Nile Equatorial Lakes Subsidiary Action Program

MARA TRANSBOUNDARY INTEGRATED WATER RESOURCES MANAGEMENT AND DEVELOPMENT PROJECT

Final Report – Annex 2

Sustainable Wetlands Management Plan

***Final Version* – December 2012**

Document Quality Information

General information

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Project title	Feasibility Study for Integrated Watershed Management and Preparation of Investment Project Proposal for the Mara River Basin
Document title	Second Final Report – Annex 2 Sustainable Wetlands Management Plan
Date	31 December 2012
Reference	RED 123009 H

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History of modifications

Version	Date	Written by:	Review by:
Version 1	27 Dec. 2012	France BAILLY-MARION, Environmentalist	Emmanuel DAVAL, Project Director
Version 2	31 Dec. 2012	France BAILLY-MARION, Environmentalist	Emmanuel DAVAL, Project Director

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List of Abbreviations and Acronyms

a.s.l.	Above sea level
CBO	Community Based Organisation
CSO	Civil Society Organisations
EIA	Environmental Impact Assessment
ESMF	Environmental and Social Management Framework
FS	Feasibility Study
GIS	Geographical Information System
HR	Human Resources
IWRM	Integrated Water Resources Management
IWM	Integrated Watershed Management
LGA	Local Government Authorities
LVBC	Lake Victoria Basin Commission
MMNR	Maasai Mara National Reserve
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
NEMC	National Environment Management Council
NGO	Non-Governmental Organisation
MNRT	Ministry of Natural Resources and Tourism
MW	Ministry of Water
PMU	Project Management Unit
PPP	Public-Private Partnership
SENAPA	Serengeti National Park
SWAT	Soil Water Assessment Tool
ToR	Terms of Reference
WB	World Bank
WREM	Water Resources and Energy Management International Inc
WRMA	Water Resources Management Authority, Kenya
WRUA	Water Resources Users' Association

1. INTRODUCTION

EGIS has been committed by the Mara River Basin Project – Project Management Unit to provide a preliminary investment project for Integrated watershed management through feasibility type studies.

The present document is the second Annex of the Final Report for Mara River Basin Integrated Watershed Management Project.

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

2. GENERAL PRESENTATION

2.1. GENERAL CONTEXT

Sustainable Wetland Management is one of the 3 projects of the Mara River Integrated Watershed Management and Investment Plan (MR-IWMP).

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.

The present report on Wetland Management, as a sector activity proposal, needs to be read in conjunction with the Main Report, which presents the project components.

2.2. REVIEW OF THE MRB WETLAND CONDITIONS

Among the five major wetlands identified in the Mara River Basin, the SWM Project is considering the Mara Wetland (or Masurura Swamp) only, located in the lower Mara river 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 3 other priority areas 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 sub-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.

2.2.1. The Mara Wetland

The Mara wetland stretches for about 50 km along the lower reaches of the Mara Ruiver 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.

The wetland is surrounded by 17[1] villages in the four districts of Musoma Rural, Serengeti, Tarime and Rorya. 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.

The map on Figure 1 presents the location of villages around the wetland.

[1] According to Minishi, 2007 quoted in NIRAS, Thematic Report (2011)

Figure 1: Villages around the Mara wetland

Table 1 : Mara wetland physical features

Parameter	Area/altitude	Comments
Altitude	1133 – 1202 m	The altitude varies from 1133 at the outlet to 1202 m asl in the upper parts of the wetland
Overall wetland area	400 km² (500 km²) # x 2 between 1986 and 2001	An additional 100 km² floodplains partly occupied by agricultural fields in dryer years
Open water area in:		
1984 2005 2011	14.5 km² 6.00 km² 4.00 km²	Based on Landsat TM / 1984/June From Google Earth Pro Image 2005/March *Estimate*, not verified by satellite images

The dynamic nature of the wetland in terms of flood levels and overall size makes it difficult to delineate it precisely, especially in the eastern part. This point may cause conflicts in case farming and grazing in the wetland is prohibited.

The Mara Wetland complex has grown considerably in size over the last 30-40 years resulting of increased silting. This is partly due to the increasing erosion upstream as a result of deforestation and land use changes. Sedimentation and the resulting increased vegetation cover further reduced the flow velocity of the river and helped maintain and increase the wetland area. Although the fastest expansion of the wetland was observed in the 80', the swamp still continues to expand. Annual variations in flood level are large.

Permanent wetlands areas have the greatest importance for maintaining beneficial ecological attributes. The vegetation cover is greatly dominated by papyrus. This by itself normally supports very low biodiversity, but these wetlands are extensive enough to have sufficient mixed vegetation to harbour a large biodiversity. The ecosystem as a whole is of prime ecological value to conserve. Permanent wetlands are generally too deep for encroachment.

The biodiversity of the Mara wetland is important particularly in terms of fish fauna (14 species) and water birds (33 species). Besides, the Mara Wetland is included in the Important Bird Area (TZ041- Bird life international) and could be classified as a Ramsar site.

The large majority of seasonal wetlands are completely cultivated. There is evidence that crop and vegetable cultivation of the swamp banks is expanding, especially during dry seasons to enhance output. The cultivation practices are mainly traditional.

Furthermore, the swamp attracts large herds of livestock during the dry season which overgraze extensive adjacent areas and degrade the soil causing bank erosion.

Agricultural and livestock grazing around the swamp have contributed to pollution (herbicides, insecticides, fungicides, and fertilizers), soil erosion and eutrophication.

As a result, sensitive fish species (such as tilapia, lung fish, and catfish) are threatened due to high sedimentation of their nesting sites.

In addition, the swamp receives heavy silt and pollution loads from the Mara River that further affect fish spawning and threatens its.

Wetlands produce papyrus, reeds and trees being harvested for a wide variety of uses. Fish are caught in open patches in permanent wetlands for home consumption but also for commercial purposes and can become an important socio-economic activity adjacent to the swamp.

At the moment, the overall existence and functions of the wetland do not appear to be threatened by human activities. Indeed, the current development (no large scale project) is not a threat to quality and status even if some practices of artisanal fishery are to be regulated.

2.2.2. Wetland Values, Functions and Attributes

Wetlands provide a number of ecosystem services and products of immense importance to people and nature. A number of the main wetland functions can mitigate the impact of climate change, and wetland management will surely gain importance as a major tool for both climate change adaptation and mitigation. Other values and functions for wetlands in the Mara River Basin are outlined below.

2.2.2.1. PROVISION OF SOCIO-ECONOMIC SERVICES AND GOODS

The wetlands most common goods and services include the following:

- Plant products for weaving mats and baskets
- Animal protein from fish and wildlife
- Water for livestock and human consumption
- Grazing land for livestock
- Recreation / tourism
  Land for cultivation by the local community
- Location for ceremonies
- Income from the sale of fish and other products;
- The swamp is a main source of raw materials for artifacts and other products like *Cyperus papyrus* used for mats, *Typha spp* used for house thatching/roofing, herbal medicines, and firewood.

2.2.2.2. ECOLOGICAL SERVICES

Biodiversity: Wetlands in general are of immense importance for biodiversity providing habitats for species which are entirely found in wetlands, as well as a large number of non-wetland species which depend on wetlands for their survival in the dry seasons or during part of their migration cycle.

The Mara ou Masurura Swamp is an important fish breeding site for Lake Victoria. After spawning, fish use this wetland as nursery grounds where young fish grow away from predators and are protected by wetland vegetation.

Water storage and flow: The role of wetland in regulating water flow, accumulating and slowly releasing the water is very important, especially in areas with seasonal rainfall, where the wetlands may enable a continuous flow of water in the streams emanating from it, thus contributing to the water retention capacity of watersheds. This function also contributes efficiently in controlling floods. In that respect, wetlands functions are key elements of adaptation to climate change.

Groundwater recharge: Wetlands, through their long-term storage of water, facilitate aquifer recharge, another very important component in adaptation to climate change in areas with limited and/or seasonal rainfall.

Water purification: Wetlands, especially those with dense vegetation, are efficient in trapping and filtering nutrients, sediments and pollutants from the water. In this way the wetlands reduce pollution and eutrophication downstream. Some of the nutrients are absorbed by the plants, and may be removed or recycled through harvest of the biomass resources. In addition, nutrients such as nitrogen stored in organic matter in the wetland are removed from the system through processes such as denitrification, resulting in the release of N2 to the atmosphere.

Carbon accumulation: Wetlands may build up and store very large quantities of organic matter, acting as carbon sinks, a process with direct importance in climate change mitigation. Wetlands may, however, also contribute to methane production, a strong green-house gas provoking further climate change. The organic matter may also be used for energy production, e.g. in form of biogas, bio-ethanol or briquettes, and may help to reduce the demand for charcoal.

2.2.2.3. WETLANDS AND CLIMATE CHANGE

Climate change will have an inevitable medium and long-term impact upon the wetlands because of two factors. Firstly, there will be much greater variability of weather. Wet will become wetter and dry drier. MR weather is already variable and it has become impossible to predict when, or if, the rainy season will begin in East Africa. Increased severity of flood events gives greater importance to stream bank wetland vegetation. The cultivation of upland rice, already limited by droughts, to replace paddy rice grown in wetlands is likely to be further compromised by greater droughts. Major fluctuations in water flow would also impinge upon paddy rice cultivation and aquaculture developments associated with wetlands. Greater importance will thus be put on impoundments to maintain water flow (multi-purpose reservoirs).

