesters has been widely developed in developing countries and particularly in Nepal.

6.6.2. Market research and development of Mara river label

This measure is aimed at ensuring the value added and quality of cheeses and other local products with a protected designation of origin (PDO) or protected geographical indications (PGI), which are particularly important for vulnerable rural regions.

In the milk sector it would allow actors in the dairy supply chain to dialogue and to carry out a number of activities. These joint activities concern, among others, promotion, research, innovation and quality improvement, for a better knowledge and transparency of production and the market.

6.6.3. Livestock improvement

Livestock is of high importance in the whole basin, for production or as a basic asset. Local breeds are the result of a natural selection process, and correspond to animals well adapted to the local conditions of temperature, food and water availability. Yet they are not highly productive, and integrating new breeds would help increase the production level. Inter-breeding with local animals should be avoided.

The main goal is to increase the productivity of meat and milk in the community. Improved goats and cattle grow faster and have higher milk production rates than the local breeds. They are also less susceptible to drought and diseases. Coming up with such a project will in turn enable better livelihood and social welfare of the people. To get such a project moving, it is important to ensure that the farmers have the required infrastructure to support a cross breeding program. There is also need to form farmer organizations or self-help groups which would be responsible for the organization, coordination and sustainability of the program. The cut-and- carry system used in improved dairy goat production can be successful under smallholder production systems. Feeds can be generated from improved tree fodder or through irrigation of fodder.

6.6.3.1. CROSS-CUTTING ACTIVITIES COST ESTIMATE

Activity	Duration (months)	Cost (USD)
Energy saving	12	720 000
Marketing/Development of a Mara river label	6	180 000
Livestock breeding centres/projects	12	1 413 000
Total		2 313 000

Detailed cost calculations are presented in Annex 4.

6.7. TOTAL COST OF THE IWMP PROPOSAL

The total budget for the Integrated Watershed Management and Investment Project is summarized below.

Management and Investment Project	Cost in USD
Project Management	3,084,000
Investment project No.1 Watershed Management Project	21,612,000
Investment project No.2 Sustainable wetlands management Project	7,134,000
Investment project No.3 Sanitation and water quality Project	4,461,000
Cross-cutting Activities	2,313,000
TOTAL MR-IWMP	**USD 38,604,000**

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