Secondly, traditional farming methods are based upon predictable seasonality and so attempting intensifying such methods as is advocated for combating wetland encroachment may have only limited success. A shift in crop type and cultivation methods is probably inevitable, but farmers would need the required knowledge and investment capability to do be able to do this. It would be reasonable therefore to propose extension service investment in the form of a fund to be drawn on as a response to farmers' requests.

Wetlands will assume more importance than they have presently in their function of damping out variability of flood events. But the need to control discharge and volume by managed impoundments will remain. There will be times when emergency irrigation is wanted, although how much cannot be known yet. And if fish farmers run short of water they will informally duct more from the wetlands.

2.2.3. Constraints

Constraints to wetland management are related mainly to the intrinsic constraint to **delineation of wetlands** in order to identify and quantify spatial management units. Determination of wetland types and their extent is bound to be tentative and is always a generalization. The difficulty will be increase in the present situation where limits between village areas are materialized by the moving river bed inside the wetland complex.

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. In addition, most gross **area estimates of wetlands** 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. Besides, in the present situation the silting of the Mara river is the cause of a rapid extension of the wetland complex area on depends of the surrounding plains more or less seasonally flooded.

Thus, 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. The first one provided the overall layout of the wetland pattern; the second one provided the possibility to update the picture from the original topographic maps to the present situation.

Another issue which can become a constraint is the fact that wetland management is based very much on **community development**. This implies an unpredictability constraint in anticipated outputs of community development activities because of normal human vagaries. Estimates of anticipated outputs to a certain extent will have to be based on expert judgments and experiences elsewhere.

Finally, **inadequate enforcement or application of existing laws and regulations** is a constraint in any area of natural resources which in theory has a protection status, but where land pressure leaves no other option but encroachment.

3. JUSTIFICATION OF THE SWM PROJECT

Wetland management can't be separated in any conceptual or organizational manner from the watershed management for the whole MRB, as far as the wetlands are part and parcel of the catchment. Wetland management will conform to the aims of the catchment management actions and be strongly community development focused.

The proposed activities for the watershed rehabilitation to improve agricultural productivity greatly overlap with developing alternative incomes to alleviate detrimental use of wetlands. Both are directly concerned with reducing poverty. Wetland management may need the involvement of the same local communities, required staffing, institutions and material resources as do the proposed catchment rehabilitation support actions.

The riverbank and spring protection component of Watershed Management Plan is relevant to the objectives of the Wetland Management Plan in that the existing vegetation of the riverbanks and around springs is a wetland type and is naturally available to be used as renovation material. Agro-forestry and other proposals to improve agricultural productivity have the same objectives as does the diversification proposals of the Wetlands Management Plan. In the MRB perspective, the Wetland Management Plan could even be considered as a downstream extension of the Watershed Management Plan.

This Wetland Management Plan is designed to address the perceived misuse or degradation of wetlands in the Mara river basin. The focus of the Wetland Management Plan, as for the Watershed Management Plan, will be on activities 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 and wetland functions as well.

Two main types (categories) of wetlands have been determined for practical management purposes in the SWM project:

- Seasonal wetlands with major seasonal flood plains: It is this category where most options for wetland development exist. They are best used in harmony with the natural flood events. That is, crops and grazing at the appropriate stage of flood and recession.

- Permanent wetlands: These have the greatest natural resource benefits of wetlands, and most strongly perform the typical ecological functions of flow regulation for the whole MR area. No drainage should be practiced and encroachment strictly controlled to temporary activities of traditional uses. Water may be diverted from, and returned to, the wetland as part of a diversification of livelihoods to reduce unsustainable exploitation of the wetlands.

The clearly outstanding important permanent wetland for the MR area is in the lower Tigithe priority area in Tanzania.

4. SWMP OVERALL OBJECTIVE AND KEY OUPUTS

4.1. PROJECT OVERALL OBJECTIVE

The Overall Objective of the Sustainable Wetland Management Plan (SWMP) conforms to that of the watershed management aims to «*improve the living conditions of people while protecting the environment*».

In this it is crucial that all wetland management activities are focused on the communities involved and that they in turn are willing contributors to the activities. A Wetland Management Plan is to a large extent a community development plan.

The main outcomes of the SWMP could be:

- To halt ecosystem damaging encroachment of permanent wetlands
- To develop equitable uses of larger seasonal wetlands
- Development of alternative sources of livelihood
- To ensure capacity building for Community to implement proposed alternative livelihood options.
- To improve technical resources and extension services
- To improve structure for planning and monitoring catchment rehabilitation activities, and for sensitization, training and mobilization of communities

4.2. PROJECT SPECIFIC OBJECTIVES

The specific objectives of the SWMP are the followings:

- Operationalize mechanisms and tools for community driven wetland management
- Improve farmer's access to service delivery and inputs
- Promote sustainable wetland utilization
- Increase and better secure livelihood productivity
- Support farmers in implementation of alternative sources of livelihoods for improved income and food security
- Enhance farmers networking to promote best practices in wetland management

4.3. KEY OUTPUTS

The project key outputs are the followings:

A. Participative land use planning is organized and achieved in all the targeted villages

B. Targeted Wetland's Village Units are identified and mapped according to various categories and Wetlands Management Plans are produced for each watershed units

C. Wetlands Management Committees are established and operational for each Wetlands Management Unit

D. FFS are established and operational in each Wetland's Village Unit

GIS facilities and training are provided at the district level

Extension staff are equipped and trained to organize, facilitate and provide on-going support to operational FFS and apply participatory extension approach for wetlands sustainable wetlands valorization development; Research institutes are identified and involved in specific supportive tasks

E. Local manufacturers and retail sector are able to supply and maintain tools and equipment suitable for new techniques and practices

F. Nurseries are operational and seedlings available for agroforestry

G. Revolving funds / micro-credit mechanisms is established and accessible to farmers for new investment in agriculture, artisanal, eco-tourism activities

H. Farmers adopt and apply promoted new activities, techniques and practices like fish farm integrated unit, other fishery technics, Fruit orchard, communal woodlot, honey, dairy production, composting, papyrus biomass briquettes…

I. Community-private partnerships for products commercialization (example for honey production, dairy products) are created and Farmers have access to market for their cash production

J. New Eco-tourism, handicraft production activities and small scaled enterprises are developed

K. Knowledge networks for exchanging experiences are established at local and transboundary levels

5. PROVISIONAL PROJECT BENEFITS

5.1. ENVIRONMENTAL CONSERVATION

Wetland conservation: The process for wetland conservation is holistic in nature, and can only be effective if the whole soil and water cycle is protected, from upstream to downstream in a same river basin. Conservation of the Mara river complex is crucial in water purification and silt deposit before entering in the Lake Victoria. In other words, the wetland complex is the best guaranty for the lake Victoria preservation against bad quality water from the Mara River.

Besides, conservation of a dense papyrus cover preserves swamps against invasive species such as the Nile perch and *Oreochromis niloticus* (unable to survive in water with low oxygen content). Hence the Mara wetlands play a barrier role to preserve native fish species in the upstream streams and river.

Ecological functions: Increasing the diversity of crops and trees in the wetland areas is associated with positive environmental outcomes because of the role trees and plants play in larger ecosystem functions. Trees, if correctly selected, can improve soil quality in various ways: root systems prevent soil erosion, leguminous species fix nitrogen and improve nutrient recycling, and detritus from trees increases the organic content of soil.

Climate Change adaptation: Global climate models forecast changes in rainfall pattern and temperature leading to shorter rains of higher intensity, with drought spells of similar duration or frequency with the current ones, but more intense. Under such conditions, the recommendations brought by the project tending to a more varied set of income sources for each household based on diversification of crops will act positively.

With this increase in varieties, selection of plants should be guided for improved soil cover leading to a decrease in soil erosion.

5.2. INCOME GENERATION

Poverty reduction: Conservation Agriculture projects can reduce poverty directly by providing higher yields for most products, in a highly significant level, with progressive efficacy. Development of non-agricultural activities such as beekeeping, production of aromatic and medicinal plants, production of raw material for briquettes, access to alternative energies, will also act in favor of poverty reduction. These activities, moreover, can be handled mostly by women.

Reducing vulnerability: Crops diversification is a strong argument towards reducing the vulnerability. Development of Conservation agriculture techniques through improvement of soil moisture during longer periods is also a resource against climate change.

Access to micro credit for new investments and development of complementary income generating activities will also participate in facilitating initiatives from persons or groups currently less favored.

Diversification of products and source of income: The sub-project, while increasing yields will also contribute to introducing of new products, cash crops and IGAs. Enlargement of the production and source of income will contribute to secure livelihoods.

Market access: Agroforestry, cash crop, dairy production contribution to poverty reduction is dependent on people's access to product markets. Market access can be improved through construction of roads, development of farmer organizations to increase the bargaining power of producers, or with direct support establishing contact between producers and traders.

5.3. INSTITUTIONAL STRENGTHENING

Access to technical advice and professional network: The double capacity building process intended for the SWM program is expected to give good results in term of professional advice. First at community level group through the Farmer Field School process, and then at coordination level promoting exchanges among the different groups.

6. INTERVENTION AREAS

For the investment strategy to be efficiently focused and not ineffectively dissipated too thinly across a wide geographical area, the sustainable wetland management project is focused on the Mara wetland complex, located in the lower-basin of the Mara river.

For identification of the intervention area or **Wetland priority area** for the Sustainable Wetland Management Project we consider a 2 to 3 kms zone all around the wetland complex, including the villages, floodplains and permanent wetland.

Estimates of wetland complex are primarily based on delineation in topographical maps and Google earth pictures. In fact, additionally to **permanent wetlands** a significant proportion includes **seasonal wetlands**, and this seasonality is irregular by itself. Indeed the extent of the flooded area, however, varies considerably from year to year.

The map on Figure 2 presents the land cover around the wetland and corresponding areas are given in Table 2.

Figure 2 : Land cover around the Mara Wetland

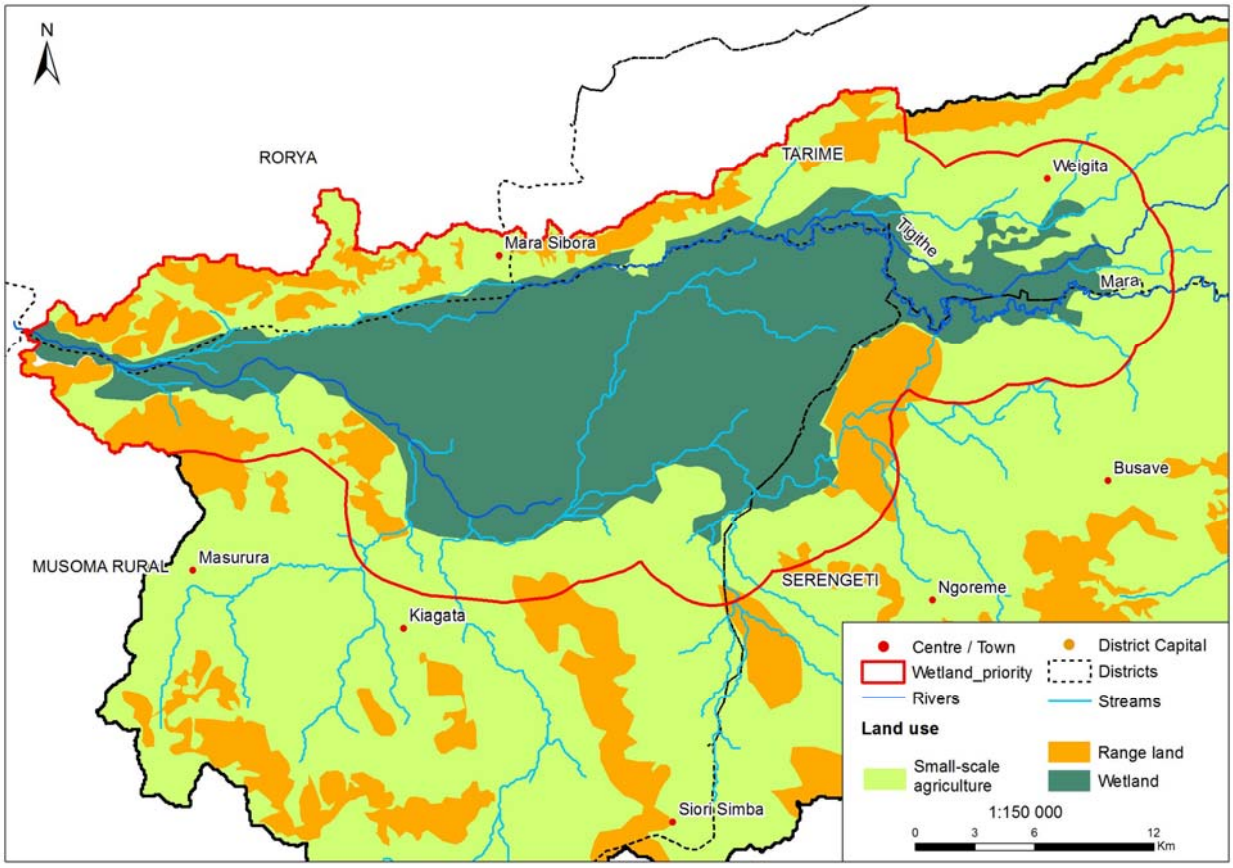


Table 2 : Land use in the Wetland Priority Area

Land use category	Area (km²)
Small scale agriculture	310 km²
Rangeland	118 km²
Wetland	396 km²
Total Wetland Priority Area	824 km²

We can consider that around 17 villages/hamlets are scattered along the almost 90 km of the wetland edge and are targeted by the project in the four districts of Musoma Rural, Serengeti, Tarime, and Rorya.

That means the majority of villages in the wetland complex surroundings are included in the project.

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 Table 3 for each category of wetland.

Table 3 : 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*			

7. PROJECT DESCRIPTION

7.1. STRUCTURE OF PROJECT N° 2

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*

Activities proposed in the components are further described in the following section 7.2.

7.2. PROPOSED ACTIVITIES AND MEANS

7.2.1. Land Use Planning & Wetland Management Plans

The SWMP will be implemented in Tanzania only, around the Mara Wetland complex in the wetland priority area. Wetland management is to a large extent synonymous to community development, the more so in areas with permanent wetlands where management (and conservation) measures may constitute the main part of all measures to be taken.

The project designed for wetlands management aims at better 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. Village councils and assemblies were given power, through the Village Land Act, to oversee the distribution and management of village land. Besides, in the Mara region villages were relocated and boundaries redrawn, letting unresolved boundary problems between and among villages. Considering this way of land tenure, any land use planning must be undertaken at the scale of the village.

However, an efficient wetland management plan is better undertaken at the scale of the whole wetland and further divided into wetland village management units. Thus the two approaches should be combined to reach objective of improved management of the wetland, in the following steps:

1. Demarcation of the whole wetland area (what is inside/outside) and into units belonging to each village must be made on a participative manner with representatives of all concerned villages;
2. Village Wetland Committees and a Mara Wetland Platform must be created;
3. Land cover mapping and zoning of the whole wetland should be undertaken to determine the type of uses/activities allowed or forbidden in the various zones. Even if this work will be undertaken with representatives of the Village Wetland Committees, supported by specialized consultants and coordinated by the Wetland Management Officer from the project office, such proposed zoning should obviously be designed/defined in close collaboration among all stakeholders, including existing Water users associations, district authorities and probably national authorities (agencies of MNRT, MW).
4. Village Land use plans must be edited at the scale of the village, integrating the findings/recommendations of the wetland zoning.
5. Wetland management plans must be drafted for each wetland village unit and periodically revised.

The implementing area will affect three districts (Tarime, Rorya and Musoma rural) and 10 villages.

The project will 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.**

Proposed zoning is outlined below (from NIRAS, 2012):

Zone 1: Where use / extraction of the resources are not permitted (areas important for breeding and / or juvenile fishes). It may, however, be necessary at some point to remove vegetation cover (papyrus, water hyacinth) in those areas in order to maintain areas with open water and preferred habitat for certain species of fish; Burning should not be employed for that purpose due to the impact on nesting birds and other wildlife (also, the papyrus would just sprout again). This zone should including the area called Mara Meandering where a dense riverine forest is still found, providing a small sample of what the Mara Floodplain may have looked like earlier.

Zone 2: Where fishing and harvest of plant resources are permitted (but following general legislation in relation to fishery related to size, equipment etc.);

Zone 3: Where fishing, harvest of plant resources and managed livestock grazing is permitted;

Zone 4: Buffer zone, where limited restrictions should apply. Land in this zone is only flooded very rarely (i.e. not annually). Sustainable grazing and farming is permitted, but use of agricultural chemicals should probably be restricted.

It is important to emphasize that drainage should not be permitted within any of the above zones. Large scale drainage projects may fairly easy be undertaken in part of the wetland due to the relatively large altitudinal differences within the wetland (1133-1202 m.a.s.l.) and poses a latent risk to large parts of the wetland

7.2.2. Community organization and preliminary activities

Based on GIS tools, preliminary activities will be focused on participative land use mapping and zoning of the wetland complex in the priority area in view to clarify wetland demarcations and village's borders in the wetland complex. The land zoning and identification of singular communities responsible for wetland's units management is also a mean to reinforce wetlands ownership although these areas are held in trust by the government.

At the basis of the implementation organization will be Groups or Committees, composed of representatives of the main stakeholders, and charged with management of the above mentioned units of about 25-30 km². Representatives will in the first place come from the local communities and interest groups, but will also include technical officers from government institutions and other organizations, who can provide advice on technical matters, on regulations to be respected, on formulation of bylaws to support site specific resource conservation, and on networking with other relevant organizations (private service providers, credit facilitators, manufacturers of small implements, marketing organizations).

Project-employed Community Mobilization Officers (CMOs) will guide this process of institution building and land use mapping and wetland demarcation. They will work together with District Technical Officers (DTO) in charge of sub-projects.

Training will be given to staff of the 4 districts. It is anticipated that the above districts will appoint 1 coordinating DTO for the SWM project.

CMOs will not directly impose institutional arrangements. They will guide discussions wherein communities or interest groups and show that improved resource management has its implications and requires a certain degree of organization to come to collective decisions and actions.

This is for the simple reason that communities and interest groups need to become aware of the fact that the "anarchistic" exploitation of resources practiced so far, is not a sustainable solution. In this way stakeholders will have an important say in the way they organize themselves, which will stimulate the sense of project ownership. The process of institution building will not be a single event, but a continuous

process of about 2 to 3 years with possible shifts in emphasis and with an anticipated gradually decreasing intensity.

The CMOs will guide the sensitization and mobilization process from its beginning, in cooperation with the technical officers.

For these areas they will organize the baseline surveys or "**preliminary resource survey**" to take place and initiate the stakeholder consultation and sensitization process. Elements to be included are:

- Wetland resources and their estimated value
- Present utilization and amounts and/or extents
- Numbers of people involved, human potential and appropriate population structure for proposed activities
- Interested stakeholders
- Current community organization
- Identification of conflicting of interests and opinions to resolve them

This information is essential for any community development project before any subsequent plan can be formulated and investment allocated. Planning will involve various community meetings to establish mutual agreements. If this is not done properly the project will fail.

A conventional time needed for surveys is usually one month for an area with an extent of about of 25 – 30 km². A survey would focus on one village within this area but draw on people in the whole area.

7.2.2.1. CAPACITY BUILDING

Technical aspects will be taken care of by District Technical Officers, who have a good knowledge of possible measures for improved management and improved livelihoods.

The project will support the production or collection of extension materials for the purpose of knowledge transfer to community level.

For innovative or more advanced measures, technical officers will be trained by a wetland management specialist or other thematic specialist mobilized by the project PMU (short term interventions).

The sensitization and mobilization process will finally result in an overall plan per basic wetland management unit.

The management plan per basic unit will then be aggregated into an overall plan for the sub-project area, from which annual plans will be formulated for implementation. For introduction of specific alternative livelihoods, for example fish pond construction, eco-tourism activities or honey production or for new dairy products development, specific separate plans can be made.

For each project area, a training needs assessment will be carried out, covering the various levels of participating stakeholders. On the basis of accumulative needs, a training program will be defined and implemented. Training may include formal training by project specialists or specialists in partner organizations, and on-the-job training for technical officers by project specialists, and for all stakeholders by CMOs. In addition, exchange visits will be organized between sub-projects or with other areas of interest within the MR basin.

The concept of Farmer Field School (FFS) will be proposed to communities as efficient organization for a learning-by-doing concept.

7.2.2.2. GIS FACILITIES AND TRAINING FOR A MANAGEMENT DATABASE

GIS is an important planning tool. Development of the Mara Decision Support System (Mara DSS) has been initiated compiling data by the Mara Monograph (2008) and should also include a suite of analysis and modeling tools designed to assess current basin conditions and quantify the tradeoffs, benefits, and impacts of alternative development scenarios. The intervention measures and projects presented in the

Mara Investment Strategy are based on detailed analyses of water resources issues and challenges contained in the Mara Monograph and the assessments conducted using the Mara DSS.

Then, a digitized database and mapping system for Mara wetland complex would be an appropriately equipment to complete the DSS data, to make available for the project (via PMU).

If Kenya has now started to make a wetland atlas, there is so far no equivalent in Tanzania.

Constitution of a wetland atlas in Kenya involves aerial surveys made and interpreted by the DRSRS of specific areas designated by the Sub-Committee for Wetlands. The results are being distributed to a team of specialists from sector government departments (wildlife, lands, agriculture, fisheries, etc.) and other institutions (National Museum, universities) who ground-truth and collect detailed ecological, taxonomic and socio-economic data. The work is co-ordinated by the Sub-Committee for Wetlands. An official document is then produced for the area concerned for the Ministry of the Environment. So far, six wetlands of national iconic value together with their catchments have been completed (Nakuru, Naivasha, Elmentaita, Bogoria, Baringo, Eldoret) all of which except one are Ramsar listed wetland sites.

To be useful for MR area wetland management, the data must be easily accessible to District Officers. For this purpose, basic software and related GIS hardware facilities should be available in all 2 districts involved. The software would be on a dedicated computer allowing internet access to maps and information from a central source at the MR-IWMP PMU in Musoma. This central source would also have a dedicated computer facility but with GIS software for spatial analysis and for building the cumulative database. Both locations would need suitable printers.

Districts would be able to access all information from the central facility but would not be able to put any digital information into the system. This would avoid losing control of inputs, misuse, errors and improper logs of entries. The use should have passwords for the designated users and have a single access channel for wetlands management information. All information, including continually updated information, from Districts will be supplied to the central facility for input. Any corrections and clarifications can be controlled in this way prior to insertion into the database. The data should be based on standardized checklist sheets to include for each location of interest:

- Geographical co-ordinates.
- Wetland types.
- Civic area.
- Stakeholders.
- Wetland uses current.
- Degradation features.
- Socio-economic relevant data.
- Interventions possible and proposed.
- Management actions current.
- Roads and other infrastructure services.
- Villages and settlements.
- Specific features of interest.

The district officer in charge of the database should be equipped with a GPS unit for locating the exact positions of an item of management interest in the wetland area of his responsibility. Short training programs will be needed for the designated operators.

The facility is suitable for linking up with investments for other projects.

7.2.3. Livelihood diversification

For the investment strategy to be efficiently focused and not ineffectively dissipated too thinly across a wide geographical area, the strategy initially needs to have a limited number of specific locations. The common feature of the locations is that they should be good examples of wetland management that can

be used as exemplars for other similar programs in the MR area and elsewhere. Hence, introduction of new IGAs should be progressively spread all around the wetland complex, during the 5 years of first phase project duration.

Proposed new activities are the followings:

- Diversification of aquatic plants based products
- Creation of communal woodlots
- Fruit trees/orchard commercial enhancement
- Other farming practices in seasonal wetlands
- Fishery and fish production
- Improvement of livestock farming and dairy sector development
- Commercial community-private association for honey production
- Ecotourism investment in the lower Mara wetland

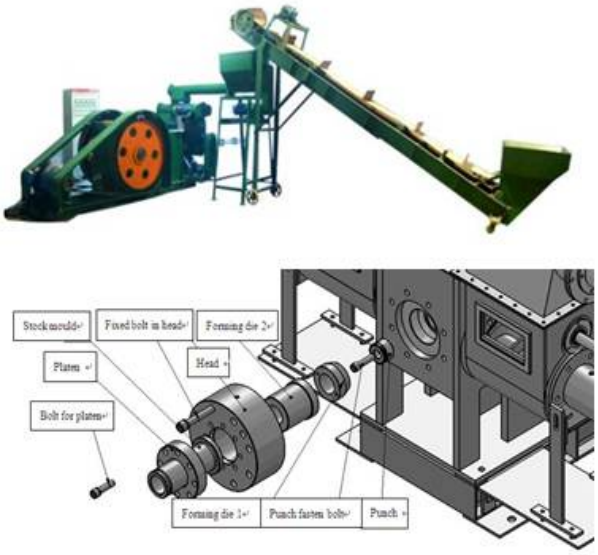
7.2.3.1. DIVERSIFICATION OF AQUATIC PLANTS BASED PRODUCTS

Briquettes made with papyrus, reeds or typha will be developed in relation with the cross-cutting activity no.1 dedicated to energy saving technologies promotion. Sustainable exploitation will be organized prohibiting spoiling vegetation cover practices.

Additionally all handicrafts like mats, baskets…made from this renewable raw material will be encouraged as a lucrative activity specifically for women. The marketing of such products could be linked with the eco-tourism development and the cross-cutting activity no. 2 dedicated to 'Market research and labeling of Mara river products'.

Mechanical Stamping Biomass Briquetting Press: Mechanical stamping biomass briquetting press is a kind of curing equipment to make wood chips, sawdust, crop straws and so on into rod-like fuel through crushing, drying, compressing and molding. Biomass rods are widely used in the heating system of industrial production, government, enterprise, and domestic service.

Technological process: Crush the raw material such as straws, twigs, barks, wood chips into fragments in about 20mm (shells and kernels need not to be crushed). Control the moisture within the range of 10-20%. The fragments are sent to screw lifter through feeding conveyor, and then are pushed into rod making machine's inlet by the screw lifter. At last, the fragments are compressed by punch,



Source *http://www.briquettepress.com/Mechanical-Stamping-Biomass-Briquetting-Press.html*

7.2.3.2. CREATION OF COMMUNAL WOODLOTS

Communal / village land use zoning will identify areas to maintain with forest/woodlots and/or to dedicate to afforestation. These areas will be first hills and steep slopes, but also riverbanks and marginal lands and will be also plots that could be reserved for commercial wood production.

This activity is somehow overlapping with Watershed Management Project and is linked with development of community nurseries.

7.2.3.3. FRUIT ORCHARD COMMERCIAL ENHANCEMENT

Fruit has increasingly great demand regionally, nationally and globally, and recent enterprises in the two countries to cater for this demand have transformed the economic status of people in many locations and have the potential to do so in the MRB area also. Of the various investments proposed here for wetland alternative income generation fruit growing is potentially the most profitable and therefore should be encouraged.

In the present context of investment for development purposes, the aims should be for the 'value added' type of production. But also income can be enhanced at the scale of cottage industry development, with the transfer of appropriate technical knowledge for localized processing and with suitable seeding investment. However, there are major limitations, some of which are itemized below.

It should be evident from this list that suitable geographic, edaphic and social conditions will be specific for every location of interest each of which will therefore have to receive its own preliminary resource assessment before any support investment can be justified.

Suitable climate for fruit cultivation is not likely to be an important limiting feature for the MRB area except in the very highest part, but soils need to be analysed and social acceptability assessed. Soils must not be waterlogged so growing areas have to be out of the floodplains of seasonal wetlands.

Fruit growing methods can be complex to maximize profitability and substantial technical knowledge has to be acquired through extension officers, who in turn need much technical support from line ministries and specialist agencies. Currently this expertise is sparse.

It is important for producers to obtain marketing knowledge, particularly because storage or preservation facilities are not usually available. Agents external to a community are normally necessary for transport, processing and packaging functions. Traditionally middlemen have provided this but have tended to exploit producers. This aspect is linked to cross-cutting activity no. 3 related to 'Market research and labeling of the Mara river products'.

Initial investment capital costs can be relatively large for some fruits, for which seeding funds have to be sufficient, and they will be variable between locations. Operational costs can also be large, although profits should more than compensate. In many cases elsewhere large commercial organizations (sometimes foreign) have provided this input, but there is a risk of exploitation.

Pest infestations in tropical climates can be particularly severe and diverse and have been known to completely eliminate crops. Agrochemicals are usually necessary and are one of the major components of operational costs. Their application again requires good technical support to avoid negative ecological effects.

Profitability increases with volume and sufficient product volume is necessary for efficient marketing. Smallholder farms benefit from co-operative type organization to combine output volumes. Such organization depends on mutual agreements not always attainable, although farmers groups and other CBUs are common.

For the area (lower-Mara), fruit crops should be tropical types and which are well tested locally for marketability and technical knowledge, and they should yield profits relatively quickly, within 1 – 3 years.

Preferred crops are: passion fruit, mango, papaya, and citrus. These fulfill the above criteria, except for the citrus which needs more than 3 years, and are commonly grown traditionally at a small scale, but are amenable to scaled up production.

It is envisaged that investment funds may be drawn on by farmers from the proposed MRB Trust Fund. For the investment estimates in this report a standard average sized MRB smallholding of 0.3 acre is used as a monoculture area, and applied to each of these crops separately.

This activity is also linked with development of community nurseries.

7.2.3.4. IMPROVEMENT OF LAND FARMING PRACTICES

These are techniques to improve the existing uses of the seasonal wetlands for farming activities. The options selected for resource development have to be subsequently supported in a management plan with the strategically defined objectives.

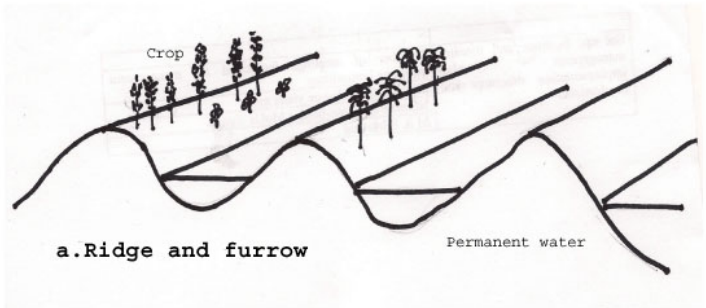
Selected interventions are mainly low technological, usually called 'traditional', methods that can be carried out by local communities will not need much investment from sector ministries, which is the most appropriate for the MRB situation at this stage.

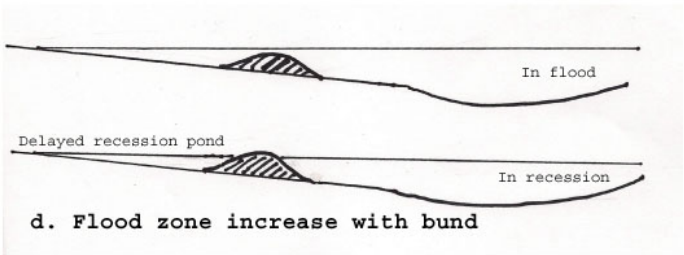
The methods are very site specific and can include substantial structures and operations such as bunds, dikes, and small dams, canalization of water, excavation and dredging.

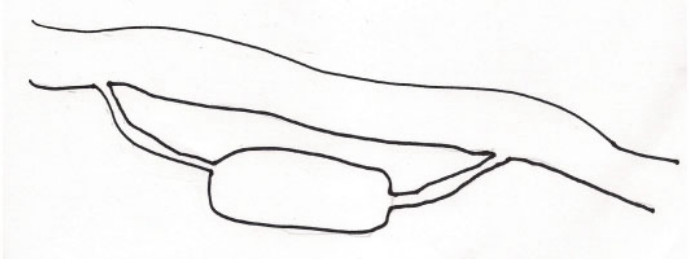
- **Ridge and furrow cultivation:** This ridge and furrow agricultural method will be encouraged by the project in places where permanent or semi-permanent swamps have been already encroached upon. Draining semi-permanent swamps for agriculture exposes to oxygen a soil that has very high organic content and very high chemically reduced sulphur compounds. Agricultural production is initially very productive but the soil rapidly loses its organic content by decomposition and the sulphur compounds oxidise to sulphuric acid creating an infertile acid soil. These degradations can be avoided by careful management and the mounding of the drained soil into ridges keeping water between them. The ridges should be sufficiently high to allow the roots of crops planted on them to be in moist oxygenated soil but below this the soil micro-conditions will be deoxygenated. Mixing between the soil layers can take place between plantings. The effect is to maintain the soil fertility suitable for MRB semi-permanent wetlands.

Annex D.

Interventions





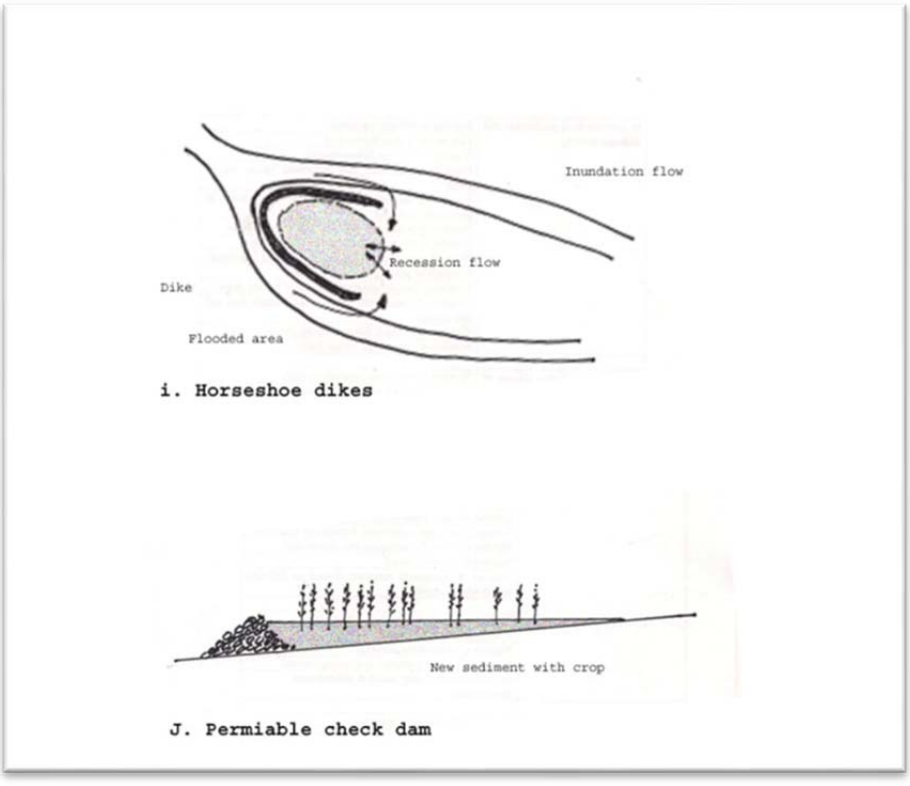


- **Flood zone increase with ditches**: The area and duration of seasonal flooding can be increased by allowing water to flow into ditches at the edge of the high water flood level. Flood benefits can be increased sufficiently to grow an additional short yield vegetable crop.

- **Flood zone increase with bunds:** If shallow bunds are made to restrict the recession of water at the end of the wet season, the retained water will allow for increased duration for crop growth, grazing and catches of trapped fish. The method will be improved if the bund is made next to a depression in the land. Detailed inspection would show whether enhancements could be encouraged.

- **Horseshoe dikes:** These provide partial flood control and allow longer growing seasons with increased agricultural production. Embankments are built where rivers branch and aligned in a horseshoe shape with the open end downstream. Water above the dike remains freely draining but below it the semi-enclosed part acts like a basin storing water in high flood and damping out some of the peak flood events. Places of interest for this is where there is river branching.

- **Permeable check dams:** This is a method that would be particularly appropriate for areas with unpredictable flood events. The dams are constructed across the non-permanent streams in gullies using loose rocks and boulders. Depending on the discharge they can be less than 1 m to more than 2 m high. In places where these are used a series of such structures are often built. They are porous and so allow water to flow through but with slowed discharge sufficient to reduce erosion of riverbanks and to allow sedimentation of suspended material that is thus saved for the fertility of the soil when there is time in the seasons to grow crops.



7.2.3.5. PROGRESSIVE INTRODUCTION OF INTEGRATED AQUA-FARMING PRACTICES

Fish culture in ponds can be practiced in many parts of the MRB but is a particularly appropriate enterprise as an alternative income to reduce unsustainable use of wetlands.

A single simple pond is a good beginning for subsequent expansion to more ponds and more complex cultivation, and to the introduction of other types of production linked to fish ponds as fish-farm integrated units.

Essential physical features of the location for fish pond are:

- An assured continuous water supply (e.g. spring, impoundment, channel from a wetland with return flow)
- No flooding
- A flat or slightly sloping surface
- Clay or fairly impermeable substrate

The actual suitability of conditions can differ over short distances and has to be assessed individually for any one potential fish farmer. This is the routine responsibility of Fisheries Officers.

A stand-alone pond size depends on the type of production aimed for:

- 1000 m2 (20 x 50 m). The basic pond for supplying food for a household with no management.
- 2000 – 3000 m2. Household food with some marketable surplus. Minimal management.
- 3,000 m2. With management is commercial.

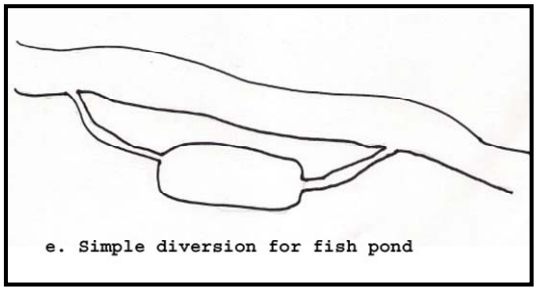
A single basic pond can be made much more productive for household production by expanding to fish-farm integrated unit.

A novice fish farmer is thus introduced progressively to increasing technology and to more complex methods. The project objective being to introduce integrated aqua-farming practices .

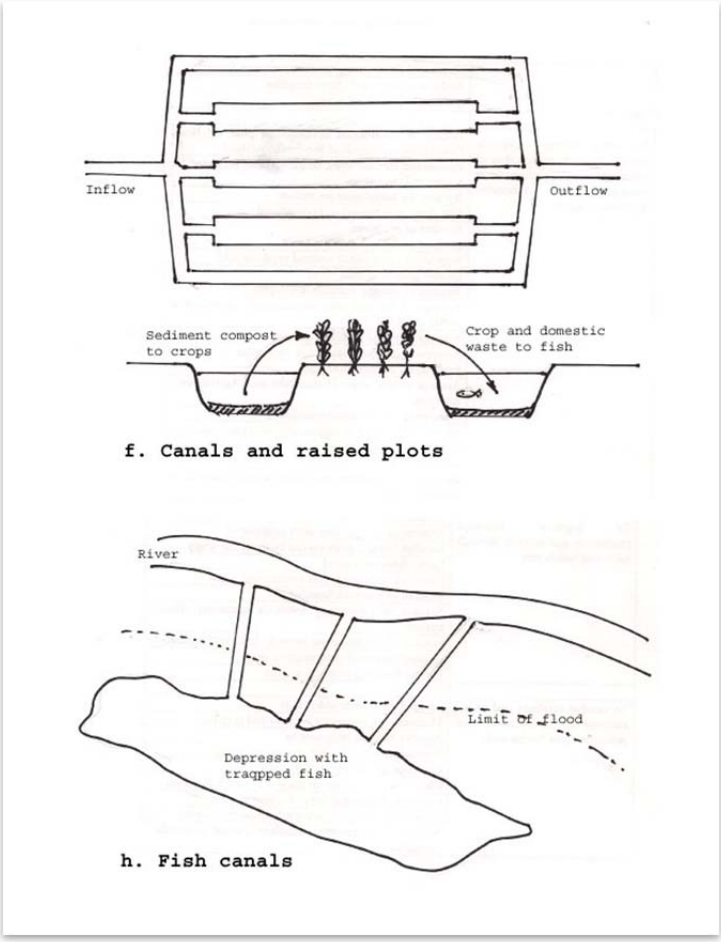
Several technics could be implemented to improve fishery and fish farming from very simple to more complex integrated fish-farming methods:

- **Expansion of wetland edge:** This concerns the enhancement of the potential of a permanent wetland to increase the fish yield, and is particularly appropriate for the papyrus swamps. Fish have rich feeding and breeding areas in swamps but they also need oxygen that usually has low concentration or is absent in the stagnant water under a floating mass of plants except at the edge. Increasing the amount of wetland border therefore increases the amount of resource available to fish and improves their production. Simply cutting channels into the vegetation one or two meters wide will suffice for this.

- **Simple diversion for fish ponds:** A common method for small-scale household production near to streams with little flood zone. The water is supplied by gravity to shallow dug ponds (0.5 m deep) and returned to the main stream. The method can also be used to grow paddy rice in combination with fish, with the fish captured when the pond is drained annually after the rice harvest.



e. Simple diversion for fish pond



- **Fish canals**: A very effective method to trap fish is to dig canals (1-2 m wide, about 2 m deep) from the river leading to a natural (usually) depression which can be out of the normal maximum extent of the seasonal flood zone but would collect water during high flood. The canals have often been known to be kilometres long. As the flood begins to subside fish will seek more water by passing along the canals to the pounded water. They can then be trapped by a net put into the canal. The method is very successful in many parts of Africa and should be investigated for upper parts of all three MRB rivers.

- **Canals and raised plots for agro-fish culture:** This is a type of halfway stage from simple diversion above to integrated fish-farming methods and is done out ozone of seasonal flooding. A series of channels are dug parallel to the flow of the river and river water diverted into them. The material dug out is used for plots between the channels upon which crops are grown, and water from the channels is used for watering them. Fish can be allowed to enter the channels from the river and prevented from escaping with nets. But the main fish would be acquired from fingerling providers. Most of the river stretches would be suitable.

- **Integrated aqua-farming methods**: There are many variations of this principle depending on local preferences and conditions. The principle of integrated fish-farming or aqua-farming involves farming of fish along with livestock or/and agricultural/horticultural crops and enables effective utilization of available farming space for maximizing production.
  Fish culture in combination with agriculture or livestock is a unique and lucrative venture and provides a higher farm income, makes available a cheap source of protein for the rural population, increases productivity on small land-holdings and increases the supply of feeds for the farm livestock.
  Production in pond-farmed fish is maintained with refuse from small herds of farm animals or chickens. The accumulating bottom sediment of the pond is taken out intermittently (yearly) to be used as compost for growing vegetables or for agroforestry on the pond's embankment. The output can be extremely efficient and productive but continuous dedicated management is needed.

The sludge collected in the ponds is used as mulch and fertiliser to grow arable crops on the pond banks. The basis requirement is a natural flow of water can be access from a nearby wetland and returned to it. Animals like pigs can be fed on household and crop wastes much of which is derived from the crops on the embankment.

Agri-based systems may include fro example rice-fish integration, horticulture-fish system. In this system, fish culture is integrated with agricultural crops such as rice, banana and other fruit tree, thereby producing fish and agricultural crops under one interlinked system.

In horticulture-fish system, the top, inner and outer dykes of ponds as well as adjoining areas can be utilized for horticulture crops. Pond water is used for irrigation and silt, which is a high-quality manure is used for crops, vegetables and fruit bearing plants. The success of the system depends on the selection of plants.
They should be of dwarf type, less shady, evergreen, seasonal and highly remunerative. Fruit bearing plants like mango, banana, papaya and lime are suitable, while pineapple, ginger, turmeric, chilli could be grown as intercrops. Plantation of flower bearing plants may provide additional income to farmers.

Ideal management involves utilization of middle portion of the dyke. Residues of vegetables cultivated could be recycled into fishponds, particularly when stocked with fishes like grass carp.

Similarly when banana is cultivated in rows in wetlands, the ditches made between such rows act as supply or drainage canals. These canals serve as fish culture systems owing to their round-the-clock supply of water and rich insect populations.

All building materials would be a type readily available locally at no great cost. There are many easily trainable details of management that are needed to maintain the equilibrium of the system, and there clearly has to be a guaranteed and controllable water supply.

The concept is amenable to an investment in a demonstration or pilot operation.

7.2.3.6. IMPROVEMENT OF LIVESTOCK FARMING AND DAIRY SECTOR DEVELOPMENT

In large areas the seasonal flush of plant growth in the dry season provides very good fodder from a large variety of common species. In the course of rehabilitation of degraded wetland locations and improvement of seasonal cattle pastures *Phragmites spp., Echinochloa spp., Vossia cuspidate, Vetiveria nigritana, Panicum repens,* and *Paspalum geminatum* are all known to be grazed upon and most can be can be transplanted to the MRB. The management issue is to not overuse the resource by having too many animals for the area's productivity nor so many that the physical structure of the wetland is damaged by trampling.

Good management will adjust the number of animals according to the area available. The notion that a farmer can be better off by selling the progeny of cattle and doing something else with the income rather than increasing the size of his herd could be addressed by a training programme.

The need of **livestock breed improvement** (genetic improvement of dairy animals) has been highlighted by several stakeholders, and will be reached through the dedicated activity related to establishment of a breed center in the lower Mara Watershed and addressed in the project no. 1 Watershed Management. Improvement of livestock in the watershed will be a long term objective.

Beyond this aspect, suggestions for the development of dairy products start with the need for improved **veterinary control** of livestock to ensure a safe milk supply and generally technical support for this sector of livestock farming. This could be achieved through government extension services or through the promotion of private services.

The sub-project would also integrate a program for improved **hygiene practices** for milk production, including:

- Establishment of village-based milk cooling centers and processing units;

- Improvements in processing equipment to achieve better efficiency and product quality;
- Training of milk producers and milk processors to develop their knowledge and skills.

Marketing is also a very important aspect if the dairy chain. Presence of close by markets for milk and dairy products is a key motivating factor for producers. The promotion of marketing will require gathering of milk from several producers, transforming it to an acceptable marketable product and delivering it to consumers at the desirable time and at an affordable price.

A common means of doing is the installation of cooling centers for milk in production areas and the organization of farmers into dairy cooperatives.

7.2.3.7. COMMERCIAL HONEY PRODUCTION

Beekeeping is a common livelihood in most African countries where it has been practiced more as a subsistence form of livelihood than a commercial oriented one. The profitability of honey production is known to be high, as is the agricultural values of beekeeping.

The majority of beekeepers have no help at present. There is a need to train farmers on modern beekeeping methods as most are still using traditional methods. Measures should also be put in place to improve the skills of the producers with so that they become more effective.

Many attempts to commercialize beekeeping have been made but frequently they are unsustainable because they have not been based upon commercial principles. Increasing income in a community is inhibited by lack of knowledge about how to produce good quality honey in a modern way, of equipment and of entrepreneurial skills to manage enterprises in profitable and sustainable manner.

Limitations to produce high volumes of good quality honey consistently for many years are not easily resolved even after training.

An alternative commercial model is a community-private partnership in which communities allow their land to be used as concession areas by commercial companies who organize honey processing and marketing, and pay the communities for the honey collected at prior agreed prices.

No funds are handed to the community at implementation as the costs are borne by the entrepreneur. But the hives and services are not free, the value being refunded from a premium on the subsequent honey sales. So initially the price paid will be lower than the commercial one until the cost of the hives, equipment and services is repaid. Experience indicates this will be about two years after which the price increases.

Opportunity exists for individuals to buy into a community company separately with their own funds for hive purchase. The honey price would then be at commercial rates from the start. Known profitability for 20 people with 100 hives can be US$1,350 from the first 4 months collection in the first year.

7.2.3.8. ECO-TOURISM INVESTMENTS INTO THE LOWER MARA WETLAND

There exists opportunity for eco-tourism development in the permanent wetlands as a measure of livelihood diversification, which has to be further explored by a short term contribution of a specialist in this field.

Small boat access into the wetland is possible from Lake Victoria via the mouth of the Mara River. This provides the possibility of combining a wetland experience with a tour of the Lake's shoreline fishing villages and islands or with bird-watching activities and why not with visits or accommodation in one of the villages settled at the wetland vicinity.

Such activities must have commercial viability. This cannot be properly assessed without entrepreneurial advice about the potential size of the market, the amount of financial capital input required for facilities, and the profitability that would make it a worthwhile enterprise for an investor. Connection with tourism networks is also necessary. This type of enterprise cannot be initiated or maintained by local communities by themselves and need external associations. It is, however, a potentially lucrative operation that can

combine community employment and other opportunities with external investors. At this stage it is appropriate to invest in a feasibility report which should be provided by a tourism advisor with knowledge of the specialized economics involved.

7.2.4. Progressive management

The introduction of improved uses of wetlands should follow a sequence of increasing technological and logistical complexity.

Investment in structures and engineering can only be successful subsequently after the benefits of improved use of the existing natural conditions are appreciated. It is therefore proposed that initial activities should need only awareness campaign, training sessions and extension work.

The preliminary phase of mapping and delineation of the wetland's village units are also crucial to strengthen the ownership of targeted communities, sense of their responsibilities regarding the wetland natural resources and their own role in the sustainable management.

Whether the project should move towards the introduction of integrated aquafarming units, other simple techniques can also be introduced gradually to improve current practices in farming, fishing and grazing like described before. Simple techniques include:

- Increase of captured fish through enlargement of the fish breeding and refugia areas by cutting channels in the existing wetlands;
- Ditches dug in the floodplain zone to increase the retention period of floodwater thereby allowing more time and area for growing seasonal crops;
- Where permanent swamps have been encroached upon, to encourage an efficient ridge and furrow agricultural method;
- Advising on the optimum use of seasonal grazing of the draw down area.
- Improving the type and extent of fuelwood and fodder production.
- Improve and organize cutting areas for papyrus and other reeds

7.2.5. Inputs for implementation

The project will provide the necessary inputs for implementation. Inputs will include planning tools, at community level and at the level of coordinating government institutions (Districts Departments), and inputs required for installation of improved livelihoods, which cannot be provided locally.

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. For example for fish farming all digging and construction work is assumed to be done by the farmer(s) interested by this new activity.

MRB fund will provide financial subsidies for raw materials (concrete…) neededd for building new infrastructure.

MRB fund would also provide with community shared equipment like biomass briquette press, basic equipment for nurseries etc…

The Project will open access to micro-credit/revolving fund for communities or individuals wishing to develop new activities in the frame of SWM Project.

Since the type of implementations will much depend on communities' preferences, precise quantification of necessary implementation inputs is not possible. Tentative and flexible budgets will be reserved to facilitate implementation.

7.3. QUANTITIES

The Sustainable Wetland Management Project provides for one integrated project with 4 different components targeting different type of complementary activities.

Yet the exact extension, and the schedule to cover the extension, will appear as the result of the participative process with the local Wetland's Village Units.

Nevertheless the quantitative evaluation is built on 17 villages targeted for development of the following activities:

Technical and financial support (subvention on raw material for construction) and access to revolving funds for development of fish-farm integrated units basically composed with :

- 1 fish pond 1000 m²
- 1 ha of orchard
- 1 bee-keeping unit with 8 hives

Technical and financial support (basic equipment) and access to revolving funds for development of 5 village nurseries (indigenous species, firewood trees and fruit trees)

Project subsidiary and access to revolving funds for biomass briquette processing machine (1 per Wetland Village Unit) and development of activity

Equipment set and technical support for development of milk products production at the village scale (storage or processing) and access to revolving funds for development of activity

Financial support for extension of veterinary services in the area

Technical and financial (subvention for raw material for construction) support and access to revolving funds for development of eco-tourism activities in the area.

8. IMPLEMENTATION FRAMEWORK

The project is planned to start with a first phase of five years, anticipating that donors see the necessity of longer term commitment to achieve tangible impacts on watershed conditions.

The project will be carried out from Tanzania MR-IWMP coordination office since Mara wetland and sub-project areas are located there.

The following full time staff members will be posted in the two IWMP coordination office

- A Wetland Management specialist in Musoma
- 1 district officer per district (4 persons), working with 2 Community Mobilization Officers per district (8 persons)
- 17 advanced farmers for FFS implementation (1 per Wetland Village Unit)

Technical inputs will be provided by

- Consultancies of International and national specialists (wetland management, ecotourism …);
- GIS specialists (from the PMU office and the two coordination offices) and GIS trainers, ensuring the setting up and operation of a GIS network, and providing training to staff of line agencies
- Training/Extension specialist.

Some capacity will be reserved for unforeseen ad-hoc consultancies (10 months), for example for a short study of eco-tourism potential.

The project will employ 8 Community Mobilization Officers (CMO). These will work closely together with 4 District Technical Officers (DTOs) detached to the project.

The Wetland coordination officer (based in Musoma at the IWMP coordination office) with its liaison officer (based in Bomet - Kenya at the IWMP coordination office) are responsible of coordination, planning of activities and monitoring process. CMO and DTO together will be the driving force in improved wetland management in sub-project areas. Contacts with other line agencies and stakeholder organizations will be more irregular and according to arising needs.

A Wetland Management Stakeholder Forum will be initiated to provide a platform for general information flow and exchange of views with a multitude of stakeholders which are not all directly involved in day-to-day project activities. This will also be the level for the project to exchange views with the national Nile Discours Forum in Kenya and Tanzania.

For the introduction of new technologies, contacts will be made with specialized organizations in the respective field, and contributions to the project will be effectuated on the basis of signed agreements.

In all technical, administrative or financial matters, the project will directly report to the PMU through technical reports, consultancy reports, progress reports, and monitoring reports. Funding lines will be directly from the PMU to the project; or be directly from the PMU to a partner institution providing services to the project, on the basis of agreements that are also approved by the PMU.

9. PROJECT MONITORING

9.1.1. Indicators

Performance indicators have been proposed to reflect the progress of the sub-project implementation and impacts of activities undertaken under the different components of the sub-project.

The Performance indicators for sub-project progress and outcomes are presented in the following Table 2.

9.2. SCHEDULE

According to the general schedule proposed for monitoring and evaluation, indicators will be informed to allow drafting of semi-annual and annual reports.

Table 4: Performance indicators for Project 2

KEY OUTPUTS	PERFORMANCE INDICATOR SUB-PROJECT PROGRESS/OUTCOMES	PERFORMANCE INDICATOR SUB-PROJECT IMPACTS
A. Participative land use planning is organized and achieved in all the targeted villages	▪ Number of land use plans edited and approved by population and communal government	▪ Number of land use conflicts
B. Targeted Wetland Village Management Units (WVU) are identified and mapped according to various categories and Wetlands Management Plans are produced for each WVU.	▪ Number of WMU identified ▪ Number of Watershed Management Plans edited and ready for implementation	▪ Un-encroached wetland area in implementing zone
C. Wetlands Management Committees are established and operational for each WMU	▪ Wetlands management committees established and operational	
D. FFS are established and operational in each wetlands management unit GIS facilities and training are provided at the district level Extension staff are equipped and trained to organize, facilitate and provide on-going support to operational FFS and apply participatory extension approach for wetlands sustainable wetlands valorization development Research institutes/specialized consultant are identified and involved in specific supportive tasks	▪ Number of operational FFS and active members ▪ Number of individual farmers applying new technologies and practices ▪ Number of training sessions/visits/workshops and persons trained ▪ Terms of reference for research institutes or specialized consultants involvement	▪ Extension staff and farmers familiar with FFS methodology ▪ New techniques and practices in use
E. Local manufacturers and retail sector are able to supply and maintain tools and equipment suitable for new techniques and practices to farmers	▪ Number of trained operators and supplier for each WM committee	
F. Nurseries are operational and seedlings available for	▪ Number of nurseries created and	▪ Income sources from nurseries

KEY OUTPUTS	PERFORMANCE INDICATOR SUB-PROJECT PROGRESS/OUTCOMES	PERFORMANCE INDICATOR SUB-PROJECT IMPACTS
agroforestry	operational ▪ Number of seedlings provided	
G. Revolving funds / micro-credit mechanisms is established and accessible to farmers for new investment in agricultural activities or eco-tourism	▪ Number of beneficiaries	▪ Financial capacities of farmers for investment in new technologies and enterprises
H. Farmers adopt and apply promoted new activities, techniques and practices like fish farm integrated units, Fruit orchard, honey…	▪ Number of fish farms integrated units, average composition and area ▪ List of other activities developed in the each wetlands management units	▪ Livelihood productivity ▪ Stabilization of wetlands areas (decrease of wetland drainage for crop lands settlement)
I. Community-private partnerships for products commercialization (example for honey production) are created and Farmers have access to market for their cash production Farmers have access to market for their cash production	▪ Volume of cash products ▪ Number of Community-private partnerships	▪ Farmers income
J. New Eco-tourism activities, handicraft production and small scaled enterprises are developed in the watershed	▪ Inventories new activities, products and operators and small enterprises in the watershed	▪ Non encroached wetlands cover ▪ Diversified farmers income
K. Knowledge networks for exchanging experiences are established at local and transboundary levels	▪ Stakeholders forums are operational	▪ Level of farmer solidarity and decision power

10. ROUGH COST ESTIMATES

Based on the activities proposed above, and considering that activities will be mostly concentrated in villages lying in a buffer area of 2 km width around the current delineation line of the permanent wetland, the investment cost for a 5-year project on Wetland Management has been assessed at an amount of **USD 7 134 000**.

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
2. Sustainable Wetlands Management Project														
1 WM Field staff = current cost														
Project officer /extension staff 4 (1 per district)	pmonth	48,00	48,00	48,00	48,00	48,00	240,00	2,00	96,00	96,00	96,00	96,00	96,00	480,00
Community Mobilization facilitators 8 (2 per district)	pmonth	96,00	96,00	96,00	96,00	96,00	480,00	2,00	192,00	192,00	192,00	192,00	192,00	960,00
Advanced farmers 17 = 1 per 1 Wetland Village Unit 10% time	pmonth	204,00	264,00	264,00	264,00	264,00	1 260,00	0,10	20,40	26,40	26,40	26,40	26,40	126,00
Subtotal 1									308,40	314,40	314,40	314,40	314,40	1 566,00
2 Equipment/Material														
equipement set for staff	unit	13,00			6,50		19,50	1,20	15,60	0,00	0,00	7,80	0,00	23,40
upgrading district division GIS facilities (computer, software, digitizer table,	Lumpsum	8,00					8,00	2,50	20,00	0,00	0,00	0,00	0,00	20,00
subsidiary fund for WVU committee equipement	Lumpsum	7,00	10,00		17,00		34,00	3,00	21,00	30,00	0,00	51,00	0,00	102,00
Motorbikes for DTO & CMO + Advanced farmer	unit	29,00			9,67		38,67	3,00	87,00	0,00	0,00	29,00	0,00	116,00
Biomass briquette processing machine (1 per village)	unit	3,00	4,00	4,00	6,00		17,00	3,50	10,50	14,00	14,00	21,00	0,00	59,50
Equipement set for milk products storage or processing (1 per village)	unit	3,00	4,00	4,00	6,00		17,00	5,00	15,00	20,00	20,00	30,00	0,00	85,00
Equipement set and raw material for nursery establishement	unit	3,00	4,00	4,00	6,00		17,00	1,00	3,00	4,00	4,00	6,00	0,00	17,00
Subtotal 2									172,10	68,00	38,00	144,80	0,00	422,90
3 Workshops & meetings														
Workshops and meetings (2 per year/WVU)	lumpsu	34	34	34	34	34	170	1,75	59,50	59,50	59,50	59,50	59,50	297,50
farmers visits costs by location (10 persons form 17 locations during 3	lumpsu	17	17	17	17	17	85	7,50	127,50	127,50	127,50	127,50	127,50	637,50
Subtotal 3									187,00	187,00	187,00	187,00	187,00	935,00
4 Transport & other operation costs														
Motorbikes operating costs 12 (1 per DTO/CMO)	pmonth	348	348	348	348	348	1740	0,05	17,40	17,40	17,40	17,40	17,40	87,00
Subtotal 4									17,40	17,40	17,40	17,40	17,40	87,00
5 Consultancies														
Preliminary village land use plans (national)	pmonth	12	3				15	6,00	72,00	18,00	0,00	0,00	0,00	90,00
Preliminary survey and implementation plan (international)	pmonth	6	3	1			10	18,00	108,00	54,00	18,00	0,00	0,00	180,00
Consultancies (international) (support to milk products processing)	pmonth	3	3	2	1		9	18,00	54,00	54,00	36,00	18,00	0,00	162,00
Unspecified consultancies (international) (eco-tourism development feasibility	pmonth	3	2	1	1		7	18,00	54,00	36,00	18,00	18,00	0,00	126,00
Unspecified consultancies (national)	pmonth	6	3	2	2	1	14	6,00	36,00	18,00	12,00	12,00	6,00	84,00
Community Mobilization officers trainer/adviser	pmonth	3	2	1	1	1	8	6,00	18,00	12,00	6,00	6,00	6,00	
Training district officers for GIS / data base (international expert)	pmonth	3	2	1	1	1	8	18,00	54,00	36,00	18,00	18,00	18,00	
Training district extension officers trainer/adviser	pmonth	3	2	1	1	1	8,00	6,00	18,00	12,00	6,00	6,00	6,00	48,00
							-						0,00	0,00
Subtotal 5									414,00	240,00	114,00	78,00	36,00	882,00
6 Revolving Funds														
Fund to support Fish Farm Integrated units: 1 per year/WVUnit	lumpsu	17,00	17,00	17,00	17,00	17,00	85,00	10,50	178,50	178,50	178,50	178,50	178,50	892,50
Fund to support development of touristic activities	lumpsu	1,00	1,00	1,00	1,00	1,00	5,00	10,00	10,00	10,00	10,00	10,00	10,00	50,00
Fund to support other activities: 5 per year/WVUnit	lumpsu	85,00	85,00	85,00	85,00	85,00	425,00	5,00	425,00	425,00	425,00	425,00	425,00	2 125,00
Subtotal 6									613,50	613,50	613,50	613,50	613,50	3 067,50
7 Environmental and Social Monitoring	percent							2,50%	42,81	36,01	32,11	33,88	29,21	174,01
Subtotal 7														
Subtotal 2									1 755,2	1 476,3	1 316,4	1 389,0	1 197,5	7 134,4